Harnessing Collaborative Technologies in Digital Disaster Response Work: An Examination of Digital Volunteers' Activities in Processing Crisis Data

A Thesis Submitted for the Degree of Doctor of Philosophy

By

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Abstract

This thesis examines the activities involved in processing crisis information. The study demonstrates how digital volunteers acquire, assess, organise and scrutinise crowdsourced information to warrant confidence that their information product is good enough for use by humanitarian organisations. Furthermore, this study explores the use and appropriation of technological tools and platforms in crowdsourcing along with their implications for digital disaster response. Together, these two areas give insight into how digital volunteer communities appropriate collaborative technologies to provide information as a form of aid.

Participant observation from virtual fieldwork work, alongside digital records, and interviews are used as methods of qualitative data collection, and the data is examined using Activity Theory Methods. These provide an interpretive frame for analysing the composition of activities and understanding the social organisation of digital volunteers' work using collaborative computing applications. This study contributes to the Computer Supported Cooperative Work (CSCW), Crisis Informatics, Information Systems for Crisis Response and Management (ISCRAM), and Disaster literatures.

Its contribution to the existing literature is threefold. First, its compliments the socio-technical debates on information quality and integrity by providing evidence and insight into the (visible) manifestation of professionalisation and knowledge of humanitarian principles. Second, this study introduces an additional perspective to the current debate about the importance of language as a substantial factor in response operations. This is crucial since responding to disasters in non-English speaking countries can be problematic and subsequently slow down response operations. Third, this research enhances the current understanding of the digital volunteer communities' delineation and typology by discovering an overlooked group - the Emergency Telecommunication Providers' Community.

Regarding its theoretical contribution, this study proposes a new analytical framework outlining the various stages involved in digital disaster response for the social media and data aggregation communities. This framework contains critical components derived from the empirical data that could potentially signal the emergence of a new model for digital disaster response. Thus, the framework is flexible enough to support the coordination of response operations across all types of disasters with different scales by these communities with comparable characteristics in different countries and settings.

This work takes a holistic approach through studying different disaster types of various scales, across developed and developing nations over an extended period. This allows an understanding of the challenges involved in responding to disasters across developing

countries. As a result, the insights derived from studying disaster across nations of different infrastructural density could potentially signal the development of an evaluation framework for the standardisation of digital disaster readiness of such countries. This approach therefore offers a unique contribution to the methodological advancement of disaster research within the CSCW, ISCRAM and crisis informatics fields.

The findings from this research have important implications, since it brings out the salient but under-reported practical field challenges associated with the use of various technological tools and platforms. By providing such insights, system designers and technology developers can utilise this information to improve collaborative work. Insights derived from the findings can also assist volunteers, aid agencies and emergency responders to adapt and improve the way they use ICT tools in their daily routine. In like manner, emergency management organisations from developing nations could take better advantage of the available tools and platforms and incorporate them into their operations.

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Declaration

The following papers have been published (or submitted for publication) as a direct result of the research discussed in this thesis:

Peer-reviewed Paper

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Abbreviations

- 3W - Who does What, Where
- AAR – After Action Report
- AODM – Activity Oriented Design Method
- AOIR – Association of Internet Researchers
- AT – Activity Theory
- CSCW - Computer Supported Cooperative Work
- DAFN – Disability, Accessibility and Functional Needs
- DDWG – Disaster Desk Working Group
- DHN – Digital Humanitarian Network
- DRC – Disaster Research Centre
- DVCs- Digital Volunteer Communities
- EDT – Eastern Day Time
- ENS – Electronic Notification System
- EOC – Emergency Operation Centre
- ETC- Emergency Telecommunication Communities
- FEMA – Federal Emergency Management Agency
- GIS – Geographic Information Systems
- HR – Humanity Road
- ICS – Incident Command System
- ISCRAM - Information Systems for Crisis Response and Management
- MSF - Médecins Sans Frontières (Doctors Without Borders)
- SBTF – Standby Task Force
- SMIC – Social Media Incident Commander
- TWB – Translators Without Border
- UNOCHA – United Nations Office for the Coordination of Humanitarian Affairs
- VGI – Volunteered Geographic Information Systems
- VOST – Virtual Operation Support Team
- VTC – Volunteer and Technical Communities

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Chapter 1: Understanding the Frontier of Digital Disaster Response

Data flowing from the public can be messy. It is often loaded with non-essential information—unrelated opinions, jokes, and off-topic conversation. The variety, complexity, inter-connectedness, and speed of information can be overwhelming for crisis managers. Hurricane Sandy sparked more than 20 million "tweets" on Twitter alone ... Response organizations typically do not have the resources to sift through these massive data streams to extract actionable information (Shanley et al., 2013, p. 868).

1.1 Overview

This thesis examines the disaster response workflow and crowdsourcing activities of digital volunteer communities (DVCs). It also explores the use and appropriation of technological platforms and tools along with their implications for digital disaster response. Digital volunteer communities refer to the "...[N]etworks of technical professionals with deep expertise in social media, geographic information systems (GIS), database management, [and] online campaigns [who apply] their skills to some of the hardest elements of the disaster risk management process" (Boehmer, 2010, p. 2). The study was conducted by monitoring volunteers working under a US-based digital disaster response organisation called Humanity Road (HR). In the context of this work, a digital volunteer is any person (trained or untrained) that make use of the internet-enabled device(s) or platform(s) to provide information as a form of aid during an emergency. HR is chosen as a case study organisation because of its potentials in adding to our knowledge a peculiar case of how groups are organised, socialised and work together in a virtual space. Furthermore, its work practice also has the potentials of highlighting how people, organisational culture, process as well as technological tools and platforms are entangled with one another. This chapter sets the foundation for the research and serves as a signpost for the rest of the eight chapters.

In the remainder of this segment, I first provide research background and motivation. Then I outline the aims and objectives of the research. Next, I highlight the approaches taken to

conduct the study. Following that, I describe the boundary upon which the study is delimited. Finally, I present the synopsis of the subsequent chapters and how each segment connects with one another to provide answers to the studies' research questions.

1.2 Research Background and Motivation

Responding to humanitarian emergencies such as disasters and public safety events like terrorist attacks continues to be one of the world's most significant challenges. In 2014 alone, 317 natural disasters were reported globally affecting almost 107 million people in 94 countries with an estimated economic loss of 99.2 billion US dollars and the death of 14, 070 people (Ager et al., 2015). It is envisaged that looming climate change, the dearth of donor funds, global austerity, and surging urbanisation will mean more frequent severe humanitarian emergencies in the future (Holmes, 2011).

Historically, the sudden onset of such emergencies is characterised with the episodic mass influx of goods, services and volunteers on the ground to give relief using collective behaviour and role enactment (Quarantelli and Dynes, 1977; Britton, 1988, 1991). Collective behaviour is a social phenomenon that spontaneous volunteers (who are mostly lacking in any formal training in disaster response) exhibit while trying to provide aid to the disaster-affected victims. On the other hand, role enactment refers to the degree upon which the behaviour of the volunteers changed or maintained during the crisis. With the advent of mobile technologies along with the development, adoption and increasing accessibility of web 2.0 technologies, the convergence phenomenon that was hitherto observed on-site are now observed online by remote digital volunteers (Hughes et al., 2008). The convergence phenomenon refers to the inevitable arrival of people to disaster sites (Fritz and Mathewson, 1957). These unpaid volunteers harness collective intelligence using crowdsourcing to provide situational awareness information for decision making as a form of aid (McEntire, 2004). However, their emergence has disrupted the old response playbook of standard operating procedures of emergency management organisations, thereby giving rise to changes in the landscape for research on humanitarian emergencies (Tapia, Moore and Johnson, 2013).

Long before the emergence of digital volunteers, researchers working in disaster domains tended to be based on disciplines such as International Development, Sociology, Geography and Environmental Studies among others. Hence, their work was mostly reported in the outlets of their field of study or specialist journals, such as Disasters, Journal of Homeland Security and International Journal of Mass Emergencies and Disasters (IJMED). However, with the emergence of digital volunteers, scholars from across collaborative and social computing domains began to examine the implications of their entry into international humanitarian systems from a socio-technical perspective.

It is against this background, studies related to digital volunteers tended to be cross-disciplinary, cutting across the field of computer supported cooperative work (Starbird and Palen, 2012, 2013; Cobb *et al.*, 2014) and information systems for crisis response and management (Dailey and Starbird, 2014b; Gorp, 2014; St. Denis, Anderson and Palen, 2014; Hughes and Tapia, 2015). Furthermore, studies of this nature are also found in the emerging areas related to Geographic Information Systems (de Albuquerque *et al.*, 2015), Policy and the Internet (Tapia and Moore, 2014), and several grey literature sites (Map Maker *et al.*, 2012; Robson, 2012; Weinandy, 2016) as well as practitioners' blogs (Capelo, Chang and Verity, 2013; Milner and Verity, 2013).

While the subject is cross-disciplinary, this study is underpinned by the literature, mostly derived from Computer Supported Cooperative Work (CSCW), Human Computer Interaction (HCI), Information Systems for Crisis Response and Management (ISCRAM), and Sociology. Moreover, institutional literature from Digital Humanitarian Network (DHN), United Nations (UN), Global Facility for Disaster Reduction and Recovery (GFDRR), ReliefWeb, International Federation of Red Cross and Red Crescent Societies (IFRCCI), Active Learning Network for Accountability and Performance in Humanitarian Action (ALNAP) and The Woodrow Wilson International Center for Scholars were also consulted and utilised. This is because most critical and theoretical contributions of DVCs are found in reports, listserv and practitioners blog postings (Bergtora Sandvik *et al.*, 2014). As such, I utilised this literature despite its limitation in lacking blind peer review as a basis for exploring valuable insights that are outside the scope of scholarly peer-reviewed work.

Synthesising the literature from the sources mentioned above has provided the basis for understanding what has been done in this field. As such, on what is known so far about this phenomenon are studies that argue about the implications of crowdsourced information generated through social media and web 2.0 platforms by DVCs. The central argument for these studies is that crowdsourced information is bedevilled with information processing problems and therefore lacks an exacting standard, quality, credibility, and the trustworthiness required by the humanitarian response organisations (Crowley and Chan, 2011; Meier, 2011; Shanley *et al.*, 2013; Tapia and Moore, 2014; Weinandy, 2016).

Also, a considerable amount of studies related to DVCs have examined issues surrounding their entry into the humanitarian arena. Such studies focus on issues regarding security, and legal liabilities (Hiltz, Kushama and Plotnick, 2014; Trainor *et al.*, 2014). Other studies have criticised DVCs for lacking knowledge and proper understanding of humanitarian principles (Collins, 2011; Morrow et al., 2011; Sandvik and Lohne, 2014; Resor, 2016). The rise of DVCs has also provided an avenue for the design and development of tools and platforms to support

the activities of volunteers in tracking, organising, visualising and reporting actionable information(Gupta et al., 2014; Ludwig, Siebigteroth and Pipek, 2015).

Furthermore, earlier studies related to DVCs examined their classification (Milner and Verity, 2013; Gorp, 2014), motivation (Starbird and Palen, 2011; Capelo, Chang and Verity, 2013), coordination and self-organising mechanisms (Starbird, Muzny and Palen, 2012; Starbird and Palen, 2013), as well as how volunteers acquire and manage information (Starbird, 2013). Past studies also investigate barriers to collaboration between physical and virtual volunteers on the one hand and traditional aid agencies on the other hand (Foran *et al.*, 2012; Sabou and Videlov, 2016).

Despite the growing body of research on DVCs, there has been little published work on how digital volunteers acquire, assess, process and scrutinise crowdsourced information to warrant confidence that their work satisfies a sufficient standard of engagement, production and analysis. To date, studies investigating information processing activities of digital volunteers tended to focus on examining the use of a single communication tool or platform using one single response within a case study (Starbird *et al.*, 2010; Starbird and Palen, 2011, 2013; Starbird, 2013).

Furthermore, the literature is both in its infancy and relatively thin with regards to the nature of ICT-mediated technologies used in digital disaster response and how these tools are working in practice (St. Denis, Hughes and Palen, 2012; Imran *et al.*, 2013; Reuter *et al.*, 2015). The literature has also been silent on how such tools are enabling or constraining the activities of digital volunteers while responding to disasters. This formed the motivation behind this study to help remedy this situation and to take a step further in providing a holistic perspective that has not been covered by the previous studies.

1.3 Research Aim and Objectives

The primary aim of this study is to provide a deeper insight into the activities of the digital volunteer communities (DVCs) with regards to the procedure involved in processing crowdsourced information along with the implication of technological platforms used by its volunteers in disaster response. The applied aim is to give practical implications to practitioners, system developers and research communities.

The research goals are as follows:

a) Understand the activities involved in processing crises information during humanitarian response operations.
b) Investigate data quality assurance mechanisms of the DVCs in determining the credibility of the crisis information shared during disasters.

c) Examine the implications of deploying such tools and offer insight on how these collaborative tools and platforms work in practice.
d) Identify the type of collaborative technologies used by volunteers in digital disaster response.
e) To offer practical implications to research communities (Computer Supported Cooperative Work (CSCW), Information Systems for Crisis Response and Management (ISCRAM), Crisis Informatics, Disasters), practitioners (Emergency Management Organisations, Aid Agencies, Digital Humanitarian Networks), and System Designers/Developers.

The above aims and objectives led to the formulation of the of the following research questions:

- RQ1:
    (a) What are the activities involved in processing crisis information among the social media and data aggregation communities?
    (b) How are these volunteers ensuring the quality of such information?
- RQ2: What are the benefits and challenges in deploying collaborative tools by DVCs in disaster response and how do these tools work in practice?

1.4 Research Approach

To answer the above research questions, a virtual ethnographic study was undertaken to understand the milieu and dynamics within which digital volunteers crowdsourced information using different technological tools and platforms. Virtual ethnography is appropriate in this context, considering the nature of the case study organisation alongside its users and the research questions involved. The advantage of employing ethnography to understand the activities of digital volunteers lies in its ability for revealing real-world work processes and work settings as well as uncovering tacit assumptions (Forsythe, 1999). Furthermore, the approach enables researchers, to uncover consistent patterns of thought and practice as well as offer impetus for researchers to discover what people say from what they do in practice (Ibid).

In line with the tradition of ethnographic data gathering methods (Garcia *et al.*, 2009; Madianou, 2015; Christensen, 2016), this study uses participant observation, formal and informal interviews and document analysis. Participant observation was used mainly in monitoring the activities of digital volunteers during disaster response operations, internal drill exercises, meetings, conversational exchanges in different Skype windows as well as during special briefing sessions. Semi-structured interviews were conducted to elicit

responses on issues bordering disaster response workflow, verification of crowdsourced information, use and problems associated with the technological tools and platforms. Informally, I utilised every opportunity to ask questions and seek clarifications during internal drill exercises, meetings, and briefing sessions. In some occasions, I reached out to some selected volunteers to learn more about the rationale of taking a decision or approach. Also, the organisation graciously allowed me to have access to their internal documents and Skype chat logs. Besides, the case organisation has a dedicated publicly accessible resource page on its websites featuring blogs, financial and annual reports, case studies as well as press room where media mentions, interviews, and past studies related to the organisations are archived. This process is elucidated in detail in the method section (Chapter 3).

In this thesis, I drew on Activity Theory methods to serve as a guiding analytical framework. Activity theory is a social psychological theory whose central argument lies in understanding the importance of cooperative work breakdown embedded within an organisation (Bardram and Jakob, 1998). This theory argues that actions are conscious, goal-oriented, dynamic processes mediated by objects and undertaken by individuals or groups alongside their rules and division of labour. The central focus of the theory is human activity which is characterised by a systemic structure where various activities are organised or extended away from the main activities (Bertelsen and Bødker, 2003).

Three considerations related to its strength, suitability and preference, guided the choice and use of Activity Theory in this study. The rationale for this choice is explained in the following paragraphs.

First, the theory offers an interpretive lens for understanding connections between activities, human actions, tools, and goals on one hand, and characteristics of the socio-organisational and societal context on the other hand within which such activities are undertaken (Kuutti, 1991; Halverson, 2002). The theory has the potential of enabling researchers to understand human activity from a broader context. It further allows for understanding socially produced artefacts and how they are entangled in a dialectical relationship with the changing practice of use (Bertelsen and Bødker, 2000). Besides, it offers a set of insights on human activity and at the same time provide a set of concepts explaining the activity from the perspective of who is doing what, why and how (Nardi, 1998; Hasan and Kazlauskas, 2014).

Second, Activity Theory aptly captures the essence of the research topic, field data and core constructs of the thesis research questions outlined earlier in Section 1.3. For instance, while the central constructs of the theory relate to people (subject), activities, interdependencies, and artefacts (tools), the central elements of the research questions ('activities', 'collaborative tools' and disasters) also mirrors the primary dimensions of Activity Theory.

Third, in crisis informatics literature, there is no consensus among scholars on a specific theory that is regarded as the best analytical tool that captures how people mediate with collaborative computing applications (Drury, 2009). However, available literature shows activity theory, workspace awareness theory, common ground theory, coordination theory, distributed cognition theory, information ecologies metaphor, situated action theory, situation awareness theory is among the most used approaches that provide the interpretive frame of understanding and learning how group interact using computer-mediated applications (ibid.). As a way of giving context, workspace awareness theory is premised on the need for the team to provide up to date activities of each member within the realm of shared workspace so that the work can be synchronised to avoid duplication (Gutwin, Greenberg and Roseman, 1996b, 1996a; Gutwin, Stark and Greenberg, 2010). The common ground theory focuses on clarity of communication which could take the form of face to face or verbal communication to ensure a shared understanding among the team members (Drury, 2009). Coordination theory emphasises harmonious coordination is predicated on understanding and managing interdependencies associated with work goals where prerequisite, shared-resources, and simultaneity are spelt out (Malone and Crowston, 1990, 1994)]. Distributed cognition focuses on the need to provide shared awareness of group knowledge in clear terms and externally viewable formats. The theory is concerned about knowledge representation among team members and the transformation of external structures (Flor and Hutchins, 1992). The information ecologies metaphor emphasises in understanding who do what and where within the purview of the work environment (Drury, 2009). The situated action theory argues that knowledge can only be interpreted in what is in their work environment (Vouligny and Robert, 2005), while the situation awareness (SA) focuses on understanding activity through a three-stage process which includes perception, comprehension, and projection of the state of the activity into the future (Endsley, 1995). Although the above theories shared some commonalities with regards to the unit of analysis, it is important also to point out that they have different areas of emphasis in the domain of crisis communication. As such, I found Activity Theory to have the level of explanatory power and analytical insight required for my research. Besides, the most important consideration for the use of any theory as argued by Bardman (1998) and Halverson (2002) is for researchers to question whether such theory can provide an objective representation of reality and how insightful is such theory in bringing to light relevant issues.

1.5 Context

This study took place from May 2016 to October 2017 and was carried out remotely by monitoring Skype windows of the case study organisation as mentioned earlier in section 1.1

(overview). Humanity Road uses Skype as its core platform for coordinating its activities. Notably, these activities are coordinated across four windows named as HR Café, HR Urgent Events, HR Useful Links, and HR Work Diary. In addition to the four main windows, interested volunteers who indicated interest in other committee work will be granted access to other windows such as Animals in Disaster (HR AID Team), HR Internal Drill, HR Disaster Desk Working Group, HR Scanigo, HR Team and Project Leads among others. HR also creates an event specific window whenever they are responding to a major catastrophe. As such, during the field work, Humanity Road granted access to all the windows mentioned above as well as windows created during significant catastrophes.

1.6 Scope

Available literature related to digital volunteers is vast and varied and so does the landscape of its research. Previous studies in this domain tend to be divided into two strands as illustrated in Figure 1.1 below. The first strand focuses mostly on studying emergent groups. Emergent groups are informal digital volunteers that spontaneously converge as bystanders during a disaster and disappear shortly because their advent and actions are extempore and therefore exclusive to the catastrophe. Disaster sociologist described their collective behaviour as unaffiliated, convergent and spontaneous (Kreps and Bosworth, 2007). The second strand is concerned with studying permanent digital volunteer communities who, unlike the emergent groups are non-ephemeral. Permanent digital volunteers are further divided into two groups. The first group called Virtual Operation Support Team (VOST) derived its membership mostly from retired and serving professional emergency management staff (Cobb *et al.*, 2014). The second groups include "...[N]etworks of technical professionals with deep expertise in social media, geographic information systems (GIS), database management, [and] online campaigns [who apply] their skills to some of the hardest elements of the disaster risk management process" (Boehmer, 2010, p. 2). Therefore, since the majority of these studies examining digital volunteers tended to focus on emergent groups, this work will investigate the established groups which I will be referring to Digital Volunteer Communities (DVC).

It is also worthy to note that this DVCs are also categorised into four subgroups namely: 1) software and development communities[1], 2) crisis mapping communities[2], 3) expert network communities[3] as well as 4) social media and data aggregation communities[4] (Gorp, 2014). This study focus is therefore delimited to examining

[1] Frontline SMS (https://www.frontlinesms.com/), Ushahidi (https://www.ushahidi.com/)
[2] Humanitarian OpenStreet Map (https://www.hotosm.org), CrisisMappers (https://crisismapping.ning.com/)
[3] Translators Without Borders (https://translatorswithoutborders.org/), Statistics Without Borders (https://community.amstat.org/statisticswithoutborders/home)
[4] Humanity Road (https://www.humanityroad.org/), ICT4Peace (https://ict4peace.org/what-we-do/)

the social media and data aggregation because of the shortage of studies that review the activities of the groups. The limited number of studies in this strand could be attributed to the evolving nature of the phenomenon since such groups are in their early development stage. Also, social media and data aggregation communities have the potential of adding to our knowledge a peculiar case of how group are organised using a variety of technological platforms in a virtual global team to provide information as a form of aid.

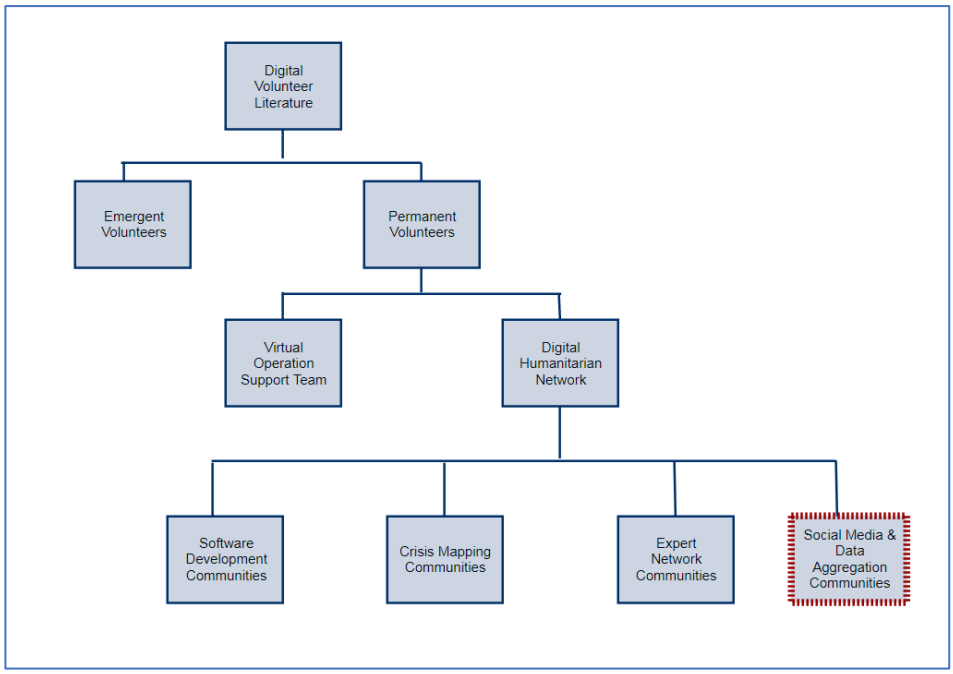

Figure 1.1: Ecology of Digital Volunteer Literature

The above figure (1.1) provides a graphical representation of the digital volunteer literature. The first level represents the entire domain. Next is the second level where the literature is segmented into emergent groups in one hand and permanent volunteer groups on the other hand. The third level depicts a further subdivision from the permanent volunteer groups with virtual operations support team at one end and Digital Humanitarian network occupying the other end. Lastly, the last subgroups illustrate four main subdomains in which the one with the dotted red lines stands for the subgroups in which this study is delimited.

1.7 Structure of the Thesis

This chapter provides background and motivation, research aims and objectives, context as well as the scope of the study. The remaining chapters are structured as follows:

Chapter 2 – "Digital Volunteerism Research Landscape" - This chapter sets the foundation for understanding the activities of digital volunteer communities. It reviews past studies on virtual organisations/communities on the one hand and literature on social media in disasters and emergencies on the other side.

Chapter 3 – “Research Methodology” - This chapter offers a detailed description of the research approach and design used in this thesis to investigate the activities of HR volunteers and their use of technological platforms in processing crowdsourced information. Explicitly, the chapter justifies the rationale of using virtual ethnography, data collection methods as well as the use of activity theory methods as an interpretive frame for analysing the data.

Chapter 4 – “The Research Site” - This chapter sets the context for understanding the social organisation of HR’s work, culture, ethics, technological mediation and HR’s volunteers alongside their recruitment and management.

Chapter 5 – “Process Workflow and Data Quality Assurance Measures” - This chapter addresses the first research question on the information processing activities of HR volunteers with regards to how volunteers acquire, organise, verify and report crowdsourced data. It explains in detail the process involved in checking the integrity of the data before making it available to emergency management organisations, aid agencies, disaster-affected communities and the global online public.

Chapter 6 – “Technological Platforms and Practices of Use” - The chapter offers insights into the work practice of HR volunteers. It sketches in detail the implications for appropriating collaborative technologies concerning their usefulness, challenges and how volunteers work around such problems and what does that mean to the overall disaster response. It further highlights the broad-ranging nature of collaborative tools and platforms used by HR volunteers.

Chapter 7 – “Synthesis and Reflections on Collaborative Work in Digital Disaster Response” - This chapter consists of the summary of the research findings presented in chapter 5 and 6. It also provides interpretation of the results and its associated implications.

Chapter 8 – “Conclusion” – Assembles together relevant components of the study to present the big picture of the thesis. It achieves this by providing a summary of the key findings, discussing contributions as well as highlighting the challenges and limitations of the study. It also features the thesis contribution drawn from the research and offers suggestions for future research and concludes with an endnote.

Chapter 2: Digital Volunteerism Research Landscape

The challenge of finding high-quality information from social media is likened to finding a needle in a haystack (Ludwig, Reuter and Pipek, 2015).

2.1 Introduction

This chapter sets the foundation for understanding the activities of digital volunteer communities. In the first segment, it reviews past studies on virtual organisations and communities. Specifically, the section addresses their definitions, similarities, differences, and drawbacks as well as approaches to overcoming such challenges. The second segment of this chapter examines the research landscape of social media in disasters and emergencies. Following this, the review explores the social organisation of volunteers in processing crowdsourced information from social media. The review then discusses past studies on emergent and established digital volunteer groups, as well as challenges associated with crowdsourced social media data. The last segment of the review examines process workflow and the appropriation of technological platfoms, as well as discussing the gap in the literature, and concludes with an overall summary of the chapter. The literature in virtual organisations/communities and social media in disasters and emergencies are the core elements upon which this PhD study is situated and studies from these two strands formed the central fulcrum for understanding the social organisation of digital volunteers in a technologically supported, virtual work environment.

2.2 Virtual organisations/communities

This subsection reviews past studies on virtual organisations and communities. The decision to undertake this academic exercise stemmed from the need to clarify misconceptions and highlight similarities and differences between the two. It is essential to make this clarification early since there is confusion in naming the phenomenon (digital volunteer communities) that is central to this study. The question here is, could 'communities' be referred as virtual

organisations, even though the name shows they are communities, or should they be classified as virtual communities, even though they possess specific features that virtual organisations have? Hughes et al. (2001) characterised an organisation as an entity with a hierarchy of authority, a high degree of centralised control, specialised roles and responsibilities within the structure, and a bureaucratic stiffness of performance" (pg. 52). Drawing from Hughes et al.'s (2001) characterisation of the organisation, HR can, therefore, be regarded as an organisation rather than a community. This could be justified by looking at some of the dimensions provided by Hughes et al., such as functional administrative structures, registration (as a non-profit), as well as the presence of paid administrative staff on its payroll. Additionally, HR meets every year to come up with its activities, conducts retreat, interacts with other formal and traditional organisations, attends conferences, presents academic papers, and considers budgets for its activities. At the same time, HR can also take the form of a virtual community based on the features and dimensions as defined by Porter (2017), who defines virtual communities as "an aggregation of individuals or business partners who interact around a shared interest, where the interaction is at least partially supported and/or mediated by technology and guided by some protocols or norms". Ridings, Gefen and Arinze (2006) defined virtual communities as an online space where members exchange information in both synchronous and asynchronous mode to discuss issues associated with instrumental aid and finding emotional, social, physical, and mental support. Some virtual communities enable members to exchange information or support one another in terms of assurance, companionship, or recovery from addiction, loss of a partner, suffering from disease or antidote to depression. As such, HR as a community, its members (volunteers) share and discuss common interest just like any other online community.

Based on the above clarification, this review will now attempt to offer a broader perspective of virtual organisations and communities. Specifically, the review will discuss their definitions, differences, commonalities, nature, benefits and drawbacks.

Past studies defined virtual organisation as a "new organisational form characterised by a temporary or permanent collection of geographically dispersed individuals, groups or organisation departments not belonging to the same organisation - or entire organisations, that are dependent on electronic communication for carrying out their production process" (Travica 1997, p. 2). It is also defined as an "identifiable group of people or organisations that make substantially more use of Information and Communication Technologies than physical presence to interact, conduct business and operate together, in order to achieve their objectives." (Sieber and Griese, 1998, p. 9). It is instructive to note that both definitions emphasise on the use of mediated communication to achieve a common goal. Early examples of virtual organisations usually focus on for-profit corporations, and private agencies related

to the banking sector, advertising, and accounting agencies such as Security First Network Bank, World Cup USA, Inc., Ernst & Young, Douglass, Rosewater & Brown (Shao, Liao and Wang, 1998). In the recent past, Wikipedia, Upwork and Amazon have also been described as virtual organisations going by the dimensions (connectivity, purpose, technology, and boundary) used in characterising virtual organisations (ibid.).

On the other hand, Porter (2006) defines virtual communities as "an aggregation of individuals or business partners who interact around a shared interest, where the interaction is at least partially supported and/or mediated by technology and guided by some protocols or norms". Other scholars such as Igbaria (1999) defines virtual communities as:

> A term commonly used to describe various forms of computer-mediated communication, particularly long-term, textually mediated conversations among large groups. It is a group of people who may or may not meet one another face-to-face, and who exchange words and ideas through the mediation of computer networks and bulletin boards (p.68).

Lastly, a more comprehensive definition suggests virtual communities as the assembly of people that regularly meet to discuss shared interests, experience, ideas and feeling through synchronous or asynchronous electronic communication (Ridings and Gefen, 2006). Virtual communities can be commercially inclined or non-profit communities. Commercially inclined communities offer among other thing product information and customer service support, while non-profits offer specialised services such as disease information and patient support. Examples of online communities include parenting communities (CafeMom[5]), book lovers' communities (GoodReads[6]), music lovers (Last. Fm[7]), travel and lifestyle (WAYN[8]), and wellness communities (inspire[9]) among others (Grabner-Kräuter, 2009; Kaplan and Haenlein, 2010; Nakamura, 2013).

From the above definitions, terms such as computer-mediated communication, geographically dispersed and shared goals/interests are common to both the virtual communities and organisations. DeSanctis and Monge (1999) described the components - individual workers, teams, departments, units, or firms - of virtual organisations as "geographically distributed, functionally or culturally diverse, electronically linked, and connected via lateral relationships". However, a more in-depth look into the type of computer-mediated communication platforms used by each group and the purpose upon which each group operates could provide an insight into how these groups differ from one another. For

[5] https://www.cafemom.com/
[6] https://www.goodreads.com/
[7] https://www.last.fm/
[8] https://www.wayn.com/
[9] https://www.inspire.com/

example, virtual organisations have tended to use industry-specific applications or specialised Workgroup software such as Microsoft SharePoint, Basic Support for Collaborative Work (BSCW) system, Nomad, Lotus Notes, Group Decision Support Systems and Electronic Meeting Rooms (Ellis, Gibbs and Rein, 1991; Rama and Bishop, 2006). On the other hand, literature revealed that virtual communities have historically tended to use asynchronous platforms such as a bulletin board system and listserv (Porter, 2006). As for the purpose upon which these groups operate, past studies show that virtual organisations mainly exist for commercial interests or public services. On the contrary, virtual communities usually come into being as a result of the needs for access to information (Wellman, 1996), social support (Ridings and Gefen, 2006), friendship (Parks and Floyd, 2006), and recreation (Jackson, 1999) among others. With hindsight from these past studies, one needs to be circumspect of the changing landscape of such technologies in this era of cloud computing, and popularisation of open source movement and social software. As such, virtual organisations and communities might also move from the use of such platforms to more scalable cloud-based platforms and mobile applications.

Having highlighted the commonalities and differences, the review will now discuss the nature and culture of the virtual organisations and communities which will be referred to as a virtual team. The term virtual team will be used interchangeably with virtual organisations/communities because it is akin to a group of people working across geographical, cultural, organisational and time zone boundaries by making use of computer-mediated communication technologies to achieve a common goal (Loughran, 2000). Virtual teams, as argued by Loughran (2000), come in different types and size. For example, it is possible to have a virtual team from the same unit in an organisation working on a project or a virtual team in an organisation drawn from different units working on the same project. A virtual team can also consist of members drawn from different organisations but having the same culture and orientation. Also, a virtual team can include a group drawn from various organisations with different culture and beliefs. Additionally, another virtual team could also involve members with different customs, beliefs and orientation drawn from different organisations and perhaps countries. The last type of virtual teams is what Jarvenpaa and Leidner, (1999) referred to as “a temporary, culturally diverse, geographically dispersed, electronically communicating workgroup” (pg. 792). As helpful as this categorisation of a virtual team is, it has not comprehensively taken into consideration some organisations that can have all the different types of teams. For example, HR as an organisation can have a virtual team from amongst its different units such as internal drills team working on a particular project. It can also have two different teams such as Animals in Disaster working in conjunction with internal drill team to develop an internal drill exercise related to Animals in Disasters. It is also a common practice for HR to team up with other organisations such as

Standby Task Force (SBTF) or Translators Without Border (TWB) during major events to produce situation reports.

Unlike in physical organisations, leadership culture within the virtual team is more about teamwork and collaboration rather than traditional hierarchical approach. Fairchild (2004), argues that virtual team leaders mostly take the role of colleagues and counsellors rather than judges and leaders. Some of the reasons adduced for this type of leadership in the virtual organisation are because the team may need each member to take a leadership role at some point in time-based on specialisation, or background, as well as where the team is in the process (Lipnack and Stamps, 1999). In essence, the leadership role may keep changing hands in the process depending on the task requirement which also relies solely on the expertise of each team member. Furthermore, Heydebrand (1989, p. 327) describe the virtual organisation with features in which "... division of labour is informal and flexible; and its managerial structure is functionally decentralised, eclectic and participative...". As a matter fact, this type of cultural differences has been described in the literature as a source of tension between traditional and virtual organisations working in disasters (Collins, 2011; St. Denis, Hughes and Palen, 2012).

Past studies in computer-mediated communication have characterised the nature of communication within a virtual team. Yates, Orlikowski and Okamura, (1999) characterise electronic communication genres into non-work related, work-related, technical and administrative. Furthermore, Hayes and Reddy (1983) suggest that regardless of the medium of communication, the principle of graceful interaction between spoken and interactive text are mostly the same. Likewise, earlier studies revealed that interactions within the collaborative environment are usually characterised with textual chat, exchange of ideas, gossips, clarifying dialogues when one user is unable to understand the other user (Hayes and Reddy, 1983; Igbaria and Magid, 1999). Specifically, interaction within the virtual collaborative environment involves the use of cooperative techniques in overcoming interaction challenges. Such approaches include implicit confirmation, explicit acknowledgement, explicit indications of incomprehension as well as echoing and fragmentary recognition.

Apart from understanding the genre of communication and mode of interaction, understanding how the adoption of technological platforms affects the future use of other mediated environment has also been addressed by past studies. Huysman et al.'s (2003) study on the use of communication technology in a virtual team observed that steps taken in adopting technological tools and platforms by the virtual team in its early formation stage 'constrain later flexibility in terms of media usage' (pg. 416). In essence, virtual teams tended to hold onto the technological tools and platforms they started using earlier during the

inception phase. The authors referred to this type of behaviour as 'media stickiness' that is 'the tendency for a group of users to collectively stick to one type or style of media use and not switching to another' (pg. 431). The study also concludes that over time virtual teams tend to develop distinct communication patterns based on what type of technological tools and platforms they appropriate, how they used such tools and why they are appropriating such tools and platforms. While the author's conclusion on media 'stickness' and distinctive communication pattern can hold true for the virtual team, this tendency can also be found in traditional organisations.

Having discussed the features of virtual organisations, this review will now move on to discuss their benefits. Earlier studies suggest that the ability to work anywhere and at any time is counted as part of the advantage of virtual organisations. Also, virtuality allows organisations to network beyond the confines of its geographic locations, opens the new possibilities for work, as well as reduces travel and meeting cost (Johns and Gratton, 2013). Past studies have shown that virtual organisations have the potential of providing greater adaptability, the immediacy of response and task specialisation (DeSanctis and Monge, 1999). Other advantages include flexibility, adaptiveness as well as speed in dynamic global events (Huysman *et al.*, 2003). In a study that examines team process of the virtual team, Rice et al. (2007) show that past literature in organisational studies found an increase in productivity, reduction of relocation cost, and better outcomes as part of the potential benefits derived from virtual organisations. Rice et al. (ibid, pg. 509) also suggest that compared to face to face meetings, a virtual meeting conducted using computer-mediated communication is far more efficient on activities related to "'brainstorming', 'consensus-building', and 'status update meetings' for disseminating and describing recent results".

While there are benefits and advantages related to working in a virtual team, as shown above, the literature is also replete with issues and challenges associated with the working in a virtual team. In what follows is the review of earlier studies that relate to these challenges concerning trust, communication, as well as cognitive and social factors.

2.2.1 Trust

As tempting as it is to think we know what it means, trust is not an easy concept to define. For example, in an introduction to special issue titled 'Not So Different After All: A Cross-Discipline View of Trust', Rousseau et al. (1998) argued that trust has no universally accepted scholarly definition. The authors opined that different fields and disciplines perceive trust based on their disciplinary emphasis and methodological approach. In this case, the defining threshold of trust for Sociologists tends to be in understanding the socially embedded dimensions of relationships among people or institutions while the Economists view of trust

tends to revolve around institutional or calculative dimensions. Other disciplines such as Psychology perceived trust from the dimensions and attributes of trustors and trustees alongside several internal cognitions that appear as a result of personal attributes (ibid.). Nonetheless, trust as argued by Mayer, et al. (Mayer, Davis and Schoorman, 1995) is the "willingness of a party to be vulnerable to the actions of another party based on the expectation that the other will perform a particular action relevant to the trustor, irrespective of the ability to monitor or control the actions of the other party". Trust is therefore assumed to be a critical factor for the success of both intra-group and inter-group activities and has been described as the most important causal prerequisite for the existence of any society, group or organisation (Dunn, 1984). Trust enables teams to achieve better accomplishments in task performance, higher and more healthy personal development, as well as the ability to cooperate with one another (Jones and Marsh, 1997). The emerging needs for understanding trust in organisations stem based on the changes and advancement of technology that have radically reconfigured exchange and the organisation of work across distance and time (Mcevily, Perrone and Zaheer, 2003). It is this need that promoted Ferrazi (2012) to argue that building and maintaining trust in traditional (physical) organisations is not an easy task that can be achieved overnight. The author opined that the difficulty is even more profound when the process involves building and maintaining trust in a virtual organisation. Long before that, trust in the virtual organisation has been a subject of concern among organisational studies scholars. For instance, in an article that appears in Harvard Business Review about the implication of establishing and maintaining trust in a virtual organisation, the author (Handy, 1995) asked: 'How do you manage people whom you do not see'? He went on to argue that:

> The simple answer is, by trusting them, but the apparent simplicity disguises a turnaround in organisational thinking. The rules of trust are both obvious and well established, but they do not sit easily with a managerial tradition that believes efficiency and control are closely linked and that you can't have one without a lot of the other (Ibid, 1995, pg. 41).

At the same time, for the virtual teams to overcome the challenge of trust, organisations need to take advantage of the expertise of the team, as well as ensuring leaders set clear and smart goals with deliverables that every team member understands (Johns and Gratton, 2013). Kasper-Fuehrer and Ashkanasy (2001) identified common business understanding and strong business ethics as the two most essential factors for building trust in an organisation. Common business understanding in this respect refers to a "transient understanding between network partners as to what they stand for, about the nature of the business transactions that they engage in, and about the outcomes that they expect—their "vision."" (ibid, 246). On the other hand, business ethics refers to a shared agreement about business standards that will form the

basis of team members decision in respect of all their activities, both internally and externally. Furthermore, Kasper-Fuehrer and Ashkanasy (2001) argued that achieving and maintaining strong business ethics can be achieved by specifying and clarifying members' tasks, responsibilities and sanctions for the violation of such norms. Earlier studies also looked at the dimension of risk and interdependence and considered them as essential ingredients for building trust in a virtual team (Mayer, Davis and Schoorman, 1995). Chiles and McMackin (1996) explained risk as a perceived probability of loss as interpreted by the decision maker and is regarded in psychological, sociological, and economic literature as an essential dimension of conceptualising trust (James, 1990). On the contrary, Wageman, (1995) defined interdependence as the degree to which team members rely on the upon the actions or information of other members to accomplish own's work. The research literature categorises interdependence into task interdependence, outcome interdependence, and resource interdependence (Gibson and Manuel, 2003). Likewise, a study that examined 65 virtual teams for a travel industry identifies reliability, consistency and responsiveness when dealing with colleagues and customers as a necessary ingredient for building and maintaining trust (Kirkman *et al.*, 2002). Other approaches include: building interpersonal trust, sharing and rotating powers across expertise and organisational units, as well as communicating with predictability (Panteli and Tucker, 2009).

Altogether, there seems to be no one agreed approach to building and maintaining trust in a virtual team. However, as shown in the above paragraph, the ability for a team to have a joint business understanding at the initial phase can help in building trust. Other important factors include ground rules, interdependence as well as consistency in responding to the team members.

2.2.2 Communication issues in virtual teams

A notable concern associated with working with the virtual team is that of lack of shared goals when communicating (Loughran, 2000). Studies have shown that virtual teams have less overlap with regards to their representation of the shared task among members and are less cohesive compared to co-located teams (Hinds, 2000). In a study that examined 13 virtual team projects including students drawn from North America, Europe and Australia, Cramton (1997) finds five types of communication problems inherent in global virtual teams:

a. failure to communicate contextual information
b. difficulties in communicating the salience of information
c. unevenly distributed information
d. differences in speed of access to information, and
e. challenges in interpreting the meaning of silence.

The author illustrates a 'failure to communicate contextual information' with instances where team members are not able to share critical information pertaining their context and constrain to their global virtual team and argues that such tendencies could cause the breakdown of team relationship. 'Difficulties in communicating the salience of information' refers to a situation where a team member might have assumed that what is salient to him or her might also be salient to other team members. Sometimes, a team member might ask indirect feedback and would be expecting to receive prompt feedbacks while such an indirect request might mean different things to other team members. The 'unevenly distributed information' challenge refers to a situation in which one of the team members will be unable to receive the same message shared to the entire team because of a technical or human error. 'Differences in speed of access to information' arises when some team members have more access to that information compared to others on the same team. For instance, it is possible to have members with 24/7 access while other distributed team members have less access. The author also describes the last challenge associated with the 'interpreting the meaning of silence' as a situation when a team member shared information to the group and receive no response. The silence according to Cramton could mean any of the following: "I agree. I strongly disagree. I am indifferent. I am out of town. I am having technical problems. I don't know how to address this sensitive issue. I am busy with other things, I did not notice your question. I did not realize that you wanted a response" (ibid, pg. 301). As such, the inability of the other team members to 'respond' to the message when perceived negatively by the person who shared the message could have implications to the overall functioning of the team. It is possible for the person to start developing an ill feeling towards other team members because of the way the team 'deliberately ignored' his/her message. Given these points, the insights from Cramton studies offers an essential lesson of what virtual global teams need to be aware of in their formation stage. Understanding some of these challenges at the inception phase will make team members adjust and come up with ground rules that will be favourable to the functioning of the team.

Past studies have shown that low team members' awareness, the reduced richness of information, a higher propensity for miscommunication, greater conflict and cultural differences are also part of challenges related to communication in a virtual team (Leinonen, Järvelä and Häkkinen, 2005; Rice *et al.*, 2007). While awareness can be an "understanding of the activities of others, which provide context for your own activity" (Ibid, p. 107), it has also been defined as "a user's internal knowing and understanding of a situation, including other users and the environment that is gained through subtle practices of capturing and interpreting information; and this awareness information partly exists in the environment and is partly provided by awareness technology" (Gross, 2013, p. 432). It "is needed for both contact facilitation in communities and teams and for maintaining teamwork at a high-

performance level within teams" (Schlichter, Koch and Xu, 1998, p. 84), and it is therefore assumed to be critical to collaborative systems where coordination and information sharing activities are involved. Awareness enables users to structure their activities which in turn prevent unnecessary duplication of effort. By contrast, its absence within the virtual team can result in a lack of the 'reciprocity of perspectives', 'and 'overlapping talk' among team members (Hindmarsh *et al.*, 2000; O'Neill and Martin, 2003). As such, to overcome the challenges of lack of awareness the virtual team will need know what team members are doing, and what the team is going to do next, this will allow synergistic group behaviour and overcome the challenge of communication (Gutwin and Greenberg, 2002). In this respect, 'who', 'what', 'where', 'when' and 'how' questions will guide the team to know who the team members are, what team members are doing, where team members are working, when the event evolved, and how such an event occurs.

For a virtual team to overcome the challenge of lack of awareness, it must recognise some features and dimensions of awareness. Earlier studies in CSCW have identified various features and characteristics of awareness in a virtual team. Gross (2013) found four core elements of awareness documented in CSCW research. These elements include general information of the participant or users, in-depth information about the member's attention, work-oriented information on participant activities as well as adjustment or modification to shared workspaces and documents. Other studies also suggest annotations, role assignment, and access right as awareness support mechanisms (Dourish and Bellotti, 1992). In this respect, Dourish and Bellotti (1992) characterised awareness into information about the substance regarding the work in context, information that relates to the coordination of the work, as well as the interpersonal relationship that makes the group members work. In the same vein, in a study of workplace awareness, Greenberg and Mark Roseman (1996a) classified awareness into group structural awareness, social awareness, informal awareness and workspace awareness. Group structural awareness refers to a type of awareness that is concerned with the different roles and responsibilities assigned to team members. Social awareness relates to the type of awareness that revolves around information about the social context of a team. Informal awareness provides general knowledge of the group, while workspace awareness deals with the type of information on the current status of the team's workspace and how such status is achieved. As shown above, there are different features of shared awareness in a virtual team that primarily revolves around the user, the work as well as the workspace.

In summary, communication challenges stemming from virtual team appear to arise when there is a lack of understanding of the team goals, failure to communicate contextual information, and difficulties in communicating the salience of information. Other challenges

include unevenly distributed information from among the team, differences in speed of access to information by the team as well as challenges in interpreting the meaning of silence. We now turn to review the challenges associated with social factors in a virtual team.

2.2.3 Social factors

In a study that examines shared understanding in virtual teams, Leinonen, Järvelä, and Häkkinen, (2005) found that one of the challenges associated with working in a virtual distributed team is the difficulty in managing the dual problem of cognitive and social factors. The challenge of social interaction in a virtual team has been examined further by Johns and Gratton (2013), who suggest that "communications technologies allowed us to expand our networks far beyond our geographic locations and gave us access to new possibilities for work, but at the same time, they weakened the local connections that were our source of social interaction and fun". Furthermore, the authors argue that virtualisation takes away the 'serendipitous encounters and hallway conversations' as well as watching through the eyes of others in a physical environment (ibid), and Handy (1995) asserts that even 'office politics and gossip have their attractions'. However, with organisations going virtual, the value derived from physical, social interaction may eventually disappear. Another concern relates to 'too little unstructured social contact', as well as 'lack of sense of community and the richness of collaboration' (Johns and Gratton, 2013). Likewise, in buttressing the importance of social context cues, Lipnack and Stamps (1999) argue that successful teamwork outcome is hinged on team members disposition rather than on the technology. The authors concluded that that regardless of how robust and sophisticated mediating tools are, such tools will not work unless the team members social issues are addressed ab initio. Indeed, the argument on the weak local connections and social issues associated with working in a virtual team sounds reasonable. However, with the current innovative advancement in technology, such idea of weak local connections needs to be revisited. Current technology allows for creating backchannel conversation space where virtual team members hang out. Previous studies have shown that the creation of such backchannels have the potentials of helping virtual team members develop relationships (Starbird and Palen, 2013). Accordingly, as technology advances, there is a possibility that the concern related to lack of sense of community and social interaction might also disappear with the passing of time.

2.2.4 Conclusion/Summary of Virtual Organisations and Communities

All in all, this section reviews past studies on virtual organisations and communities. The choice for reviewing the literature on virtual organisations and communities stemmed from the fact that the phenomenon in question – digital volunteerism - is entirely virtual. As such,

the review examined similarities and differences between virtual teams and organisation as well as offering justification for combining the two. Furthermore, this section covered features, benefits, issues and challenges and concludes with the discussion of approaches for overcoming the virtual collaborative work challenges.

2.3 Social media use in Disasters and Emergencies

Having reviewed earlier studies on virtual organisations and communities alongside their features, challenges, and benefits, this section will now move on to explore related studies on social media use in disasters and emergencies. The review begins with a definition of concepts and offers an overview of the social media research landscape. Afterwards, the review discusses earlier studies on crowdsourcing, emergent volunteers and established digital volunteer communities. Following that, the review discusses data quality challenges associated with crowdsourced data, process workflow and appropriation of technological tools and rounded up with the identification of the research gap.

By way of introduction, social media as defined by Kaplan and Haenlein (2010), "is a group of Internet-based applications that build on the ideological and technological foundations of Web 2.0, and that allow the creation and exchange of User Generated Content" (Pg. 60). Likewise, the Social Media Working Group for Emergency Services and Disaster Management described social media as any online or digital medium provided and/or collected through a channel that enables the two-way sharing of information, involving multiple parties. This includes social networking sites, texting, blogs, etc. (Department of Homeland Security *et al.*, 2018, p. 2). On the other hand, the United Nations Platform for Space-based Information for Disaster Management and Emergency Response (UN-SPIDER) clarifies the difference between a disaster and an emergency. According to the UN-SPIDER:

> An emergency is an event that can be responded to using the resources available at hand, implying that there is no need to request external assistance. A disaster, on the other hand, is characterised by impacts that overwhelm the capacities of local responders and place demands on resources which are not available locally. Hence, an event is declared as a "disaster" when there is a need for external assistance to cope with its impacts (UN-SPIDER, 2008).

Having identified the concepts of social media, disasters and emergencies, the review will now examine the changing landscape of social media studies in disasters and emergencies.

Past studies have documented that the use of social media in this domain could be traced to the time when the Federal Emergency Management Agency (FEMA, USA) and Red Cross made use of web-based collaborative Wikis to manage information during 9/11 attack (Harrald

et al., 2002). Since then, the use of social media during disasters and emergencies has become routinised among emergency responders and aid agencies. Researchers across disciplines and fields have studied and continue to understand this phenomenon. To date, several studies have been undertaken to explore the characterisation and the pattern of its usage (Abedin, Babar and Abbasi, 2014; Reuter, Hughes and Kaufhold, 2018), collective behaviour associated with its use (Eismann, Posegga and Fischbach, 2016), as well as similarities and differences in crisis communications (Olteanu, Vieweg and Castillo, 2015). Past studies also sought to understand the knowledge gap that exists in its research (Fraustino, Liu and Jin, 2012).

Reviews of the social media studies in disasters and emergencies have tended to cover both natural disasters, non-community crises, as well as conflict type situations. Natural disasters include events such as a tornado, hurricane, flood, landslide, earthquake, volcano, wildfire, heat/cold wave, epidemic and infestation (Olteanu, Vieweg and Castillo, 2015). Non-community crisis includes events such as building collapse, train derailment, and transportation accidents, gas explosion, and oil spillage among others (Quarantelli, 1988). Conflict type situations are events such as civil disturbances, blackout, riots, terrorist attack, school shootings, and bombings (Quarantelli, 1988; Olteanu, Vieweg and Castillo, 2015). However, most of these studies tended to approach their work by using information harnessed through Twitter.

Past studies in social media have revealed its use across a broad range of disasters and emergencies. For example, from 2004 to 2016 most of the published studies tended to cluster around investigating events such as an earthquake, flooding, hurricane, wildfires, conflict type and non-community crisis. Table 2.1 offers an overview of a variety of social media studies in disasters and emergencies.

Table 2.1. Social Media Research Landscape (Adapted from Reuter, Hughes and Kaufhold) (2018)

Disasters	Studies
Earthquake	Acar and Muraki, 2011; Mendoza, Poblete and Castillo, 2010; Wu, 2009; Kogan et al., 2016; Starbird and Palen, 2011; Wilensky, 2014; Yates and Paquette, 2011
Flooding	Peters and de Albuquerque, 2015; Chaturvedi, Simha and Wang, 2015; Starbird et al., 2010; White, Palen and Anderson, 2012
Hurricane	Endsley, Wu and Reep, 2014; Hughes and Palen, 2009; Hughes, Palen and Peterson, 2008; Liu et al., 2008; Sagar, 2016; Yang et al., 2013
Wildfires	Chauhan and Hughes, 2017; Helsloot and Groenendaal, 2013; St. Denis, Hughes and Palen, 2012; Shklovski, Palen and Sutton, 2008; Starbird et al., 2010; Sutton, Palen and Shklovski, 2008
Conflict type	An et al., 2016; Burnap et al., 2014; Heverin and Zach, 2010; Palen and Liu, 2007; Perng et al., 2012; Starbird and Palen, 2012; Wan and Paris, 2015; Wiegand and Middleton, 2016; Wulf et al., 2013
Non-Community crisis	Wulf et al., 2013; Kuttschreuter et al., 2014; Muralidharan, Dillistone and Shin, 2011; Nagy and Stamberger, 2012; Reuter, Marx and Pipek, 2012; Medina and Diaz, 2016; Sutton, 2010; Utz, Schultz and Glocka, 2013; Zeng, Chan and Fu, 2016

Table 2.1 offers a synopsis of the types of social media studies within the last decade. The reviews cover both natural disasters, non-community crisis as well as non-conflict type of humanitarian emergencies.

These reviews of the crisis informatics literature show the predominant use of Twitter as a source of data across social media studies. For example, past studies documented the use of Twitter during conflict type of crisis (Heverin and Zach, 2010; Burnap et al., 2014), flooding (Chaturvedi, Simha and Wang, 2015), wildfires (Starbird et al., 2010; Helsloot and Groenendaal, 2013) and Hurricanes (Hughes and Palen, 2009). Furthermore, earlier studies examined its usage as a tool for crisis management and communication (Acar and Muraki, 2011; de Albuquerque et al., 2015) while others highlight how citizens make use of Twitter alongside Facebook to communicate to disaster-affected communities with information related to aids and disaster alerts and warning (Sagar, 2016). In addition, earlier studies presented mixed findings with regards to the use of Twitter in disasters and emergencies. For example, Mendoza, Poblete and Castillo (2010) examined Twitter users' behaviour with regards to how they share false rumours or use Twitter to confirm the truthfulness of news during the 2010 earthquake in Chile. The study revealed how information related to rumours

differs from the news. The authors claimed that Twitter users tend to question rumours shared on Twitter more than the way they questioned news. With that in mind, the authors concluded that based on their study, it is possible to discover rumours through the use of aggregate analysis of the twitter messages. In like manner, Wilensky (2014) investigated the use of Twitter following the Great East Japan Earthquake of March 11, 2011. The study offered a mixed finding on the usefulness of the Twitter and its drawbacks. For example, finding from the study shows how Twitter was used to provide situational awareness information, advice, as well as emotional support to the stranded victims. On the flip side, the study revealed that Twitter serves as an avenue for the unintentional sharing of obsolete and inaccurate information as well as the unequal distribution of vital information. In short, Twitter provides both opportunities and challenges in digital disaster response as well as in crisis informatics research.

Reuter, Hughes and Kaufhold (2018) and Reuter and Scholl (2014) offer three possible explanations for the dominance of Twitter as a research tool and data source in crisis informatics. First, they argue about the ease of access to crisis data Twitter offers through its application programming interface (API) compared to other social media platforms. Second, Twitter messages allow for more natural statistical sampling. Third, its contents are more accessible to store, process and analyse compared to other platforms. While the arguments on the predominance of Twitter in the disaster research relates to ease of access, statistical sampling and processing, it is also possible to argue that Twitter is among the few platforms that people find more comfortable to share disaster-related information quickly. This could be due to the minimal number of steps required for people to attach pictures, use links, or upload videos and write a message before publishing the content.

To sum up, studies of social media in disasters and emergencies are diverse and broad ranging. As seen in the previous paragraphs, various disciplines and fields have in one way or the other examined social media in disasters and emergencies. As such, the review will now move on to discuss studies that explore the application of crowdsourcing in processing social media data.

To begin with, Crowdsourcing is a neologism of the word ‘crowd’ and ‘outsourcing’ coined by Howe (2006) in his seminal article to mean “the act of taking a job traditionally performed by a designated agent . . . and outsourcing it to an undefined, generally large group of people in the form of an open call.” However, it is worthy to note that, apart from Howe’s coinage, several scholars characterised crowdsourcing with different nomenclatures. For instance, some scholars referred crowdsourcing as ‘collective intelligence’, ‘open innovation’, ‘collective wisdom’, or a ‘crowd work’ (Thuan, Antunes and Johnstone, 2016). Building on Howe’s and other scholars’ work, Estellés-Arolas and González-Ladrón-de-Guevara (2012) synthesised 32 research papers that defined Crowdsourcing and came up with a consolidated definition as:

> A type of participative online activity in which an individual, an institution, a non-profit organisation, or company proposes to a group of individuals of varying knowledge, heterogeneity, and number, via a flexible open call, the voluntary undertaking of a task. The undertaking of the task, variable complexity and modularity, and in which the crowd should participate bringing their work, money, knowledge and/or experience, always entails mutual benefit. The user will receive the satisfaction of a given type of need, be it economic, social recognition, self-esteem, or the development of individual skills, while the crowdsourcer will obtain and utilise to their advantage what the user has brought to the venture, whose form will depend on the type of activity undertaken (pg.197).

In like manner, Liu (2014) defines crowdsourcing as:

> A dynamic form of cooperative work involving a large and often indeterminate number of civic participants conducting semi-autonomous tasks to address information management issues. This type of mass collaboration typically occurs in a distributed way often leveraging social networking technologies to facilitate coordination among different crowds (pg., 390).

In the context of digital disaster response, crowdsourcing was used by online volunteers as far back as 2004 to self-organise in situations of crisis. These online volunteers make use of mobile technologies and web-based applications to raise awareness and solicit support for the affected communities. The earliest traces of such activities by these disparate online volunteers were during Indian Ocean Earthquake and Tsunami (2004), London bombing (2005) as well as Hurricane Katrina (2005). During such periods, volunteers used Flickr to rally support for the disaster-affected communities (Liu *et al.*, 2008). Moreover, some added evidence of the applications of crowdsourcing to situations of crisis using social media platforms such as Blogs and Facebook were seen during Hurricane Katrina in 2005 and Virginia Technology shooting in 2007 (Vieweg *et al.*, 2008). Such platforms served several purposes. For instance, in certain circumstances, they served as tools for collective intelligence while in other situation, they facilitate in maintaining a sense of community. Likewise, these platforms were also helpful in finding missing persons and identifying victims. Vieweg et al. (2008) claimed that during the Virginia shooting, volunteers used Facebook to determine the identities of most of the victims ahead of the official pronouncement by the University.

The convergence phenomenon in which volunteers spontaneously assemble (online) during disasters and provide information as a form of aid is an age-old knowledge theorised by disaster sociologists long before the advent of web 2.0. (Quarantelli and Dynes, 1977; Britton, 1988, 1991). Behaviours such as organised response and role enactment by the established digital volunteer groups (which will be explored later) have also derived their inspirations

from the same field. Webb (1999), argues that for an in-depth understanding of organisational response to disasters, one needs to recognise the nature of the organisation itself. Past studies in disaster sociology mostly utilised the seminal work of Dynes (1970) as a framework for understanding the social organisation of disaster response, popularly known as the DRC (Disaster Research Centre) Typology. The typology classifies organisations, according to task and structure. The type of task could be either regular or non-regular and then ranked into structures as old or new. From that classification, Dynes (1970) categorised organisations as Type I, II, III or IV as shown in Figure 2.1 below. For example, Type I or established organisations such as police, fire, and ambulance as being characterised by an existing (old) structure while carrying out regular tasks during a response operation. Type II or expanding organisations (i.e. Red Cross) are characterised by carrying out regular tasks, but with the new structural procedure. Type III or extending organisations have an existing (old) structure but undertake non-regular tasks in the event of a disaster. Lastly, a Type IV organisation, which is also known as an emergent organisation, is characterised by a new structure and always-undertaking non-regular tasks.

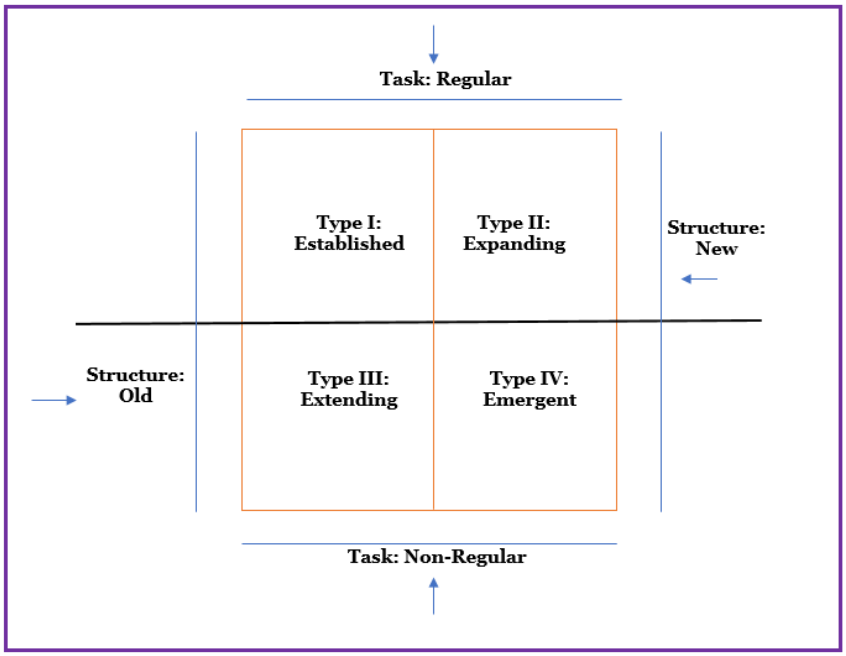

Figure 2.1. An illustration of DRC typology adapted from Kreps and Bosworth (2007)

Similarly, existing literature on the digital volunteers has tended to cluster around understanding the self-organisation of emergent groups on the one hand and established/expanding groups on the other side. CSCW and crisis informatics scholars have characterised unaffiliated, and spontaneous/bystander digital volunteers as 'emergent groups' (Starbird and Palen, 2011; Reuter, Heger and Pipek, 2013) on one hand, and those that work with established volunteer communities, such as Humanity Road as an 'expanding group' (Starbird and Palen, 2013; Cobb *et al.*, 2014).

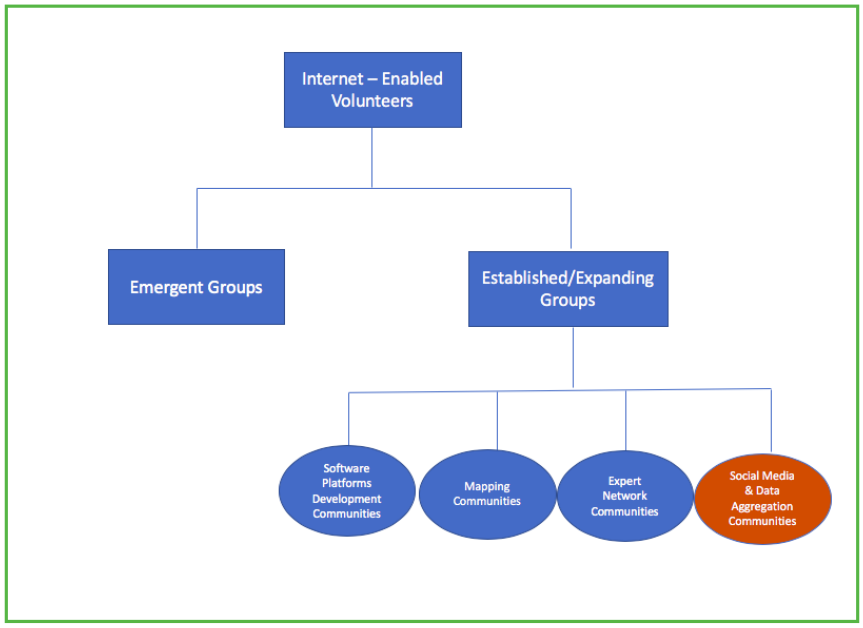

Figure 2.2. An illustration of the different research streams adapted from Gorp (2014).

Figure 2.2 above shows the different types of studies on digital volunteers. The first category relates to studies on emergent – unaffiliated, spontaneous, bystander – groups. The second – established/expanding groups – include communities such as software platforms and development communities, mapping communities, expert network communities and social media and data aggregation communities (Gorp, 2014). I have highlighted Social media and data aggregation communities' category differently to show that the primary focus of this PhD research is on one of its community members–Humanity Road. Thus, I elaborate on the crowdsourcing activities of both groups in the following subsections. The rationale for including both groups is to bring to light their operational and structural differences. By providing such highlights, the awareness of such differences might help in reducing the marked lack of understanding of their operational activities.

2.3.1 Emergent Volunteer Groups in Disasters

Emergent groups are composed of volunteers that spontaneously converge as bystanders during a disaster and disappear shortly. Kreps and Bosworth, (Kreps and Bosworth, 2007) argue that their advent and actions are extempore and therefore exclusive to the catastrophe. Furthermore, Kreps and Bosworth, (Kreps and Bosworth, 2007) described the collective behaviour of emergent groups as unaffiliated, convergent and spontaneous. Disaster sociologists provide theoretical advances on the concept of collective behaviour, social solidarity and convergence phenomena (Fritz and Mathewson, 1957). Interestingly, crisis informatics researchers have observed that the difference between offline and online

convergence behaviour is in the immediacy in which information and people converge as well as the distance from which people can contribute to the relief effort (Hughes *et al.*, 2008).

To understand emergent groups, Stallings & Quarantelli (1985) investigated their roles and their implications for the emergency management process during disasters. The authors observed that these emergent groups are informal and evolved based on the notion that emergency management organisations are nowhere near the disaster scene, or those present are overwhelmed or incapable of providing services to the disaster-affected communities. They also characterised these groups as lacking in the formalisation of structures and tasks as well as tradition. The groups can also take the form of 'damage group', 'search and rescue group' or 'coordination group' depending on the circumstances. While the sociological depiction of emergent groups appears before the advent of web 2.0, such type of emergence is also prevalent in the virtual world. Crisis informatics literature document the appearance of virtual emergent groups during the July 2005 London bombings, Hurricane Katrina (Liu *et al.*, 2008), Virginia Tech event (Palen *et al.*, 2009), as well as 2007 Southern California wildfires (Hughes *et al.*, 2008). Accordingly, Stallings & Quarantelli (1985) claimed that emergent groups are found in nearly every major disaster. The authors argued that such appearance is inexorable, obvious, neither necessarily dysfunctional nor conflicting and its obliteration by any groundwork is something next to impossible. In other words, spontaneous and unaffiliated groups will emerge in every major disaster. As a result, the study, therefore, recommends the need for their recognition publicly by those in authority as well as the need for linking their activities to the network of the organised response system.

Majchrzak, Jarvenpaa, & Hollingshead (2007) use transactive memory system (TMS) theory to provide insight into how this virtual emergent response team coordinate their activities using technology and available resources. Likewise, Kreps & Bosworth (2007) theorised the concept of collective behaviour which they derived from the DRC postulation of the organised response. According to these authors, "formal organising starts with a clear understanding about domain [D] and tasks [T] (i.e. What is being done, by whom, and how) before resources [R] are mobilised, and activities [A] takes places (Ibid, pg. 300). According to this proposition, established groups exhibit formal organising behaviour while emergent groups exhibit collective behaviour. The difference is, "with collective behaviour, activities [A] take place and resources [R] are mobilised before such understanding exist. The sequencing of the organisational element for the emergent group is A– R- T- D" where 'A' stands for activity, 'R' for resources, 'T' for the task and 'D' for the domain. This sequencing differs from the organisational element of formal organising by the established/expanding groups in which the reverse is the case. In other words, the organisational elements for the established/expanding groups start with D-T-R-A (Ibid, pg. 300). On the whole, emergent groups are spontaneous

and do not have an existing structure and standard operating procedures, unlike expanding and established groups.

This review of the emergent groups' literature has revealed much interest in areas related to self-organisation, information sharing, and computational information processing. The research on the self -organisation of digital volunteers has documented their phenomenal rise (Starbird and Palen, 2011), as well as how they self-organise and share disaster-related information (Heverin and Zach, 2010). Some of these studies that attempt to understand the work of unaffiliated spontaneous volunteers approach their research by collecting and examining information contents produced by such groups during disasters. For example, Liu et al. (2008) study examined how the disaster-related activity of emergent volunteers evolved on Flickr - a photo sharing website - by studying six significant disasters. The authors investigated how these volunteers produced and shared images. Findings from the study observed how volunteers across different disasters made use of Flickr to organise pictures around themes such as newsworthiness, solidarity and community cohesion, historical value, global education and awareness. Although the study dwells on the self-organisation of digital volunteers in processing disaster images, it has not provided insight into how these volunteers ascertain the authenticity of the photos prepared by the online volunteers in their studies. Likewise, Heverin and Zach (Heverin and Zach, 2010) explore the use of Twitter as a crisis communication platform during the search of the suspect who shot four police officers in the Seattle - Tacoma area of Washington. The study highlights the information contents shared by spontaneous and unaffiliated volunteers which include opinion, technology, emotion and action related information among others. However, the study has not provided detailed picture on the vetting mechanisms or how this disparate, unaffiliated spontaneous group self-organise to validate information and share it to the police.

Past studies related to how social media enables information sharing during a crisis event examined the nature of messages and how the location of such messages can provide useful information for managing response operation (de Albuquerque *et al.*, 2015). To undertake such study, the authors combined georeferenced Twitter crisis messages produced by volunteers during the River Elbe Flood in Germany with external data sources to identify spatial patterns. The external data sources include sensor data, hydrological data and digital elevation models. The results from this quantitative study show that combining georeferenced data and authoritative data helped in identifying broad spatial patterns from the tweets with a higher probability that may be related to the location of the events. With that outcome, the authors claimed that their findings have the potential of providing useful situational awareness information for managing disasters (ibid). Likewise, Starbird et al. (2010) explores the information content shared through Twitter to understand the nature and features of

messaging people shared on Twitter during the Red River Valley Flooding. Finding from the analysis identified five types of unique characteristics of information contents. These messaging include generative, synthetic, derivative and innovative types of information that characterise the interaction in the microblogging platform. Moving to the literature on computational information processing, past studies examined social behaviours using a sentiment analysis approach (Nagy and Stamberger, 2012) and classification algorithms (Yang *et al.*, 2013). Interestingly, some of the studies in the field of crisis informatics found privacy concern, security, and accessibility issue as the fundamental reasons preventing people from using social media during emergencies (Fraustino, Liu and Jin, 2012).

Having reviewed literature on emergent volunteers, the next subsection will address studies associated with the established/expanding digital volunteers.

2.3.2 Digital Volunteer Communities

As mentioned, the CSCW and crisis informatics literature on digital disaster response is broad-ranging and cuts across disciplines and fields. The interdisciplinary nature of the field has led to the lack of consensus in naming these Internet-enabled communities from practitioners and academics. For example, terms such as digital volunteer [communities] (Starbird, 2013; Hughes and Tapia, 2015; Kaufhold and Reuter, 2016) digital humanitarians [actor networks] (Meier, 2011; Sabou and Videlov, 2016), and volunteer and technical [technological] communities (Gorp, 2014; Weinandy, 2016) have all been used in various studies and across disciplines. This lack of consensus became visible following the publication of Disaster Relief 2.0. where members of the digital humanitarian network openly disagreed in their blog post titled 'Why We Need a Disaster 2.1 Report'(Standby Task Force, 2011). In the blog post, these members protested the term 'volunteer and technical communities' as "is being used as a catch-all for technology companies, volunteer groups, etc. that have notable differences. One should be careful about generalising like this because it may give the wrong impression about specific groups" (ibid, 2011). As such for clarity purpose, I refer to these communities as Digital Volunteer Communities (DVCs).

As discussed earlier in subsection 1.1, digital volunteers are individuals (trained and untrained) that appropriate technological tools and platforms, including social media, to help disaster-affected communities and in some specific cases, disaster management organisations and aid agencies with situational awareness information as a form of aid. On the other hand, digital volunteer communities refer to the trained volunteers who have "deep expertise in geographic information systems, database management, social media, and online campaigns" and use their technical know-how and skills to support emergency preparedness and response operation (Map Maker et al., 2012, p. 3). For example, when the crisis in Libya erupted in 2011,

the UN partner with Standby Taskforce (SBTF) to find out what is happening in Libya since it does not have personnel on the ground to assess the humanitarian needs. The Standby Task is a volunteer platform of 'global network of trained and experienced volunteers working together online'. The UN OCHA requests a live map of reports generated from social media outlets such as Twitter, Facebook, Flickr, YouTube and mainstream media sources10. To provide such report, SBTF collaborates with its partners (DVCs) such as Crisis Commons, the Humanitarian OpenStreetMap Team, Humanity Road, NetHope. During the deployment, SBTF divides the tasks based on the expertise of these DVCs. For example, the HR team led social media monitoring team to provide situational awareness information related to military actions, evacuations, movement of refugees, and street fighting among others11. Other tasks include geolocation, translations and knowing available humanitarian agencies that are providing aid while Crisis Common and the Humanitarian OpenStreetMap Team plot the live crisis map based on the information provided by a social media monitoring team, geolocation and translation team respectively.

To understand these communities, I review past studies that attempt to provide their taxonomy. Review of these studies shows that Milner and Verity's (2013) work seems to be among the first study that attempts to delineate DVCs based on their expertise and activities. The authors classified the communities as crowdsourcing umbrellas, community centralisers, volunteer connector platforms and technology solution providers. They defined crowdsourcing umbrellas as a platform that connects DVCs with formal aid agencies. Community centralisers focus on developing capacities of volunteers to self-organise and tackle issues while volunteer connector platforms serve as a liaison between aid agencies and volunteers. Technological solution providers offer their products, expertise or platforms for assisting disaster response to both responders and members of the disaster-affected communities. Milner and Verity's (2013) work contributes to our understanding of the nature of such communities. However, I found it difficult to understand the logic behind delineating crowdsourcing umbrellas and volunteer connector platforms as distinct entities because both are serving as a liaison between volunteers and aid agencies requesting for assistance.

A further attempt by Gorp (2014) was made to build on Milner and Verity (2013) seminal work on the taxonomy of the digital volunteer communities. Gorp (2014) conceptualised digital volunteer network into four distinct communities: software platform development communities, mapping communities, expert network communities and data aggregation communities. Gorp (2014) described software platform development communities as organisations that focused on the development of tools or providing platforms that assist in

[10] https://irevolutions.org/2011/03/04/crisis-mapping-libya/
[11] https://www.prlog.org/11354809-mapping-crisis-humanity-road-volunteers-lead-media-monitoring-team-for-libya-crisismap.html

responding to disasters. This characterisation of software platform development communities appears to reinforce and validate Milner and Verity's (2013) classification of Technological solution providers. For example, in discussing the role of Technological Solution Providers, Milner and Verity (2013) argue that they offer their products, expertise or platforms for assisting disaster response to both responders and members of the disaster-affected communities. As such, the roles reflect that of Gorp (2014) in which the author described the work of software platforms development communities to include the development of tools or providing platforms that assist in responding to disasters. Accordingly, mapping communities assemble and coordinate communities of volunteer organisations that specialise in providing a live crisis map to support aid agencies and relief organisation that requested their help whereas expert network communities are volunteer platforms that offer specialised services like translation, statistical analysis or on-the-spot technological solution to assist in disaster response. Data aggregation communities' harness mobile technologies and web 2.0 platforms to provide real-time situational information to aid disaster response.

Putting the two studies side by side as shown in Table 2.2. below, one will find areas where both studies share some commonalities and differences. Both studies delineate DVCs into four categories. Again, there is considerable overlap between both side when one look at the Crowdsourcing umbrellas and compare it with Mapping communities. Both communities featured in each category share something in common – mapping activities through crowdsourcing. Similarly, by comparing the activities of technological solution providers with software platforms development communities, one will find strong overlaps in what these communities do as part of their missions. Gorp's (2014) taxonomy offers a more granular view of digital volunteer communities compared to Milner and Verity (2013) intervention. However, it is surprising to note that both studies overlooked to include communities that offer online rapid response communication whose job is to restore communication in disaster-affected communities. This overlooked community deploys physically to disaster zones and they, however provide online situational awareness information for the benefit of partner organisations. For example, International Radio for Disaster Relief (IRDR)[12] offers disaster relief using online coordination of frequencies system. Likewise, First Response Radio Team (FRRT)[13] provides radio services where infrastructure no longer functions. Lastly, Disaster Tech Lab[14] provides on the spot rapid response communication networks when there is a sudden onset of disasters.

[12] http://www.hfcc.org/humanitarian/
[13] http://www.firstresponseradio.org/
[14] http://disastertechlab.org/

Table 2.2. Comparative Analysis Table for DVCs Taxonomy

Milner & Verity (2013)	**Examples**	**Examples**	**Gorp (2014)**
Crowdsourcing Umbrellas	- Humanity Road - Standby Task Force - Humanitarian OpenStreet Map	- Humanitarian OpenStreet Map - Standby Task Force - Crisis Mappers - GEOCAN - GisCorps - Map Action	Mapping Communities
Community Centralisers	- Geeks Without Bound - Data Kind - Map Action	- Humanity Road - ICT4Peace	Data Aggregators
Volunteer Connector Platforms	- TWB - SWB - UN Online Volunteers - GISCorps	- Crisis Commons - Random Hacks of Kindness - Geeks Without Bounds - Data Kind	Expert Network
Technological Solution Providers	- ESRI Disaster Response and Assistance	- Sahana Software Foundation - Frontline SMS - Ushahidi	Software Platforms Development Communities

As these communities continue to grow, researchers across disciplines and fields have begun to explore digital volunteers' motivations. For example, some studies suggest interest, curiosity and the desire to make information more accessible and usable (Liu and Palen, 2010) while others indicate a desire to learn, refine and show off technical skills, personal connections, and altruism (Capelo, Chang and Verity, 2013).

An equally significant aspect in the literature is the debate about challenges associated with established digital volunteer organisations. Some of these challenges tended to cluster around volunteer management, perception issues and interfacing problems that arise when working with formal and traditional agencies.

A review of the past studies indicates that volunteer management is the most common pressing issues affecting digital volunteer communities (Meier, 2011; Robson, 2012; Gorp, 2014; Weinandy, 2016). DVCs such as HR invest their efforts and resources in training volunteers so that over time they will become highly skilled, well-experienced and trusted. However, suddenly, such volunteers can become inactive and disappear without pre-withdrawal notice. Accordingly, this leads to a loss of 'institutional memory'. As a result, these organisations will have to keep training and retraining, skilling, reskilling and upskilling of volunteers that they are not sure of retaining. While research dealing with this type of issue is in its infancy (Meier, 2011), past studies have shown that volunteers usually disappear because

of burnout, psychological stress, and lack of engagements and recognition (Weinandy, 2016; Van Gorp, 2014; Meier, 2011). However, it is not yet clear how researchers and practitioners are tackling these issues.

Another challenge relates to a lack of understanding about the value digital volunteers bring to disaster management (Collins, 2011; Gorp, 2014). For example, an independent report on the Ushahidi Haiti Project concludes that there was "a marked lack of understanding of operational aspects of emergency response" among the volunteers (Morrow *et al.*, 2011, p. 25). These charges border on three broad issues. First, digital volunteer communities are characterised as lacking professional training and identity (Sandvik *et al.*, 2014; Resor, 2016) while other studies argue about their inability to maintain a professional standard and unifying cord (Raymond, Howarth and Hutson, 2012; Resor, 2016). Second, volunteers are criticised for their lack of awareness of humanitarian principles and being less equipped in respect of understanding their boundary of operation (Foran *et al.*, 2012; Sandvik *et al.*, 2014). Finally, some authors argue about their lack of consistency and organisational commitment (Foran *et al.*, 2012).

On a different dimension, challenges related to coordination between digital volunteer communities and traditional organisations revolve around two principal issues. First, differences in organisational structure present interfacing challenges since traditional and formal humanitarian organisations operate within the confines of hierarchical bureaucracy, whereas digital volunteer communities are horizontal (process-oriented) types of organisations (Weinandy, 2016). Some studies characterised formal and traditional humanitarian organisations as being bureaucratic and rigid with poor understanding of digital volunteer culture and tools (Collins, 2011; St. Denis, Hughes and Palen, 2012). Second, misalignment of culture, philosophy and to some extent approach is another point of concern. As an example, an after-action report on the Haiti Response concludes that " [t]raditional humanitarian organizations were often open to the new technologies, but remain nervous about the implications of information and powersharing through crowdsourcing, and other new media platforms" (Nelson, Sigal, and Zambrano, 2010 pg. 4). Likewise, some traditional organisations such as uniformed services operate under standard operating procedures and restriction. Sometimes, such organisations work under the constraints of security concern while other organisations such as the Red Cross and Doctors Without Border operate under the treaty of protecting confidentiality. Such a philosophy is not in line with that of digital volunteers whose philosophy derived its roots from open-source movement (Rozakis, 2007; Weinandy, 2016). Nelson, Sigal, and Zambrano, (2010) argue that the coming together of these organisations – virtual and traditional – can lead to friction and misunderstanding. Having reviewed past studies on established digital volunteer groups, the next subsection

addresses general concerns associated with the information product generated through crowdsourcing by digital volunteers.

2.3.3 Crowdsourcing and Data Quality Challenges

Turning now to data quality, several studies are replete with concern associated with information generated through crowdsourcing from social media and web 2.0 platforms. Some of these concerns tended to revolve around the context of use, quantity, trust, locations, aggregations and mode as well as the manner of distribution (Ludwig, Reuter and Pipek, 2015). Furthermore, Dailey and Starbird (2014a), argue that the lack of trust associated with data is one of the primary reasons that is making response organisations reluctant to incorporate social media into their day to day practices fully. In a report published by Virtual Social Media Working Group (Homeland Security *et al.*, 2013) following Hurricane Sandy, the authors recognised the challenges and difficulties in finding high-quality information through web 2.0 platforms. This challenge is likened to finding a needle in a haystack (Ludwig, Reuter and Pipek, 2015). However, amidst the rising challenges, past studies have shown that in the heat of a crisis, the currency of the information and credibility of the source may be considered more critical than achieving extremely high accuracy and completeness (Goodchild and Glennon, 2010). Likewise, Tapia and Moore (2014) argue that "in the sphere of emergency response, trust in people trumps trust in information (p. 508)".

Past studies have theorised several dimensions upon which information quality can be understood. For example, Wang and Strong (1996) found 15 dimensions of information quality. The dimensions are further categorised into four domains which include intrinsic, context, representation and access. The intrinsic data quality entails understanding data quality from the perspective of credibility, accuracy, objectivity, reputation. Contextual data deals with the understanding of data from the dimensions related to relevancy, up-to-datedness, completeness, appropriateness and value addition. Representational data quality includes dimensions associated with interpretability, ease of understanding, representational consistency, concise and representation. Accessible data quality dimensions include accessibility and access security. Alongside Wang and Strong's dimensions to the general aspect of data quality, Ludwig, Reuter and Pipek (2015), have proposed five dimensions for measuring the quality of social media crisis information. The dimensions include (a) whether the content has a link (b) credibility of the content sharer (c) information up-to-datedness (d) the degree at which the information has been disseminated, and (e) the location of the user-generated content. Additional dimensions for verifying data quality include independent confirmation of the information (Coleman, Sabone and Nkhwanana, 2010) and the application of trust and relationship model (Bishr and Janowicz, 2010). Others are factoring

the proximity of the person sharing the information to the situation (Shanley *et al.*, 2013) as well as in-depth local knowledge (Latonero and Shklovski, 2010).

While the previous paragraphs addressed concerns and data quality dimensions, the review focus will be on understanding approaches to verifying crowdsourced information. The review of past studies indicated that verifying crisis information generated through crowdsourcing has tended to take the form of social and collaborative aspects on the one hand, and technical perspectives on the other hand. Although the focus of this study is on the social and collaborative aspect, it is useful to highlight briefly the technical studies that relate to verifying the information quality of the crisis information. By providing such insight, readers will have a better understanding of the topical issues covered in that field of studies.

Under the technical aspect, there is a shortage of studies that solely focus on examining the stable DVCs related to social media and data aggregation communities. However, there are studies whose focus mostly revolve around finding quality information (Ludwig, Reuter and Pipek, 2015), and overcoming inter-organisational collaboration and challenges (ibid; Zettl *et al.*, 2017). Such studies, therefore, ended up in developing platforms and tools that can automate the process. For example, Ludwig, Reuter and Pipek (2015) used a design case study approach to investigate how emergency management organisations can be helped in finding quality social media information generated by citizens during humanitarian emergencies. To answer the research questions, the study developed a tool and went on to assess its usability and appropriation in practice.

The focus of studies that relate to exploring the social and collaborative computing when verifying the credibility of information have tended to examine the role of spontaneous and unaffiliated volunteers. For example, a study that examines the activities of virtual online groups, volunteers utilised Reddit discussion thread to help Police to identify the Boston Marathon Bombers. Volunteers engaged in a virtual crime scene investigation by sharing and comparing photos and videos of supposed suspects among themselves and reporting their findings to the police. Analysis of the informal cyber-sleuthing by unaffiliated spontaneous groups, even though they have not provided accurate intelligence that will lead to arresting suspects, has helped in providing resources to the law enforcement agencies (Nhan, Huey and Broll, 2017). Likewise, Tapia and Lalone (2014) examined the self-organisation of two virtual platforms – Reddit and Anonymous - in the aftermath of the Boston Marathon Bombing. The digital volunteers' activities revolved around collecting and sharing relief materials as well as videos and photos shared after the bombing incident. The groups engaged in informal policing by collecting videos and photos to determine the perpetrators and the type of bomb used during the event. The authors used sentiment analysis to understand public opinion. Findings from the analysis revealed crowdsourcing crisis information from people that lack formal

training and awareness of ethical issues surrounding crime scene investigation is fraught with ethical concerns. The authors argued that the online volunteers have not only confined their activities to supplying information to authorities but engaged in the investigation that led to the misidentification of a suspect. By doing so, the authors concluded that their action was considered by the online public to have crossed ethical lines. Using the same setting and data, Tapia, LaLone, and Kim (2014) examined the implication of this virtual group to engage in intelligence gathering and crime solving activities. The findings revealed challenges associated with the crowdsourced investigation in which was marred with misunderstanding, misinformation and misidentification of the supposed perpetrators. Equally important, the finding suggests that the crowdsourcing activities have indirectly pressured law enforcement agents to release their findings earlier as opposed to their desired time. The law enforcement agents succumbed to the pressure based on the accelerated nature of the untrained spontaneous online volunteers' investigation.

What we see then, is that the finding revealed that these virtual groups shared vital information with the law enforcement agents that were accepted and acted upon as if they were the product of the standard vetting process. A similar study conducted by Dailey and Starbird (2014b) illustrates how volunteers employ the use of 'visible scepticism' to combat the spread of rumours and misinformation during the Hurricane Irene. Visible scepticism as described by the authors refers to a "strategy that intentionally allowed misinformation to rise to the surface—so it could be addressed publicly" (pg. 773). As can be seen, finding from the past studies on spontaneous volunteers concerning the quality of their information product is mixed. In one hand, their input provides vital information to the law enforcement agents, and on the other hand, their engagement as independent investigators has not only crossed ethical lines but present dilemmas to their engagement in humanitarian work. However, one thing to note is most of these studies focused on unaffiliated spontaneous volunteers. More detailed studies on established groups are needed before an informed conclusion is made about whether the challenges these groups brought to the humanitarian sphere outweigh their benefits. While this subsection discusses concern associated with information generated through the crowdsourcing activities of digital volunteers, the following segment addresses literature on process workflow.

2.3.4 Process workflow

Considering the data quality concern raised in the above section alongside the dearth of studies that focused on established and expanding groups, this section attempts to review the process workflow of digital volunteer groups. The rationale is to understand the activities involved in processing crisis information since traditional institutions have established

standard operating procedures. However, reviews of the past studies have shown that studies that have examined process workflow mostly relate to the field of Volunteered Geographic Information (VGI) and management information systems. In one of the studies related to VGI, the authors introduced conceptual workflow for evaluating the credibility of VGI in humanitarian crises using the European Forest Fire Information Service as a case example. The conceptual workflow includes five steps beginning with retrieval and moving through processing, integration and ending at the dissemination phase. At the retrieval phase, the system retrieves relevant social media and other disaster information using keywords. Next, when the data is retrieved, the workflow will continue with the processing phase where the location and source profile data will be picked and later use to determine relevance, credibility and analysis of the information. The workflow will then continue to the next phase (integration) in which the output generated from the processing phase will be combined with the information from official and authoritative spatial data infrastructures. Last, the result of the integration will then be shared (disseminated) across the stakeholders (Ostermann and Spinsanti, 2011). Another study developed a workflow for the Sensor Web Enablement platform for VGI sensing in six significant steps. The steps include stimulus, sensor, sensation, perception, attention and lastly reaction. The stimulus phase involves web mining for Volunteered Geographic Information for observing user-generated information. The sensor phase deals with creating coverage for VGI flow measures where it transforms information into digital values. The sensation phase involves finding and interpreting VGI flow patterns. The perception phase is where assigning relevance to the result takes places. The attention phase consists of creating and sending alerts associated with the VGI while the last segment (reaction) involves integrating VGI sensor network system into the decision support system (Schade *et al.*, 2010).

Other papers evaluate disaster workflow using a scenario-based approach in the context of crisis management which culminated in the design and implementation of the virtual information centre for emergency response organisation (e.g. Bui and Sankaran, 2001). In one such study, the authors introduced workflow-based templates for supporting unaffiliated and spontaneous volunteers to provide critical information to emergency responders and disaster-affected communities (Sebastian and Bui, 2009a). Drawing from Bui and Tan (2007), Sell and Braun (2009) evaluated paper-based emergency plans by German's emergency management agency and introduced a model for developing workflow management system that can support the activities of emergency responders across disaster phases. The model's process workflow outlines suitable measures for a dedicated event in a set of chronological order. The measures allow for delegation and management of resources as well as execution and management of emergency plans before and during a disaster. Overall, studies associated with process workflow within the domains of digital disaster field are technical in their

orientation and tended to cluster around the fields of Volunteered Geographic Information (VGI) and management information systems.

2.3.5 Appropriation of collaborative technologies

Past studies in CSCW emphasised that understanding how users adapt and adopt technologies in a highly dynamic environment is critical to developing interactive systems (Dourish, 2003; Mark and Seeman 2008). Against this background, the review will focus on understanding how scholars examined the use and appropriation of technologies and their impact on the work environment. Generally, literature about how users' appropriate technologies are varied and diverse within the CSCW community. Earlier studies in CSCW approached this phenomenon by examining the appropriation of specific tools, investigating challenges associated with using a range of tools, or exploring the process and developing techniques, systems or heuristics as discussed in the following paragraphs.

In terms of the use of specific tools, past studies in CSCW explore the use and appropriation of technologies such as Lotus Note, Calendars and Workflow systems in an organisation to understand a range of issues related to social and organisational factors (Bowers, Button and Sharrock, 1995; Grudin and Palen, 1995; Orlikowski, 1995). These studies were primarily concerned with how such technologies contribute to the success and failure of systems use and deployment in CSCW. Likewise, Dourish (2003) studies examined how systems design can support and accommodate appropriations. In that study, the author uses 'Placeless' technology to understand the interactional and collaborative implication of technological design that fit into adaptive patterns of work practice. The 'Placeless' technology is a document management system that offers email infrastructure and day to day information needs for a group of researchers. The findings provide three design principles that are relevant to components-based approaches to system designers. These principles include (a) supporting the interoperation between multiple perspectives or organisations for the same information (b) making the action and the consequences of such action visible in an interface and (c) making control over information a priority for the application rather than the infrastructure.

A further look into the studies that examine how users' appropriate technologies revealed work that investigates information management related challenges. For example, in a study that explores the appropriation of technology among 12 Macintosh users in their everyday work activities (Kaptelinin, 1996), the findings revealed a range of challenges experienced by these participants. The author established that the users have problems with structuring file systems, challenges in reorganising information that has been captured into the system. The study also revealed other challenges that include a mismatch between the system's persistence in keeping information in one place, and a user's understanding that information can be

placed in different places and can play different roles and tasks in certain circumstances (ibid, 1996). Other studies in CSCW domain explore the appropriation of collaborative technologies on the range of adoption patterns amongst organisations (Harrison and Dourish, 1996).

Elsewhere, Mark and Semaan (2008) explore how citizens appropriate technologies such as emails, Skype, Mobile phones, Wikis among others to collaborate with work groups or to socialise in a highly dynamic disrupted environment of Israel and Iraq. Findings from the study revealed the appropriation of technological tools to recreate, adapt, and develop new patterns of action for work and social interaction. The authors identified some consequences arising from the appropriation of such tools. For example, using a virtual meeting instead of face to face has resulted in the team to resort to 'shouting' so that other virtual team members can hear and understand one another. Likewise, Mark and Semaan (2008) argue that the use of the telephone for consultation between health personnel and patients has made interactions to become far more personal. Also, the use of technology has influenced the abandoning of age long tradition in the military hierarchy of communication using a top-down approach and weakened the check and balances protocols associated with radio communication. Closely related to the Mark and Semaan (2008) study is another work by Mark, Al-Ani, and Semaan (2009) that explicitly focused on how citizens adapted and re-appropriated a range of technologies during wartime in the context of Iraq war. The authors reported how citizens made use of such technologies to reconfigure their social life by transferring their social behaviours into web space. Other findings indicate the use of mobile phones to self-organise against disruption to enable them to attend classes as well as developing resilience against redundancy, proactive practices, and revamping trust in information seeking. By and large, while the above review does not fall directly within the scope of the digital disaster response realm, it has provided vital insight into the use and appropriation of technologies. Accordingly, the review will now move on to discuss the use and appropriation of technologies within the realm of digital disaster response.

As seen earlier that understanding appropriation has been a central concern among CSCW researchers, this concern has also been extended into the use of ICTs in humanitarian emergencies. The review of the past studies has tended to revolve around the evaluation of the existing tools with the view to developing a more scalable and robust one as well as their use among emergent and established groups. Earlier studies related to this field assessed existing platforms and tools and thereby developed alternative ones. Some of these studies developed platforms that can support the activities of volunteers in tracking, organising, visualising and reporting actionable information (Cobb *et al.*, 2014; Gupta *et al.*, 2014; Ludwig, Siebigteroth and Pipek, 2014; Reuter, 2015). Reuter et al. (2015) work examined the use of existing social media tools, platforms and approaches among volunteer communities to understand the

challenges associated with their use in crisis management. However, since the research focus was on developing a scalable application that can overcome the limitations of the existing tools, the study does not provide insights on how such tools are appropriated in practice during disaster response (Ibid.).

Moving on to the non-technical oriented field related to social and collaborative computing, such studies tended to focus on how emergent volunteers make use of a range of tools and platforms. For example, the literature is replete with the use of platforms such as Google Docs, Skype, Emails, Twitter, and Facebook to converge and self-organise while responding to events. (Palen, Hiltz and Liu, 2007; Starbird, 2011). Likewise, past studies explore the information seeking practices of communities during disasters using a range of ICT platforms. For example, during the 2007 Southern California wildfires a study revealed how users that were geographically dispersed leveraged ICT to build community resources that enable members to organise themselves and find community specific information (Shklovski, Palen and Sutton, 2008).

As for the studies that examine the appropriation of tools by the established groups, their focus tended to revolve around highlighting the type of tools without putting emphasis on how their use enabled and constrained disaster response (Shklovski, Palen and Sutton, 2008; Starbird and Palen, 2013; Cobb *et al.*, 2014). For example, in a study that sought to understand the implication of deploying a team of trusted volunteers to work side by side with the emergency management team (St. Denis, Hughes and Palen, 2012), an attempt was made to outline the use of tools in organising their work. The study offers insight into the use of tools and platforms such as internet conferencing tools, Gmail account, Dropbox, WordPress blog and Google docs for coordinating their activities and communicating with the public. As such, while the use of platforms and tools is a known issue, understanding how such technologies present challenges and opportunities in practice is something that needs to be empirically validated.

2.4 Research Gap

The review has revealed valuable insights into the research landscape of digital humanitarianism. Specifically, it identifies areas of concern on the use of social media in disasters and emergencies, role enactment, social convergence of emergent groups and formal organising of the established/expanding groups. So far, past studies have documented research on self-organisation, information processing, information sharing, and social behaviours of the emergent groups (Liu *et al.*, 2008; Heverin and Zach, 2010; Starbird and Palen, 2011; Yates and Paquette, 2011; Nagy and Stamberger, 2012; Wang, Huang and Louis, 2013; de Albuquerque *et al.*, 2015; Eismann, Posegga and Fischbach, 2016). The rationale of

having more in-depth and reach studies focusing on the emergent groups as opposed to the established groups could be due to the immaturity of the social media research field.

The review also shows the prevalence of technically oriented studies in the field rather than studies that aimed at offering insight from the collaborative and social computing streams (Bishr and Janowicz, 2010; Coleman, Sabone and Nkhwanana, 2010; Latonero and Shklovski, 2010; Shanley *et al.*, 2013; Ludwig, Siebigteroth and Pipek, 2015; Zettl *et al.*, 2017). Also, studies from collaborative and social computing domains have not tended to focus on the social media and data aggregation communities. For example, Palen et al. (2015) explore the path of Humanitarian OpenStreetMap through the lens of two major disasters and provide a glimpse of how it organises its activities. Furthermore, the recent studies focusing on social media and data aggregation communities as an established group have delimited their scope to concentrate mostly on one case study or investigating one disaster type or articulate the usage of a tool/ application over a short period. Take, for example, the work of Starbird & Palen (2013) in which the authors provide insight into the organisational development and work practice of HR where they traced its origin, identity negotiation, membership and the nature of its work. However, these studies have limited scope with regards to the contexts, the use of tools and the duration upon which the response lasted. For instance, in the case of the Peru Earthquake, the entire response operation lasted for 3 hours and involved eight volunteers. While insightful, these studies have not comprehensively touched on the activities involved in processing *crowdsourced* information and have not adequately covered the data integrity procedures and mechanisms being used by DVCs at scale, and over the long term. Furthermore, the literature in this multidisciplinary field does not offer a full picture of the diverse technological platforms use by DVCs and how these tools work in practice. Even in the studies where the focus is on understanding the use of tools and techniques, there is no clear pronunciation of how volunteers use tools and its implication besides the identification and use of some essential tools such as Google Docs and Skype (Shklovski, Palen and Sutton, 2008; Starbird and Palen, 2013; Cobb *et al.*, 2014). Against this backdrop, an opportunity exists to build on the contribution made by the past studies to address the existing gaps by investigating this vital yet underscored aspect of information processing within the social media and data aggregation communities.

2.5 Summary and Conclusion

As a way of recapping, the literature review has two primary segments. The first section reviews the literature on the virtual organisations/communities which give the context for understanding the social organisation and collaborative activities of the virtual teams. Specifically, the review explores differences and similarities between virtual organisations on

the one hand and virtual communities on the other hand. Next, the review expounds on the features, benefits, challenges and concludes the section by explicating on the possible approach for overcoming challenges in the collaborative activities of the virtual team. The second segment discusses research landscape of social media in disasters and emergencies. Furthermore, the review synthesises finding from the past studies in crowdsourcing, as well as spontaneous and established volunteers. It concludes the section by highlighting the research gap.

In what follows in the next chapter is the discussion about critical methodological considerations taken while conducting this PhD study.

Chapter 3: Research Methodology

> "Be aware that, as an HCI researcher, you may run into people who don't like your research methods, are not comfortable with them, or simply come from a different research background and are unfamiliar with them. And that's OK."
>
> (Lazar, Feng and Hochheiser, 2010, p.7)

3.1 Introduction

Lazar, Feng and Hochheiser's statement quoted above typifies the various and diverse nature of research methods available in HCI and CSCW fields. Furthermore, research in HCI and CSCW fields is fascinating and complex in such a way that both have derived their approaches and methodologies from multiple disciplines and areas. Researchers in HCI and CSCW fields have a long tradition of borrowing, recreating and modifying research methodology to suit their standards (Lazar, Feng and Hochheiser, 2010). Despite the existence of these multiple and diverse research approaches, a researcher must decide and offer justification for choosing one method as opposed to others.

This Chapter seeks to illustrate the research approach and design used in this thesis to investigate the activities of HR digital volunteers and their use of technological platforms in processing crowdsourced information. I began by declaring my epistemological stance with regards to research approach. Then I proceeded to justify my choice and position myself as an interpretive qualitative researcher. Later, I argue why I chose Virtual Ethnography as the most suitable methodology for conducting the research. Furthermore, I discuss Activity Theory (AT) methods as an analytical lens for making sense of the empirical data I gathered from the fieldwork. In the same way, I explain the use of participant observation, and my use of Skype chat logs, internal documents, interview and other secondary sources as part of the study design. Finally, I discuss access to the field, ethical considerations as well as analysis and organisation of the data.

3.2 Research Approach

In undertaking research, scholars argue that different disciplines may need particular perspectives, value system and in some circumstances expectations, and more focused interest in the research process (Lazar, Feng and Hochheiser, 2010; Hudson and Mankoff, 2014). The central approach for this study is qualitative. It is employed based on the understanding that

"the methods used in all type of social research unavoidably influence the objects of enquiry" (Mays and Pope, 2007, p. 88).

Typically, the qualitative method is preferred in this context since qualitative methods are well suited for the understanding of social and cultural phenomena. The approach is often employed when examining the happenings in ordinary workplaces that are not subjected to statistical hypothesis testing and experimental manipulation. Qualitative research seeks to understand the realities of the workplace in the naturally occurring environment (Jordan, 1996). Furthermore, qualitative research provides researchers with the freedom to capture essential aspects of phenomena from the perspective of the research participants. The approach also allows researchers to expound and account for the context and conditions under which the study has taken place (Cook, Campbell and Day, 1979).

Qualitative methods help researchers to study the dynamics of the process that make up the phenomena over time. Such exploration will enable the researchers to go beyond asking how subjects feel and think, but to ask how and why they think that way, as well as their perceptions and how it is influencing what is going on. The method is also useful for understanding the effect of the social, organisational and cultural context of the phenomena under study and vice versa (Kaplan and Maxwell, 2005). Besides, qualitative methods help in "avoiding tunnel vision, seeing the unexpected, disconfirming one's assumptions, and discovering new ways of making sense of what is going on" (Ibid, pg.36).

Four major reasons motivated the choice of qualitative research approach in this thesis. First, the nature of the research questions (as stated in Chapter One Section 1.3) dictates the use of this approach since these questions were framed to elicit answers through the 'What' and 'How' questions. The 'what' and 'how' questions are mostly suited for providing a rich description, interpretation, and explanation of phenomena of study rather than the correlation of variables (Markus and Robey, 1988; Kaplan and Maxwell, 2005). Furthermore, 'What' and 'How' questions are more useful in providing insight where the views of actors will lose it vigour when textual data are quantified (Ghoris, 2007; Iacono, Brown and Holtham, 2009).

Second, a qualitative method of inquiry is appropriate where the objective of the research is concerned with deriving a rich understanding of how a work is carried out as well as the meanings given to the context and settings within an organisation (Shapiro and Dan, 1994). Myers (1997) argues further that this kind of research is appropriate when the overall goal of the researcher is to have insights on people as well as their social and cultural sphere in which they coexist; such kind of goal is undoubtedly what my research is aiming at. The choice of qualitative approach for this study is relevant since the research goal is not to

formulate a hypothesis that would be tested using statistical analysis or controlled experiment (Kaplan and Duchon, 1988).

Third, another justification for employing this approach is because of the nature of the research [natural] setting (Curry, Nembhard and Bradley, 2009). Jordan (1996, pg. 21), argues that:

> Work practice has to be understood as a dynamic system where changes in one aspect produce multiple changes that reverberate throughout. Each component, event, or action has the potential of affecting the entire system. Furthermore, as researchers in functioning workplaces, we are rarely in a situation where we can do controlled experimentation. Rather we are typically dealing with a moving target, a system that doesn't stand still long enough to be checked out, but rather one that is in constant flux, undergoing constant self-reorganization, even when there is no systematic, planned-from-the-outside change visible.

Fourth, qualitative research is particularly appropriate for this study based on the research design and the approach to data collection (Myers, 1997; Mingers, 2003; Curry, Nembhard and Bradley, 2009) adopted in this study as would be explained in Section 3.5. In summary, the objectives of the research, alongside the nature of the research questions, the setting as well as the research design influenced the decision to use a qualitative research approach in this study.

Having stated the justification for using qualitative method, it is worth noting that qualitative approach has its limitations since no research method, approach or discipline is without limitations (Lazar, Feng and Hochheiser, 2010). As such, research outputs derived from the qualitative method are criticised for being subjective and susceptible to the influence of researcher's bias as well as having limited generalisability to broader research settings (Adams, Lunt and Cairns, 2008; Atieno, 2009; Kjeldskov and Paay, 2012). Furthermore, qualitative research is characterised by difficulty in maintaining anonymity and confidentiality, and usually involves a small number of research participants (Anderson, 2010). The inability to include a large number of participants in the research could lead some scholars and policymakers to take the outcome of the studies less seriously (Griffin, 2004). Nonetheless, must of these concerns and limitations have been addressed in this study through reflexivity and data triangulation as argued in subsection 3.3.4 and 3.5 respectively.

In contrast to the use of the qualitative approach, a quantitative method is not suitable for answering the research questions raised in this thesis. This is because quantitative approaches involve the manipulation of discrete variables which often make it not suitable for offering rich insight on what is going on in many work situations (Shapiro and Dan, 1994). Quantitative

methods are not well suited where the research question demands a more in-depth insight into who is doing what, and how work is carried out (ibid). The method is more suited with research that can take place in a more controlled laboratory such as experimental psychology among others (Jordan, 1996).

In brief, this subsection argues about the suitability of choosing a qualitative research approach based on (a) the nature of the research objectives, (b) research questions, (c) research setting (d) as well as research design and the approach to data collection. In contrast to the use of qualitative approaches, the subsection explains the rationale that a quantitative approach is not suitable for this type of study. This is because the central claim of the thesis does not lie in generalising the findings and does not involve the manipulation of discrete variables. The next subsection discusses the approach to using ethnography.

3.3 Ethnography

In this subsection, I discuss the choice of using ethnography and its variants. Next, I justify why I chose to use virtual ethnography from the various approaches discussed under the variant's subsection. Following this, I explain some alternative ways in which research of this nature could possibly be undertaken through such methods. However, I provide a rationale that prompted my preference as opposed to these other methods. I conclude the subsection with the discussion on reflexivity and how it helps me to have a critical reflection on how I looked at issues from different perspectives.

Ethnography is employed in this study during the fieldwork with the sole purpose of examining how digital volunteers work. Also, to have a deeper insight into what that work means to them, why and who among them do what, when are they doing it, and through which means. Therefore, ethnography can be used as a lens to understand the everyday realities which confront digital volunteers in their organisational life. This approach also enables me to deepen my understanding of the work practice of the Humanity Road. Harper (2000), described ethnography as a method in which researchers in the HCI and CSCW community employ as a tunnel to delivering knowledge about an organisation.

Ethnography has its roots derived from Sociology and Anthropology and is a form of qualitative approach to research which is characterised by detailed observation of the people in a naturally occurring workplace. It involves uncovering what people do, what they say or have to say, as well as what they pay attention to in their natural setting and detailed understanding of the social organisation of the work (Randall and Rouncefield, 2012). Other HCI and CSCW scholars define Ethnography in different ways. For example, Dourish (2014, p. 1) describes it as an "approach to understanding the cultural life that is founded not on

witnessing but on participation, with the goal of understanding not simply what people are doing, but how they experience what they do". Ortner (2006, p. 42), defines it as "the attempt to understand another life world using the self-as much of it as possible-as the instrument of knowing". Looking at ethnography from another dimension, Blomberg et al. (2007) described it as a method that encompasses deep immersion and participation of the researcher in the workplace with the view of enhancing an understanding that other research approach might not provide. Central to the ethnographic fieldwork is the belief that to gain insight about the organisation that you know little about, you must encounter it 'first-hand' (ibid). Also, Harper (2000, p. 257) states that an "ethnographer needs to investigate all the oddities, the strange cul-de-sacs, the apparently arbitrary social processes and ritualised organisational protocols, that embody the work in question".

Having articulated what ethnography entails, it is useful to highlight the justification for employing ethnography as an approach in this study. Ethnography is considered suitable for this study because it is mostly used where there is a need for describing and accounting activities as well as for understanding what to automate and what needs human skills and experience (Shapiro and Dan, 1994). Similarly, it is employed when there is a need for an added understanding of the domain knowledge, general understanding of complex work setting, which could be difficult to understand and when there is a need for detailed understanding of the routine ways of appropriating technologies. It suites research endeavours that seeks to examine the organisation of activities, its sequencing and task sharing approach from the actors' perspective (Randall and Rouncefield, 2012). Furthermore, Anderson, Hughes and Sharrock (1989) share the opinion that it is vital where the need for understanding the organisation of work in real time and how individual actors orient to task sharing and make sense of the activities in question.

Juxtaposing the above salient reasons of using ethnography in HCI and CSCW field with my research questions and aims (see Chapter 1 section 1.3) will further justify reasons why it is suitable for use in this study. For brevity and clarity, I summarised the main arguments offered by these scholars as the justification for using ethnography:

(a) describing and accounting activities
(b) detailed understanding of the routine ways of appropriating technologies
(c) sequencing and task sharing approach from the actors' perspective
(d) making sense of the activities in question

Having justified the rationale behind the choice of using ethnography in this study, it is important also to highlight some historical and developmental phases of ethnography. Historically, the origin of ethnographic fieldwork was traced to Bronislaw Malinowski, a Polish scholar who spent some time at the London School of Economics. Dourish (2014) in his work

'Reading and Interpreting Ethnography' traces the historical development of the field starting from 1910, a phase he describes as the 'origin' phase. Subsequent phases of ethnographic development include ethnographic work of the 1920s, the structuralism era (1960s), the Hermeneutic turn (1970s), the reflexivity phase (1970s) and the globalisation and multi-sitedness phase (1990s) (Ibid).

Having traced its historical phases, it worth noting that, ethnographic approach is employed by both HCI and CSCW communities because of its strength in uncovering tacit assumptions, thereby making them available for questioning and testing (Forsythe, 1999). Besides, Ethnography enables detailed and nuanced understanding of how technology is used by groups – real or virtual – about how the features of the design impact on its usage. The approach has been employed in understanding non-traditional setting associated with cognitive science, ubiquitous computing for studying interaction patterns and experience design, as well as cultural analysis among others (Dourish, 2014). Scholars in CSCW employ ethnographic fieldwork to uncover "the details of the work that individuals do, the particularities through which the various processes that need to be done get undertaken" (Harper, 2000, p. 255). Also, Ethnography has been used to understand among others system requirements and user needs (Lazar, Feng and Hochheiser, 2010), communication behaviour (Su and Mark, 2008), the interaction between workers and expert systems (Suchman, 1987) as well as in the designing of workplace technology (Gaver *et al.*, 2004). It is used mostly in HCI and CSCW as a way of examining groups' and communities' aspect of technological usage (Dourish, 2014).

It is also essential to recognise the fact that like all other methods, Ethnography has its fair share of limitations and criticism. For instance, HCI and CSCW literature is replete with concerns related to the production of the ethnographic data (Dourish, 2014). Ethnography is also criticised for its inability to holistically translate findings to design recommendations and requirements (Randall and Rouncefield, 2012). Ethnographic fieldwork is criticised for falling short on areas related to reliability, validity and generalisation of the research findings (Hammersley, 1990; Brewer, 1994). It is also criticised for its limited use regarding scale and context. Researchers using ethnography have also been criticised for selective assembling and manufacturing of text to describe a phenomenon using persuasive force (ibid).

Apart from the realisation of the actual criticisms associated with ethnographic fieldwork, literature is divided on what exactly constitutes a 'good time' or 'proper length' for undertaking ethnographic fieldwork. Harper (2000) argues that a well organised and articulated ethnographic study could offer a great deal of insight within a concise time depending on the context and setting. He stressed that what is the most important here is the time taken for the researcher to be considered by organisational actors as an insider. More importantly, Harper

(ibid.) recommends CSCW community to evaluate ethnography based on researchers' assessment, and that of the organisation studied rather than on how orthodox practitioners of ethnography define what constitutes a proper length. Similarly, Randall, Harper and Rouncefield (2007) assert that issues surrounding what constitutes a good time for conducting ethnographic studies are dependent upon the case study subject.

3.3.1 Variants of Ethnography

Reviews of the literature have shown that there are many variants of ethnography. For instance, Randall and Rouncefield (2012), included Marxist, feminist, post-modern and ethnomethodologically informed ethnography as types of ethnography. Other scholars also mentioned virtual ethnography, realist ethnography, autoethnography, confessional ethnography, life history ethnography, visual ethnography and critical ethnography as additional variants (Creswell, 2007; Lazar, Feng and Hochheiser, 2010). However, within the HCI and CSCW communities, ethnomethodologically informed ethnography has appeared to be among the most favoured approach (Dourish, 2014). This approach was popularised by the work of by Harold Garfinkel in his famous collection of essays (Garfinkel, 1967). Dourish and Button (1998) described ethnomethodology as a particular form of analytic orientation that sets out to study of the practical issue of the problem of social order. The approach was motivated by the need to be attentive to the work and is underpinned by the particularity and the specificity of the phenomenon under study (Randall and Rouncefield, 2012). Furthermore, ethnomethodologically informed ethnography allows for the use of 'local rationalities' as part of the topic of inquiry and is concerned with how orderliness is performed as an element of sense-making procedures that a research participant employed while in the workplaces (Randall, Rouncefield and Hughes, 1995).

As it is not the purpose and central focus of this thesis to provide a critique of the ethnomethodologically informed ethnography, this research does not consider its application to be more helpful in giving an answer to its research questions. This is because the approach "is not driven by theory or explanation but by the stringent discipline of observation and description" (Shapiro, 1994, p. 418). In other word, an ethnomethodologically informed ethnography is an atheoretical approach that is premised on the belief that: "understanding of any setting is derived from the study of that setting itself, rather than from any highly structured model or theory of work organisation or work processes; it ties itself closely to the observed data, it is 'data-driven'(Rouncefield, 2011). Moreover, the methodological approach for finding answers to this unique virtual phenomenon needs a different approach that is unique to the phenomenon in question in which ethnomethodologically informed

ethnography does not favourably cater. This unique method and the justification for its usage in the study is explained in the following subsection.

3.3.2 Virtual Ethnography

Having provided the justifications for the appropriateness of choosing Ethnography as a method as well as discussed, its variants, the following subsection will explicate on virtual ethnography as the primary method used in conducting this study. In this subsection, I provide an overview of the term along with examples of earlier works. Next, I discuss the justification of using virtual ethnography and highlight criticisms, concerns, limitations and challenges associated with the approach.

As a way of understanding the context, it is essential to understand that there is a lack of consensus among scholars in naming research related to studying online activities. For instance, terms such as remote ethnography (Postill, 2017), digital anthropological ethnography (Rode, 2011), digital ethnography (Pink *et al.*, 2016), cyberethnography (Ward, 1999), ethnography of the internet (Hine, 2015), online ethnography (Markham, 2005) and netnography (Bowler Jr, 2010) have all been used to refer to studies examining social space of the internet. Other scholars reject the notion of those 'misleading labels' and prefer to call it 'virtual world research' since according to their understanding "ethnographic methodology translates elegantly and fluidly to virtual worlds" (Boellstorff *et al.*, 2012, p. 4) As such, they see themselves as ethnographers researching virtual worlds, not as "virtual ethnographers." (Ibid).

This lack of coherence in the nomenclature could be attributed to the unique resonance the internet space has provided to the diverse academic communities. This is because studies of this nature can be found in Anthropology, Sociology, Communication and Media Studies, Business and Marketing, Psychology, Computer Science alongside HCI, and CSCW (Hine, 2000; Boellstorff *et al.*, 2012). For the sake of clarity and brevity and in recognition of the various naming convention, this study adopts the term 'virtual ethnography' (Hine, 2000).

Having made this clarification, it is pertinent to provide a working definition of what this study refers with the term virtual ethnography. Virtual ethnography is an extension of the traditional ethnographic fieldwork of studying cultures in a virtual space where important social interaction takes place (Hine, 2005, 2012; Boellstorff, 2012). Furthermore, Hine (2008) describes virtual ethnography as a way of transferring the ethnographic fieldwork to the social sphere of the internet. This approach also involves studying virtual communities and their various types of interactions (Lazar, Feng and Hochheiser, 2010). In this type of study,

researchers are in mediated communication with the participants throughout their everyday lives via chatting, digital tracking, watching what participants are doing, and listening to their meetings among others (Pink *et al.*, 2016).

Reviews of the literature involving virtual ethnographic studies across HCI and CSCW fields have tended to be delineated into the subdomains of computer-mediated communications, social media studies, mobile media and game studies (Boellstorff *et al.*, 2012; Hjorth *et al.*, 2017). Studies related to computer-mediated communications have tended to focus on understanding the social organisations of the virtual teams. For example, some of these past studies examined trust, use of specific technologies for the virtual teamwork, and the effect of computer-mediated communication in decision making and problem-solving as well as web-based support communities for individuals affected with torn Anterior Cruciate Ligament (Maloney-Krichmar and Preece, 2005; Markman, 2009). Also, several studies in CSCW and crisis informatics domains have promoted the use of virtual ethnographic methods (Ducheneaut, Moore and Nickell, 2007; Irani, Hayes and Dourish, 2008; Boellstorff, 2012; Starbird and Palen, 2013). Social media research mostly involves the study of platforms such as Facebook, Instagram, and Google while Game studies concern with understanding virtual worlds such as Second Life and other massively multiplayer online game such as World of WarCraft, EverQuest as well as MUDs (multi-user dungeons) among others (Boellstorff, 2012).

The above review of the past studies involving the use of virtual ethnography has revealed the growing relevance of this approach in HCI and CSCW communities. It is for this reason, I will argue about why I adopted it as the best-suited approach in this study.

First, as argued by Markham (2005), decisions about the methodological approach a researcher would take depends on the researcher and the researched. This argument canvassed by Markham (ibid) fits my research setting since the case organisation is virtual, the research subjects (volunteers) work remotely, and the object of analysis (disasters) has no geographical confines. In other words, Virtual ethnography is suitable for the study because the research participants (volunteers) are geographically distributed and not bounded by any specific place. As such, it is practically impossible to study a group or community whose nature of work dictates working remotely and is not bounded by any milieus, the majority of which they have never met each other physically. Therefore, the best and most proper approach to understanding digital volunteers in this regard is to study their social organisation in the same setting and manner in which they meet, coordinate and undertake their activities via a digitally mediated environment.

Second, long before the birth of the internet, a precedent exists for conducting 'at a distance' ethnography where traditional anthropologists employed the approach to study culture from

afar. The 'at a distance' approach could be dated back to World War II where American Anthropologists such as Mead, Bateson, and Benedict used films, novels and poetry to study Japanese and German culture, among others. These researchers were constrained to employ the concept of 'being there' as lately popularised by Geertz (1988) due to the world war. Such approaches have since been adopted and used by Gray (2016) in her study of a massive public protest in Moscow while sitting in her room in the USA. The author argues that she was constrained to be at the protest because "even if I had been free to jump on a plane at the first sign of activity and spend the next several weeks in Moscow researching this phenomenon first-hand, it would have been risky for me to do so [..]. As an American citizen, I am a lightning rod for negative attention from Russian authorities (Gray, 2016, p. 503). Likewise, Postil (2017) drawing from Gray (ibid) examined the protest of some Muslim Students at Goldsmiths College, University of London remotely while sitting in his room at Melbourne.

The above justification could be summed up in to two components. First, the exigencies surrounding the research setting and second, the venerable precedent set by the first-generation anthropologist who used the 'at a distance' approach to conduct the research based on the existing constraints. While these justifications highlight the basis for choosing virtual ethnography as a distinctive methodological approach, this choice was made with full realisation that the method has its own limitations, concerns, criticisms and challenges just like all other methods. Historically, the use of virtual ethnography has initially been received with scepticism and at one time was debated by critics to the extent of questioning whether the use of this method is advisable or (even) possible (Gatson, 2011). Research associated with the virtual ethnographic approach has been criticised for being unscientific and anecdotal (Castronova, 2001; Bloomfield, 2009). Besides, there has been a considerable amount of literature that argues about the challenges associated with conducting virtual ethnography. One of such concern has to do with assessing the reality of the research participants behind the screen a researcher is mediating with, since in the virtual space people can deliberately assume different identities or characters that are far from the reality (Hine, 2000; Lazar, Feng and Hochheiser, 2010). Similarly, virtual ethnography does not easily allow for the researcher to capture the way volunteers multi-task while working on smartphones, desktop, laptop or tablet machines (Jordan, 1996).

In addition, virtual ethnographic approach is fraught with concern bordering on ethical and privacy concerns. For example, there have been concerns about unauthorised covert participant observation, illegal screen captures, quoting a portion of chats without the knowledge of the participants, or reconstructing groups meetings and discussions (Busher and James, 2007). Another concern borders on the security of the environment and absence of privacy within the remote environment an ethnographer might be working (ibid).

Having recognised the limitations, concerns and criticisms, it is also important to argue about how the awareness of such limitations helped me to consider how to mitigate some of these concerns.

First, the argument put forward in respect of the unscientific nature of the approach was partly addressed through data triangulation with constant comparison of Skype Chat Logs, interviews, field notes, and several after action reports (AAR). Indeed, the very point about 'scientific' is perhaps not relevant. This is because descriptive accuracy and truthfulness are prioritised over generalisability in qualitative research (Seale, 1999; Golafshani, 2003; Stahl, 2014).

Second, on issues surrounding the certainty of the identity of the research participants, it is highly unlikely to occur in this study. This is because these concerns appear mostly in a role-playing environment such as MUDs where players pick characters that may not be in tune with their real identities. In this study, the time taken to observe volunteers at the Café, and during internal drills, exercise and meetings, as well as retreat, have enabled me to understand the nature of volunteers I worked with in HR. After all, the identity of some of the volunteers that attended the HR 2016 (physical) retreat was published and still publicly available on HR's blog, Twitter handles and Facebook page[15] as at the time of writing this Chapter. Volunteers are also assessed by HR before they can join the organisation.

Third, while acknowledging the limitation that virtual ethnographic research does not sufficiently allow for observing the entirety of the activities and nuances of an organisation or group with regards to understanding users multi-tasking behaviour (Jordan, 1996), this concern is less problematic in respect of this work. This is because the central focus of the research relates to examining the components of the activities of volunteers' response alongside their social organisation of volunteers' appropriation of collaborative computing applications. Specifically, the observation will emphasise on understanding their social interaction with regards to coordination, communication, workplace culture, activities sequencing, frustration, arbitrary social processes and ritualised organisational protocols. The observation will also focus on how individual actors orient to task sharing and make sense of the activities in question. More so, the observation includes understanding the appropriation of tools and platforms with regards to the affordances and constraints. Others include observing how these volunteers deploy some of these tools and platforms in an unconventional way or abandon their use or how these collaborative tools are shaping their response approach.

15 https://www.facebook.com/HumanityRoad/photos/a.740631549294375.1073741830.111949498829253/1286821174675407/?type=3

Fourth, this study is not only complying with the research ethics and regulations governing the conduct of research at Brunel and that of HR, but it also draws from the recommendations of the Association of Internet Researchers (AoIR)[16] Ethics Working Committee for conducting research. Although the AoIR working document is not in any way a prerequisite for conducting this study, I still used it with the view to satisfy my conscience and as an additional safeguard of not violating the HR non-disclosure agreement and data access policy, I signed before I received permission to study the organisation.

The AOIR guidelines offer possible approaches on how to navigate the tension arising from contextual requirements with constraints related to disciplinary, institutional, legal, and cultural and jurisdictional bounds among other obstacles. The guidelines include set of internet-specific ethical questions, tools, FAQs a researcher is expected to engage with before, during, and after the research process. These sets of questions covered broad areas related to (a) data management, storage and representation, (b) the use of texts/persons/data being studied (c) presentation of findings among others.

Having argued about the rationale for choosing virtual ethnography from among its variants as well as awareness of its limitations and approach to mitigating such weaknesses, I discuss some possible alternatives to virtual ethnography in the next section.

3.3.3 Alternative methods

Having chosen virtual ethnography as a method for this study, it is relevant also to acknowledge the fact that other competing methods could also serve as a good candidate for this research. For example, case study and action research share some level of commonalities. Against this background, the following paragraphs explain these methods and argue about the reasons in which this study prefers to use virtual ethnography as opposed to the case study and action research.

Case study research pays particular attention to understanding the dynamic settings where researchers can undertake numerous levels of analysis using single or multiple cases (Eisenhardt, 1989; Yin, 2003). Lazar, Feng and Hochheiser (2010, p. 153) describe case study research as "an in-depth study of a specific instance (or a small number of instances) within a specific real-life context". Case study research is mostly undertaken with the intent of 'demonstrating', 'exploring', 'explaining' or 'describing' a phenomenon of interest (Yin, 2003).

16 https://aoir.org/reports/ethics2.pdf

Lazar, Feng and Hochheiser (2010) contend that case study and ethnographic method share more things in common than their differences. This is because both methods use an in-depth examination of a small number of situations, multiple data sources and involve the use of qualitative data analysis. Indeed, a case study is often characterised by ethnographic participant observation. However, traditional ethnographic research usually is more in depth in approach, and the researcher stays longer in the field and includes a mixture of participation and observation. Case study research also tends to be guided by theory, unlike ethnography which usually employs an inductive approach (ibid.).

Although the ethnographic method and case study share some commonalities, the following considerations influenced the nature of preferring the former as opposed to the latter. First, the quest for staying longer in the field. Second, the urge to combine participation with the observation as explained in subsection 3.5.1. Third, the decision to use inductive approach at the beginning of the research.

In addition to the case study research, action research is another potential method that could be used in examining the phenomenon at stake. Action research is described as a method that involves interacting with groups or communities to find a solution to problems or challenges through a democratic and collaborative process (Hayes, 2014). Likewise, Kock (2005, p. 2195) argues that "Action Research is the study of how technology is applied in the real world and the practical consequences of technology-enabled action". It is used in HCI when there is a need for knowing and effecting change using design, development and deployment of tools and technologies. Most of the action research that centred on problem-solving approach tended to take the form of (a) scientific-technical, (b) practical – deliberative and (c) critical-emancipatory (McKernan, 2013). However, since action research in HCI involves introducing new technological artefacts in an organisation, and at the same time studying its implications in that organisation (Kock, 2005), the approach, though useful, does not conform to the research aims I set out to achieve in this study in studying the use of existing technologies.

3.3.4 Reflexivity

Reflexivity is central to ethnographic fieldwork and refers to the needs of the researcher to continually self-introspect in the light of his or her participation. Reflexivity enables the researcher to examine the setting and to show where bias or other factors may influence interpretation. Reflexive practice calls for the ethnographer to be open to his personal belief and interest (Gilbert, 2008). Being reflexive also entails the ethnographer to have a critical reflection and the ability to look at issues from different perspectives. Furthermore, reflexivity allows an ethnographer to detach self from inappropriate assumptions, preconceived ideas and avoid passing judgement about research subjects (Karp and Kendall, 1982). The process

involves understanding and recognition of one's background about assumptions and preconceptions a researcher brings into the study. This is because a researcher's knowledge of the world is predicated on experience, worldview, personal values, religious beliefs, political leanings and several other socio-economic factors.

In line with this reflexive practice I tried to understand the actions from three perspectives. The first angle entails my personal belief, background and bias. The second perspective relates to understanding actions from the volunteers' point of view. The third perspective deals with the organisational point of view in which I tried to critically look at the action of paid HR staff to understand whether such action was sanctioned by the HR policies and standard operating procedures.

From the individual self-perspective, I always reflect with the appreciation that as a non-native English speaker from a developing country (Nigeria), my background would influence the way I see and analyse things. As someone studying an organisation that is entirely virtual, with members that are mostly raised and located in the west, the way I will perceive things will undoubtedly be different from the way people with a different background would see things for themselves. For example, I had my first culture shock during the ethnographic fieldwork, when I learnt that HR has a dedicated Skype window for Dogs and Cats (Animal in Disaster). I murmured 'WHAT! - Why on earth should someone waste precious effort and time working to rescue Dogs and Cats?' The culture shock may not be unconnected to where I came from as someone in whose community has the believed that Dogs are only meant for hunting, guarding, and rearing and is considered as a taboo for domesticating such type of animals. Later, I came to learn that animals are also a critical part of disaster response operations as they are an integral part of most families and are regarded as best companions and loyal friends. Subsequent reading of disaster literature made me learn how people have sometimes opted to stay and died with their pets rather than to evacuate without such an important and loyal companion. As such, awareness of my subjectivity allows me to develop the consciousness of 'clarifying my personal stakes' in the research process (Peshkin, 1988).

Being reflexive also enables me to understand motivation and factors influencing preference and the action of volunteers. Such understanding allows me to question the probable cause of volunteer's action. For example, some actions of volunteers are influenced by their passion or conditions upon which they found themselves as such; they come to HR with that passion or motivation. Participation in response operations alongside meeting and inter drills had confirmed my understanding of such actions. As an example, it is explicit that some volunteers are more active with a sudden onset of the earthquake while among the volunteers there are some that mostly show up whenever the disaster relates to severe weather storm. Reflexivity also allows me to understand that some actions such as the use of slang, constant use of

abbreviations, a celebration of days, and posting of videos that are heavily loaded with western values could influence the way volunteers disappear shortly after joining HR.

As such, I tried to reflect on how my background, beliefs and social understanding will shape the outcome of this study. It is against this backdrop; I went to the field with knowledge about the need to separate what work looks like from the volunteers' perspective (etic) and what that means from the outsider's perspective (emic). The separation of such understanding was to allow for the emergence of important insight that might be overlooked or considered less significant from the outsider's perspective. Jordan (1996), argues that such type of understanding will allow the field worker to explain the insiders' understanding to the outsiders while writing the report of the ethnographic fieldwork. To do so, I developed the habit of taking notes in a digital diary (Google Keep) to reflect on my experience which I have consistently written down and referred to while writing this thesis.

3.4 Pre- Fieldwork Considerations

In this subsection, I discuss how I arrived at a decision for selecting HR as well as a strategy for getting access. Furthermore, I also point out procedures followed for obtaining ethical approval.

3.4.1 Access

It was Milner and Verity (2013) as well as Gorp's (2014) categorisation of DVCs (see Chapter subsection 1.6) that prompted me to start thinking on which type of DVCs my research scope should be delimited to. As previously mentioned, these communities are divided into software platforms and development communities, crisis mapping communities, expert network communities and lastly, social media and data aggregation communities. However, regardless of choice, one of the critical considerations I had to make was to find out how accessible are these organisations alongside their volunteers to the researchers. As such, I identified Crisis Mappers UK, the Humanitarian OpenStreet Map and Humanity Road as the potential organisation to research about. However, on undertaking further reflection and background checks, Humanity Road appeared to be the most suitable choice. This choice was further strengthened by the organisation's open declaration of supporting "academic and private sector research, tools and development to improve disaster response"[17].

As part of the strategy to gaining access, I signed up to volunteer with the HR. My application was received, and I was inducted on January 6th, 2016. During the orientation, I introduced

[17] https://www.guidestar.org/profile/27-2047079

myself as a research student whose interest revolves around crisis informatics with a concern on digital disaster response and crowdsourcing. After spending four months working as a volunteer, I approached HR with a request for carrying out the research. However, before I put forward the request to HR, I received ethical approval from the College Research Ethics Committee and HR also granted approval to proceed on 25th June with the condition that I abide by their data protection and research guidelines alongside with the Non-Disclosure Agreement (See Appendix I A and B). In addition, I was asked to insert the word "Researcher" in front of my Skype name so that other volunteers will be aware of my presence in all the Skype chat rooms as shown in Figure 3.1 below. Later, a formal announcement was made about my intention to study the activities of the HR volunteers.

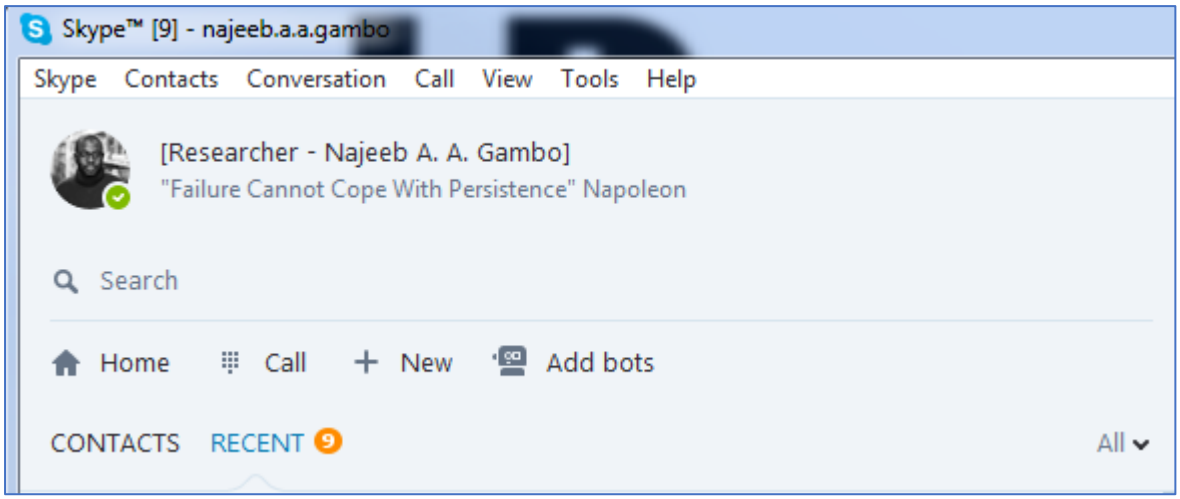

Figure 3.1. Skype name

Over time, I acclimatised and got to know volunteers. As such, the familiarity allowed me to ask questions on a one-to-one basis or during training, meeting, disaster response or internal drill. Also, when the time for conducting interview came, I approached my liaison and informed her about my readiness to start interviewing volunteers. The permission was granted, and she announced that I would be approaching volunteers to seek their consent for a one-to-one interview.

3.4.2 Ethical consideration

McAndrew and Jeong (2012), argue that an ethical consideration is crucial in all research and is expected to be applied in all facets of the research process. As such, I strived to follow all the protocols needed from a researcher. One of such protocol was the obtaining of ethical approval in which a researcher must provide all the necessary background information to make the committee believed the research approach fulfilled all the necessary criteria required. For instance, I provide evidence in my ethical approval application that there are no known risks

for the participants and that all information provided will be kept confidential, their names will be anonymised, and they are at liberty to opt out or skip any question. Furthermore, volunteers' permission was sought before recording the interview and they were asked to sign a consent form.

Likewise, to safeguard the confidentiality of the volunteers a coding strategy was developed (see Appendix II). I also refer to the Association of Internet Researchers guideline as an added safeguard of abiding by the research ethics committee and HR data access policy and guidelines.

3.5 Data Collection Methods

Previously I argued about the suitability of using virtual ethnography (subsection 3.3.2) in this PhD study, as such, this segment will elaborate on the approach to collecting data using virtual ethnography. Specifically, I will discuss the use of participant observation to obtain empirical data from the Fieldnotes, use of semi-structured interviews as well as internal documents. I will point out why this approach is suitable in this respect, how it was undertaken, and finally highlight some limitations associated with the method and give justification for minimising such limitations.

3.5.1 Participant observation

Participant observation typically involves the researcher to be taking part in the activities of the organisation as local circumstances allow while keeping a distance to enable continuous reflection and understanding of the situations. The approach enables the field worker to have the opportunity to ask questions, undergo training where possible, partake in routine activities such as meetings with the intention of getting knowledge and skills as well as uncovering tacit knowledge of the organisation (Lave and Wenger, 1991). It also offers the opportunity for researchers to unravel hidden organisational realities in its social and historical context and from diverse points of view.

As part of the ethnographic technique, participant observation enables researchers to explore in detail the realities of the workplace when interviewing actors. Jordan (1996) argues that what people think and say they do and what they do are two different things. The relationship between events (what people did) and accounts of events (what people say they did) is an empirical question that must be determined by research. Furthermore, other research approaches like surveys, structured interviews and focus group discussions lack the potential to uncover behind-the-scenes activities in the workplace and meanings attached to them.

Participant observation is employed here because it provides the gateway to understanding what the world looks like from the volunteers' point of view. This could be in areas related to how they make sense of what is going on from the monitoring stage of the disaster down to the response stage, as well as when the volunteers resolved to stand down. It also serves as a window for examining what is critical to the volunteers, what is considered less important, what technological tools and platforms they appropriate, and what type of information sourced from the internet and social media platforms are relevant and meaningful to the response operations. Participant observation also offers the potential of revealing information that challenges traditionally known assumptions and knowledge (Myers, 1999): this is an important role in the interpretive research process.

In undertaking the field work, I draw from the theory of role and self (Gold, 1958), thereby taking the role of participant-as-observer where I spent time and energy to take part in the real disaster response. Participant-as-observer is a stance where a fieldworker strikes a balance between complete participation and complete observation. Gold (1958) describes 'complete-participation' as a stance in which the true identity and motive of the researcher are not known to the research participants. In this approach, the researcher participates in the day to day activities of the group. On the other hand, 'complete-observation' refers to the type of fieldwork in which the researcher does not participate in any activity. In 'complete-observation', the research participants are not aware of the ongoing observation, or they do not know that they are indirectly serving as the informant of the researcher (ibid). Taking the stance of participant-as-observer is appropriate since it will enable me to maintain the status of an independent observer so that the consequences of this exercise may not impair my ability to unravel the initial objective in which I set out for the field work. As such, as a temporary member of the group, I combined some level of participation with the observation. See Appendix III for the breakdown of some notable activities. The nature of the fieldwork involves formal observation where I observed the activities of volunteers during response operation and informal observation where I 'hung out' at café to observe, chat and crack jokes.

During the ethnographic fieldwork, I took the opportunity to ask questions informally as they arose with the view to understand why the volunteers did what they did and how their actions were necessary for the response operation and the operational organisation. I asked such questions during response operations, training, internal drill exercises or while volunteers were in the café 'hanging out', 'eating' digital pizza and 'sipping' e-Green tea.

Specifically, I took time to observe in detail the description of activities, circumstances, practices, conversations as well as activities in between, during and after disaster response operations. I paid attention to how activities were carried out particularly with regards to its sequencing, division of labour, resources needed and task delineation as well as observed what

activities and actions always follow other activities. I also took time to observe how HR volunteers were appropriating diverse range of technological platforms and tools with regards to how they use, modify, circumvent, abandon and utilise such tools and platforms in their activities.

As pointed out in Chapter 1 Section 1.5, the fieldwork was carried out remotely through HR's Skype windows. The field work involved monitoring daily activities of the volunteers in six different windows, observing volunteers while attending meetings. The meetings I attended include standing committee meetings and extraordinary meetings. I chose to have access to three different standing committees as well as attend two different, extraordinary meetings. The first extraordinary meeting involved recognising an HR volunteer who has contributed more than 5000 hours in responding to disasters. The meeting was called to inform HR volunteers that the volunteer won US President's Service Award (also known as Lifetime Achievement Award). The second centred on articulating the type of public safety events HR volunteers should be involved in responding. Again, the fieldwork involved taking part in response operations that include special operations as well as significant and minor disaster responses. Special operations are types of operations in which organisations will approach HR to request for activation. In this regard, I took part in five different capacity building training as well as in eleven different types of internal drill exercises. Appendix III provides a complete breakdown of the activities I was involved during the ethnographic fieldwork.

All the above activities were conducted with the understanding that participant observation is also an approach with its share of limitations. This is because in participant observation, outcomes might be influenced by the researcher's values and purposes (Evered and Reis, 1981). The approach is also regarded as lacking a full breadth about coverage since it explores particular organisation, phenomena or a culture which can eventually provide limited generalisation (Myers, 1999; Iacono, Brown and Holtham, 2009). However, having struck a balance between becoming a 'complete participant' and 'complete observer', the consequences of such immersion may not have impaired my ability of completely 'going native' and forgetting about my stance as an independent observer in the field. Besides, using multiple approaches could help in overcoming some of such limitations.

3.5.2 Interview

In undertaking this study, I utilised two types of interviews – formal and informal interviews. The informal interviews in the context of this work refer to the onset interviews that involves asking questions during meetings, training, or response operations on issues, actions or decisions taken that require further clarification. In certain circumstances, I opted to seek clarification on one to one through Skype. For example, after attending a media monitoring

and disaster desk training in which we undergo training on how to identify news source, I informally follow up with the two trainers to understand the rationale for dividing news source into five categories. On the other hand, while informal interviews took place throughout the observation period, formal interviews were conducted after the observation period and analysis of the data between October and November 2017. The reason for delaying the interviews is to allow for further reflection and identification of other issues that might be overlooked during the informal interviews and observation period. Moreover, delaying the interviews have also provided opportunities to seek further clarifications because during the analysis of Skype chat logs, internal documents as well as field notes, several issues were identified about why specific actions were taken or how problems were tackled. For example, analysis of the Skype chat and observations from field studies has not been able to answer why some people were ejected from the Skype windows and later re-added when they were unable to join the group call or when Google docs became unresponsive or kept lagging. The Interviews give an avenue for untangling such an incomplete jigsaw and gaining a better understanding of the volunteers' point of view. It also enables me to capture essential aspects of phenomena from the perspective of the study participants. The interview also has the potential of providing insight into the context and conditions under which the ethnographic field study has taken place (Cook, Campbell and Day, 1979).

Previous studies in HCI, CSCW and disasters have employed the use of interviews as part of their research strategy to provide insight into their studies (Starbird and Palen, 2011, 2013; St. Denis, Hughes and Palen, 2012; Preist, Massung and Coyle, 2014). Therefore, drawing from such traditions, this study conducted seven semi-structured interviews. A semi-structured interview is preferred here as opposed to structured or unstructured interviews because it offers a high level of flexibility. It gives room for the interviewer to identify new potential issues and ask a probing question as a follow-up and it enables the interviewer to change questions rather than sticking to the predetermined set of questions (DiCicco-Bloom and Crabtree, 2006; Daymon and Holloway, 2010).

Before the commencement of the interview, I planned to interview five categories of volunteers and groups. These categories include founders, early entrants, later entrants, retired volunteers as well as past interns/researchers. The founders refer to those volunteers that conceptualise the idea of setting up the organisations alongside those that joined the organisation within the first two years. The early entrants are categories of volunteers that joined HR between 2012-2015 while the later entrants are those that entered the organisation from 2016 onward. The last group involves retired volunteers and past researchers as well as interns. The essence is to gather a spectrum of insight to allow me to provide a thicker description of the research findings. However, by the time, I started the interview, I was lucky

to get only seven people who agree to be interviewed. As a result, the composition of those that were interviewed include two founding volunteers, and one early entrant– who joined HR after two years of its existence. The remaining four make up two volunteers who joined between 2013 and 2015 while the rest (2) joined HR in 2016. Out of the seven volunteers, 4 are females while the remaining 3 are males. It is worth telling that it takes diplomacy and persistent and polite follow up to have the attention of some volunteers among these seven to sacrifice their time for the interview. Two volunteers who agreed to take part were unable to turn up even though one among these two created an outlook calendar invitation to invite me based on the agreed time and date. Subsequent follow-ups for rescheduling an interview failed.

Each interview lasted for approximately 50 minutes, apart from two interviews. One of the two interviews lasted for 85 minutes while the other one was cut short and reconvened after 45 minutes due to an emergency call from a potential donor organisation. It shall be noted that I shared the participant information sheet and consent form for the volunteers who agreed to take part in the interview a day before the meeting. Likewise, even after receiving their signed form, I reminded them about my request for audiotaping the conversation (See Appendix IV for the consent form). As such, I used the combination of Dictaphone and Audacity desktop software for recording the interviews as a safeguard mechanism against any technological failure.

The interview questions covered personal experiences and reflections as an ice breaker and strategy for uncovering volunteers' motivations for joining the organisation. The second segment involves understanding some elements of organisational culture. The answers to this might provide a lens for a nuanced understanding of context and the 'way we do things here' at HR. The third aspect covers operational engagements on issues related to disaster response work, information verification as well as work practices associated with the use and appropriation of technological tools and platforms. The reasons for choosing to ask these questions is to generate insight that will provide answers to the research questions set out at the beginning of this work. I attached the sample copy of the semi-structured interview in Appendix V.

3.5.3 Internal Documents

This study also employed the use of Skype chat logs and reviewed internal documents as part of the data gathering process.

HR granted permission to use the Skype chat logs with the condition that all personally identifiable information be anonymised unless a volunteer expressly agreed to be made public.

Skype chat logs include the digital traces of communication exchanges which contain date and time stamp as well the name of the users alongside the conversation. Previous studies in HCI, CSCW and Computer Supported Cooperative Learning have also used chat logs from different services such as Skype, Google hangout or other customised applications. For instance, Starbird and Palen (2013) use the excerpt from a Skype chat to examine the articulation work of digital volunteers. Other studies also examined social dynamics and user experience of Microsoft V-chat graphical systems (Smith, Farnham and Drucker, 2000), work tasks (Handel and Herbsleb, 2002) and efficient use of chat tools (Lewis, 2000).

During the first round of data collection, I used chat logs from the central Urgent Event window as well as 11 windows created (see Appendix VI) during significant response operations and special projects. The digital traces span from 15th February 2016 to 22nd May 2017. The logs covered hurricane, public safety events, flooding, wildfires, earthquake, dam spillage as well as special project on crowdsourcing common and functional datasets of Burundi hospitals.

Consistent with the nature of the study and the need to provide triangulation (Benbasat, Goldstein and Mead, 1987; Yin, 2003), the study also reviewed the organisation's internal documents. Specifically, these documents include tip sheets, policies, meeting minutes, memos, and event status and information logs. Others are blog entries, after-action reports, situation reports, annual reports (2010-16), and curated interviews granted by HR officials and volunteers. It is instructive to note that related research in the field also used secondary sources to support their work (Meier, 2011; Milner and Verity, 2013; Shanley *et al.*, 2013; Gorp, 2014; Waldman and Kaminska, 2015).

The internal documents collected helped in providing insights associated with a deeper understanding of the HR functional areas, organisation's size, structure, status, and operational area of coverage as well as HR's mission, vision, location, standard, policies, procedures, key players, staff, culture, and practices. The documents helped in shaping my knowledge with regards to volunteers, collaborators, training, team experiences, skills, knowledge, work performance, and interactions with partners.

All in all, this subsection gives details of data collection methods in which I employed while conducting this PhD study. Primarily, I used Fieldnotes from the virtual ethnography alongside internal documents and digital traces of Skype chat logs. I also followed up with an interview where I focused on seeking further clarifications about response workflow, use of technologies as well verification mechanisms. In the next segment, I discuss the use of activity theory as an analytical lens for making sense of the empirical data mentioned in this subsection.

3.6 Activity Theory

In this subsection, I discuss Activity Theory (AT) and its associated methods as an analytical tool used in making sense of the empirical data generated during the field observation. To do so, I briefly offer an overview of AT, give justification for its suitability, and outline its limitations.

AT is an analytical framework for analysing and understanding human behaviour in context (Quek and Shah, 2004). It helps in describing the structure, development and context of human activity (Kaptelinin, Nardi and Macaulay, 1999). Researchers in several disciplines and fields such as education, as well as organisational and cultural studies have employed AT as an analytical framework (ibid.). In HCI and CSCW, AT has been described as instrumental in understanding the context in which several interface designers used to develop their products (Ludwig, Reuter and Pipek, 2015). For example, HCI and CSCW scholars have also employed AT as an analytical lens in the design, evaluation and development of some activity-centric computing systems as well as showing how people use interactive technologies in the mobile and ubiquitous computing domains. It has also been applied by a broad spectrum of scholars and practitioners to solve HCI related problems. For example, Bodker (1989) used activity theory in the design of user interfaces while Bardram and Doryab (2011) applied the method to offer an in-depth analysis of complex collaborative work activity in the hospitals, which later culminated in the designing of context-aware systems for health personnel.

Historically, the earlier notable work related to AT is said to have its roots from the 18th and 19th-century classical German philosophers - Kant, and later by Hegel - who championed the concept of *activity* (Kuutti, 1991). Later, Mark and Engels expounded on such concept and the idea was further expanded by Vygotsky and several other thinkers such as Leontiev, Luria, Ilyenkov under the Soviet Cultural School of Psychology (ibid.). Lately, Engestrom and other scholars from the west have extended the constructs of AT to cover mediated interaction between subject, object and community (Kaptelinin, 2005). Presently, there are several variants of AT. For example, Leontiev's variant emphasises on the *activity* of individuals as social creatures existing within the realm of social context. Another notable variant is that of Engestrom. Engestrom's activity system model focuses on the group and collective organisational activities. Systemic-structural activity theory, on the other hand, focuses on the interconnection between the structure of the activity and the formation of the material components of work (Bedny and Harris, 2005; Kaptelinin, 2005).

Despite these differences, the central premise of the AT is governed by five sets of principles. These principles include the hierarchical structure of the activity, object-orientedness, internalisation and externalisation, tool mediation as well as development. The central unit of

analysis in AT is the activity itself. Activity, as described by Kaptelinin, Nardi and Macaulay (1999), consists of a subject, an object or motive, artefacts and socio-cultural rules. Engestrom (2014), submits that the components of any activity can be organised into activity systems: the activity system is represented in a triangle as depicted in figure 3.2. The initial historical focus of the analysis in AT has been on the top triangle in which depicts how the activity is carried out. The accomplishment of any activity encompasses a subject, the object of the activity, the tools that are used to carrying out the activity, the actions as well as the operations that affect an outcome of the activity (Nardi, 1996).

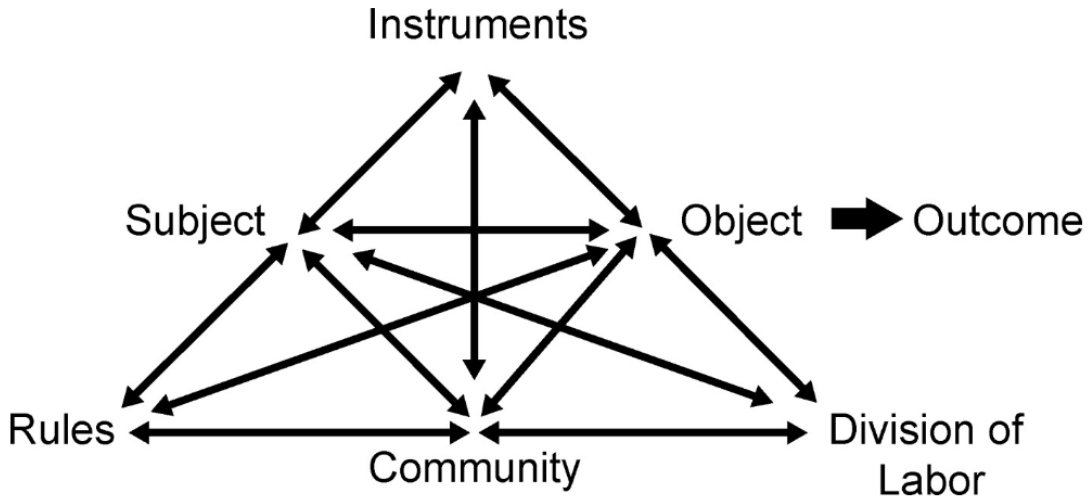

Figure 3.2. Engestrom's activity system model (Bakhurst, 2009).

The *subject* of any activity could be an individual or group of actors engaging in the activity. For instance, in the context of HR digital disaster response, the subject may be a volunteer or a group of volunteers. The *object* of the activity is the physical or mental product that is intended as an outcome of the activity. This object is acted on by the subject of the activity. For example, in the context of HR, the object is the digital disaster response. Next is the *tool* used in undertaking the activity which can take the form of hardware such as computer or tablet or mobile phones along with software such as Skype and Google Docs. From the base of the triangle are rules, community and division of labour. *Rules* govern the conduct of the activity of the volunteers. Thus, volunteers are encouraged not to amplify unverified information or reveal the identity of the emergency responders while responding to public safety events. The *community* consists of individual volunteers who share some common social meanings. For example, this included committee members within the organisation who perform special functions such as a Disaster Desk Working Group and other interested members outside the organisation that sometimes partake in the disaster response such as members of the Translators Without Borders (TWB). *Division of labour* involves the task

specification, variation of roles and responsibilities as well as allocation given to members. For instance, while responding to disasters, some volunteers will be encouraged to search for urgent needs, others will be advised to amplify verified official information, while some volunteers will be tasked with the co-authoring of situation report.

In addition to the above major elements of the theory (subject, object and tools), activity also involves three hierarchical layers (Kaptelinin, 2005) as shown in Figure 3.3 below. The first layer stands for '*activity*', which is directed towards a motive. The motive in this regard is the objective that the subject (individual or groups) wishes to attain. The second layer, called the '*action*', is ordered as a multi-layer system of sub-units oriented towards a goal which must be carried out to accomplish an objective. Goals can also be broken into several sub-goals depending on the nature of the activity. Actions are executed through the third layer called '*operations*'. Operations are established processes that guide the modification of an action under which the subject is trying to carry out the task with the view to meeting a goal.

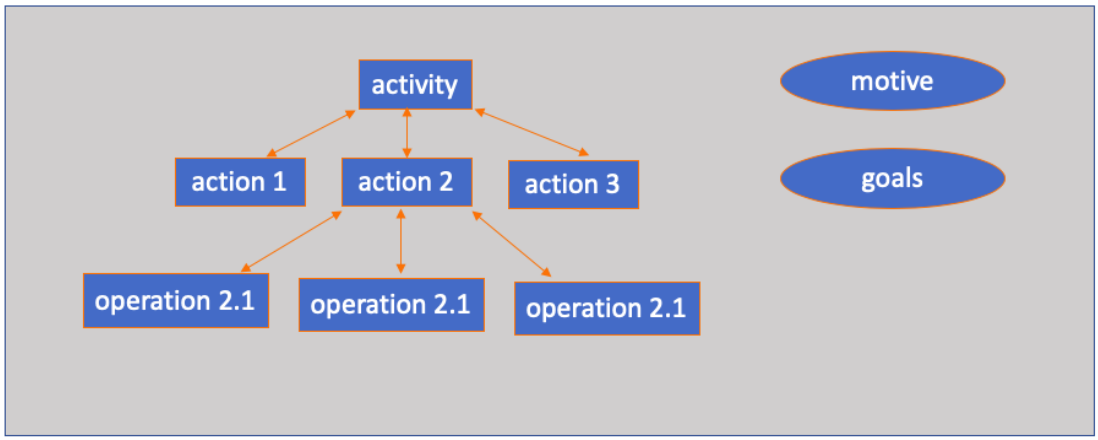

Figure 3.3. Hierarchical structure of activity (Kaptelinin, 2005).

Using the example of the HR response to Hurricane Irma, I contextualise the above hierarchy of activity (Figure 3.3) for ease of understanding as follows:

Responding to Hurricane Irma is the high-level activity which is undertaken by volunteers with the sole purpose (motive) of providing information as a form of aid to emergency management organisations/aid agencies and disaster-affected communities. This high-level activity (Hurricane Irma response operation) sits at the peak of the hierarchy above the goal-oriented actions and underlying operations. As we go on to explain in the analysis, one of the first things volunteers do after the onset of disaster is undertaking a listing activity in which volunteers search the internet to find addresses and contact information of emergency management organisations. Thus, listing activity is one among different types of actions that volunteers undertake to respond to disasters. The action (listing) is oriented towards reaching a goal which in the context of HR listing activity is the collaborative authoring of information

resource list – a compendium of addresses and social media handles of response stakeholders. The action (listing) is carried out through lower level-units of activity called operations which involve volunteers, finding social media account of fire services, ambulances, transport for London among others. As a summary, in the context of HR work, responding to Hurricane Irma is the high-level activity, and the motive for the response is to provide information as a form of aid. This high-level activity involves a series of sub-activities (actions) such as 'listing', 'listening and verification', 'amplification' and 'reporting' as we would come to see in the finding sections. These sub-activities (actions) are oriented towards different goals. For example, the goal of 'listing' is to produce an information resource list, and the goal for 'listening and verification' is to datamine and verify actionable information that is relevant to the response operation.

As I noted in Chapter One Subsection 1.4, three main considerations derived the choice of AT as opposed to other theories in this study. First, it offers an interpretive lens for understanding connections between activities, human actions, tools, and goals. Second, AT captures the essence of the research topic, field data and core constructs of this thesis research questions. Third, the argument put forward by Kaptelinin (2005) that later version of AT instantiated by Engestom and Boer align and resonate well with studies seeking to understand how information workers organise, transform and deals with interruptions within ongoing activities in the workplace.

The fact that the AT is interested in the utilisation of tools when humans conduct activity is a primary selection criteria for its choice in this study (Kaptelinin, Nardi and Macaulay, 1999). Other reasons include that it offers an analytical lens to (a) Identify significant activities alongside its subjects, object and purpose (b) identify the actions and mediating instruments of the activities and (c) identify the dynamics and tension inherent within and between the activities (Hasan and Kazlauskas, 2014). It can also help in understanding the social organisation of the principal actors in the activity (Redmiles, 2002).

While I argue about a rationale for choosing the AT, it is also worth noting that I chose AT with a marked awareness of the inherent weaknesses associated with the theory. For example, Kaptelinin (2005) argued that some scholars have criticised AT for its inability to cater for the coordination of multiple activities and cross activity integration alongside their structure and dependencies. This is because the framework assumes that the activity system is relatively well bounded. This assumption has therefore raised practical issues concerning applying the concept efficiently across multiple individuals or multiple activities. As such, "the flexibility offered by the AT framework is seen as a weakness since its hierarchical structure of activities and the inherent variability in the granularity at which people describe-and organize-their ongoing activities sometimes makes it difficult to adequately model the relationships at play

in empirical data, especially across multiple individuals or multiple activities" (ibid, p. 1015). However, for the fact that the research scope of this study does not aim to look at the AT from the inter-organisational and across organisational perspective, this weakness should not in any way affect the analysis and understanding of the empirical data.

Having justified the rationale for choosing AT as an analytical lens, the next subsection will explain how I draw from the Activity-Oriented Design Method (AODM) and the Martins-Daltrini approach to operationalise the use of AT in analysing empirical data in this study.

3.6.1 Activity Theory Methods

Kaptelinin, Nardi, and Macaulay (1999) argue that the high-level nature of AT framework does not provide prescriptive solutions that can be applied to specific contexts. As such, some scholars developed methods for the operationalisation of the AT framework. Some of these methods dissect the abstraction in AT framework into a ready-made solution where researchers could take advantage when analysing empirical data. For instance, Quek and Shah (2004) identified 5 activity theory based prescriptive methods for operationalising AT framework. These methods include the (a) Activity Analysis and Development (ActAD) method, (b) Activity Checklist, (c) Activity-Oriented Design Method (AODM), (d) Jonassen & Rohrer-Murphy framework, and (e) Martins & Daltrini framework.

The ActAD method is aimed at improving work process, designed methods and techniques. The method involves analysing the composition of the activities using a checklist. The Activity Checklist Method is targeted at finding contextual factors and spotting potential problem areas that designers can address. The checklist addresses the design and evaluation procedures. The AODM method centres at capturing requirements for analyst and designers with interests revolving around human-computer interaction. The Jonassen & Rohrer-Murphy framework provides six-step approach for the design of constructive learning environment. The central focus of Martins & Daltrini framework is on the principle of the hierarchical structure of activity. The framework outlines an approach to software requirement elicitation using three-step precepts. The authors suggest that the decomposition of the elicitation requirements into the following steps (Martins and Daltrini, 1999, p. 6):

i. Identify procedures performed in the system, which can be classified as activities.

ii. Identify for each activity: subject, tool, object, community, rules, a division of labour and results (representation of the systemic model of activity).

iii. From the systemic model of activity, decompose the activities into actions and operations.

The framework strength lies in its simplistic notation for the decomposition of actions and operations within a high-level activity (Quek and Shah, 2004; Wangsa, Uden and Mills, 2011). At the same time, the framework is criticised for its inability to provide a simplistic frame for identifying activities or its components (ibid).

From the five activity methods identified by Quek and Shah (2004) study, I chose to combine the AODM and Martins & Daltrini framework in this study. I combined the two methods for the following reasons.

First, AODM offers a unique simplification of activity system components and practical questions for capturing each component in a template. The method allows for analysing individual and collaborative practice. Specifically, the framework can be used to understand the structure of activity, relationships that exist between and among the many components of activity as well as examine the motives of the activity drivers. It is also developed to guide researchers to understand the roles of tools, rules and regulations governing the activity as well as the division of labour (Mwanza-Simwami, 2011). The framework includes a) eight-step model checklist for applying activity theory to identify component b) activity notation table with step by step approach to decompose activity into sub activity systems c) technique of generating questions and d) technique of mapping operational process. The eight-step checklist provides an analytical frame for researchers to operationalise the fundamental principles of AT by translating the activity system. The steps include identifying the activity of interest, understanding why the activity is taking place, identifying actors (subjects) involved in carrying out the activity, finding out the means upon which the subject undertakes the activity. Other steps involve identifying cultural norms/rules and regulations governing the conduct of the activity. Next is determining responsibilities concerning who is doing what (division of labour) as well as finding the environment (community) upon which activity is carried out. Last, the step includes understanding the desired outcome of carrying out the activity. From the above steps, the checklist captures the activity of interest, the objectives of undertaking the activity, subjects (actors), tools, rules and regulations, the division of labour, community as well as the desired outcome involved in understanding the activity. The second tool in the AODM framework – activity notation table - was developed to simplify complexity in activity analysis through modelling and decomposition of activity systems. This is to enable researchers working on AT to produce sub-activity triangle models. The activation notation table is shown below in Table 3.1.

Table 3.1 AODM's Activity Notation (Adopted, Mwanza, 2002, p.152)

The Activity Notation				
Actors (Doers)	~	Mediator	~	Object-ive (Purpose)
Subjects	~	Tools	~	Object
Subjects	~	Rules	~	Object
Subjects	~	Division of Labour	~	Object
Community	~	Tools	~	Object
Community	~	Rules	~	Object
Community	~	Division of Labour	~	Object

On the other hand, the third tool – technique of generating research questions – is developed to operationalise the sub-activity triangle generated from the activity notation table. This is to help in facilitating a data gathering from the AT perspective. To generate these research questions, a researcher shall ask the following questions (Mwanza, 2002, p. 155)

- What Tools do the Subjects use to achieve their Objective and how?
- What Rules affect the way the Subjects achieve the Objective and how?
- How does the Division of Labour influence the way the Subjects satisfy their Objective?
- How do the Tools in use affect the way the Community achieves the Objective?
- What Rules affect the way the Community satisfies their Objective and how?
- How does the Division of Labour affect the way the Community achieves the Objective?

The technique of mapping operational process involved developing a visual illustration of the sub-activity triangle alongside the generated research question as well as the identification of the contradiction in the system.

Second, while AODM has a notation table for decomposing activity, the Martins & Daltrini framework offers a much more straightforward approach compared to AODM. The framework proposed three steps in analysing activity. The step involves the identification of activities, followed by the identification of a component of the activity system for each activity and lastly the decomposition of each sub-activity into actions and operations (Martins and Daltrini, 1999). The explanation for combining the two methods follows below in subsection 3.7.2.

3.7 Analysis of Qualitative Data

In what follows is the discussion related to the identification and choice of the unit of analysis and why that choice was used. Further to that, I elaborate on the data organisation and

analysis of the empirical data gathered. Specifically, the discussion borders on the use of a hybrid approach to the thematic analysis.

3.7.1 Identification and choice of cases

As previously mentioned in 3.6, activity is the central focus of the AT. Therefore, to answer the research questions, a unit of analysis must be identified. To do that, I draw from Fritz's (1961, as cited in Kreps, 1984) core properties of disasters as a framework for selecting the unit of analysis: events, social units and response type. Events are defined as disaster types – earthquake, hurricane, flooding, wildfire, etc. - which could be small or large. Social units could be individuals, family, region, country or continents affected by the disaster. Response type refers to the degree of emergency response mobilisation alongside with the time taken to give relief to the affected communities (ibid.). Accordingly, I tried to cover a broad range of disasters (events) such as dam spillage, earthquakes, explosions, flooding/landslide, severe weather, wildfires alongside a special project on Burundi Hospital emergency response operations. The choice of these events covers thirteen countries (social units) representing six continents – Africa, Asia, Europe, North America, South America, and Oceania. The rationale for choosing these countries across six continents evolved out of the researcher's curiosity to uncover whether the type of response operations provided by HR differs from one country to another. Mainly, I chose such countries to figure out whether there exists any difference in the process workflow, use of technology or factors that enable and hamper the activities of HR volunteers.

Analysis of the data was carried out in two stages. The first phase involves the analysis of Skype chat logs and observation field notes from 15th February 2016 to 22nd May 2017. Within the period, the analysis centred on seventeen types of responses (see Table 3.1). Out of these responses, I took part in twelve and opted to observe five. This has enabled me to have a fair understanding of what is it likes to take part in one hand and to observe on the other hand. The second phase covers taking part in public safety events (Westminster Attack) and severe weather (Hurricane Irma). Such a decision was made with the view to compensate the missed experience of the lack of participation in the previous response operations I earlier opted to observe.

Table 3.2. Summary of the disasters used in the study

EVENTS (TYPE)	ANALYSIS PHASE	SOCIAL UNITS		RESPONSE
		COUNTRY	CONTINENT	
Dam Spillage	Phase 1	USA (Oroville)	North America	Red
Earthquake	Phase 1	Japan (Kumamoto)	Asia	Red
	Phase 1	Ecuador	South America	Red
	Phase 1	Italy	Europe	Yellow
Explosion	Phase 1	Belgium (Brussel)	Europe	Green
	Phase 1	Turkey (Istanbul)	Asia	Green
	Phase 1	Manchester (UK)	Europe	Green
	Phase 2	Westminster (UK)	Europe	Green
Flood/Landslide	Phase 1	Sri Lanka	Asia	Green
	Phase 1	Peru	South America	Yellow
	Phase 1	USA (Louisiana)	North America	Red
Special project	Phase 1	Burundi	Africa	Purple
Severe weather	Phase 1	Fiji Tropical Cyclone	Oceania	Green
	Phase 1	USA (Oklahoma)	North America	Green
	Phase 2	Hurricane Irma (USA)	North America	Red
Wild fire	Phase 1	Canada (Fort McMurray)	North America	Yellow
	Phase 1	Chile	South America	Green
Legend		Combined participation with observation		Observation only

3.7.2 Data organisation and Analysis

The data used in this study were mainly drawn from Skype chat logs, notes from field observations, transcribed interviews and internal documents (after-action reports, situation reports, archived interviews in which HR volunteers granted to national and international media, policy documents, annual reports, tip sheets, and excel workbooks).

Literature shows that data analysis methods for qualitative research are varied and each approach is undertaken depending on the nature of the study. For instance, Braun, Clarke and Terry, (2014) and Liamputtong, (2009) described content analysis, thematic analysis, narrative analysis, discourse analysis, and semiotic analysis as the most popular methods for analysing qualitative data. Even though content analysis and thematic analysis share many things in common (Vaismoradi, Turunen and Bondas, 2013), thematic analysis is preferred here as opposed to content analysis because the output produced from content analysis mostly tended to be quantitative in nature (Joffe and Yardley, 2004; Guest, MacQueen and Namey, 2011). Since this study is interested in generating insights from the ethnographic field data, a

thematic analysis is deemed to be more suitable. The suitability of this approach is strengthened by its flexibility since it can be used across a variety of research problems, theoretical frameworks and data sets (Boyatzis, 1998).

In this study, I employed the use of a hybrid approach to thematic analysis where I combined inductive and deductive methods. In an inductive approach, a researcher derives categories and themes from the data while in the deductive approach, the categories and themes are directly drawn from the theoretical constructs guiding the study (Fereday *et al.*, 2006). By integrating the two approaches, I have struck a balance between becoming too rigid with the application of theoretical constructs and the freedom to recognise and include recurring patterns and themes (Walsham, 1995).

Following Braun and Clark (2006) approach to thematic analysis, I read the entire Skype chat logs (799 pages of Microsoft Word documents) with the intention of familiarising myself with the data (Skype chat logs, field notes and internal documents). While reading the textual data, I used One Note to annotate salient points that correspond to the area related to the research questions.

Having become intimately explicit with the textual data, I re-read the transcript two more times with the sole purpose of gaining a more nuanced understanding of related concepts/ideas and recognising recurring patterns. At that stage, I began to code my data where 31 codes emerged. For example, prominent codes such as 'monitoring', 'official source', 'translation tools', 'verify x 2', 'live feeds', 'GroupTweets', 'amplification', 'sitrep' and 'Scanigo', 'partners' were featured prominently throughout the textual data. Furthermore, a more in-depth reading of the textual data begins to reveal similarities, overlaps and a broader cluster of codes and subthemes. For example, deploying AODM and Martins-Daltrini framework as an interpretive frame to understand the composition of work involved in responding to disasters, the initial coding provides eight sub-themes. These sub-themes include monitoring, activation, listing, listening, verification, amplification, reporting and standing down. However, after using the AT frameworks, the subthemes were collapsed into five. For example, monitoring and activation sub activities led to one outcome. Likewise, listening, and verification led to one single outcome. Also, reporting and standing down coalesced into reporting. It is worth noting that further reflection and reading of the textual data alongside the research question led to the generation of five (5) main themes. These themes include response activities, data integrity and assurance mechanisms, ICT tools types, ICT affordances and Issues associated with the use of collaborative tools.

During the second round of the analysis in which transcribed interview data and other response operations were included, the main themes reduced to four and the original names

of some themes changed. The new themes are response workflow, data integrity, practices of use and classification of ICT tools.

For a better understanding of how AT methods were employed by combining AODM and Martins-Daltrini framework, I used one sub-theme to illustrate the process: First, I used an eight-step model checklist of AODM by asking the following questions and provide answers as shown below

Table 3.3. Illustration of Monitoring and Activation activity using Eight-Step Model

The Eight Step Model			
Steps and components		**Questions**	**Answer**
Step 1	Activity of Interest	What sort of activity am I interested in?	Monitoring and Activation
Step 2	Object	Why is the activity taking place?	To determine the type of response HR will provide
Step 3	Subject	Who is involved in carrying out this activity?	'active volunteers' 'inactive volunteers' SMIC
Step 4	Tool	By what means are the subjects performing this activity?	Skype PC, Tablets, Phones ENS Emails -
Step 5	Rules & Regulations	Are there any cultural norms, rules or regulations governing the performance of this activity?	Report incident to Urgent Event Window Verify twice
Step 6	Division of labour	Who is responsible for what, when carrying out this activity and how are the roles organised?	DDWG to discuss the nature of response required SMIC to send activation information
Step 7	Community	What is the environment in which activity is carried out?	HR volunteers Researchers/interns
Step 8	Outcome	What is the desired Outcome from carrying out this activity?	Activation of the Disaster Desk

The table (3.2.) above simplifies Engestrom's (2014) activity triangle in to eight steps. Such steps include identifying the activity of interest, the objective, the subject, the tool, and the rules and regulation governing the activity. It also involves identifying the division of labour, the community, and the intended outcome of the activity. The eight-step checklist also has a column for questions that guides users to answer each step. Thus, by following the steps and answering each question, the above table was populated with content. It is worth noting to state that although Chapter 4, 5 and 6 provide context to all the terminologies and abbreviations used in populating the table, it is pertinent at this juncture to give an overview of some terms as a way making the eight-step model more readable. Some of these terms are explained as follows:

- 'Monitoring and activation' refers to an activity that involves observing the sudden onset or slow-moving disasters by active volunteers using electronic notification systems (ENS) and making such information available to the Urgent Event window for discussion and possible activation of disaster desk.
- 'Active volunteers' are volunteers that are actively participating in Skype windows that volunteers make use to coordinate response activities (Urgent Event window), exchange pleasantries (Café window) and inform their colleagues the type of activity they are working on to avoid duplication of efforts (Work Diary window).
- Inactive volunteers are volunteers that have access to all the Skype windows, but only become active whenever HR needs surge support during a massive catastrophe.
- Electronic Notification Systems are platforms that automatically send notifications via email and SMS about sudden onset or slow-moving disasters to its subscribers. Examples of such platforms include the Pacific Disaster Centre (PDC), and the Global Disaster Alert and Coordination System (GDACS).
- SMIC refers to the social media incident commander which is a role among volunteers that oversee the coordination of response operations
- DDWG is an acronym for the Disaster Desk Working Group, which is a subcommittee that determines the type of response HR volunteers will provide
- Activation of disaster desk refers to the implementation of the decision reached by DDWG of the kind of response HR will provide and sending that invitation to both active and inactive volunteers

- Verify twice is a concept in disaster response that encourages volunteers to always look for more than one independent source of information that is not tight to one another before sharing such information to the global online public.

Following this, I then used Martins & Daltrini framework of sub-activity decomposition (as could be seen in the table below) to decompose each sub-activity into actions and operations.

Table 3.4. Decomposition of sub-activity using Martins & Daltrini framework

Activity	**Action**	**Operations**
Monitoring and Activation	Announcing the anticipation of slow-moving disaster or its sudden onset	Triangulating the news sources
	Discussing the type of response HR will give	Understanding the impact Type of response
	Sending activation information	SMS, email and Skype Urgent Event Window

To decompose the sub-activity (monitoring and activation) as seen in Table 3.3., I examined the series of actions involved in monitoring and activation of the empirical data. For instance, announcement, discussion and sending invitations are the prominent actions engaged in this sub activity. Later, I compare each action with its corresponding operation(s) from the empirical data. For example, 'triangulating the news source' is the main operation under the announcement (action). Likewise, 'understanding the impact' such as casualties, damages, locations as well as 'type of response' HR will give corresponds to the type of operations that mainly take place at the discussion (action) stage.

I chose to combine AODM's eight-step model checklist and Martins-Daltrini tool for decomposing activities and discard other steps in both AODM and Martins-Daltrini framework for the following reasons:

- The second AODM tool (activity notation table) which is primarily developed to decompose activity into sub activity systems is not as straight forward and insightful compared to Martins-Daltrini tool for decomposing activities into actions and operations. Hence, the reason for using Martins-Daltrini tool for decomposing activities into actions and operations.
- The third AODM tool (the technique of generating questions) seems to me as unnecessary repetition of questions articulated by the eight-step model checklist

- The last AODM tool (the technique of mapping operational process) is aimed at finding contradictions in the system which is beyond the scope of this study
- The first two steps of Martins-Daltrini framework has not been included because the AODM's eight-step model checklist has already taken care of the steps with regards to identifying activities as well as subject, tool, object, community, rules, division of labour and results.

In table 3.2. and 3.3. above, I provide a summary of how I combined AODM and Martins & Daltrini framework to describe the data analysis process using the example of monitoring and activation sub-activity. In what follows, I offer a glimpse of the overall activities involved in responding to disasters.

Table 3.5. AODM Eight Step Model for generating HR response workflow

The Eight Step Model			
Steps and components		**Questions**	**Answer (from the thesis data)**
Step 1	Activity of Interest	What sort of activity am I interested in?	Digital disaster response
Step 2	Object-ive	Why is the activity taking place?	To provide valuable resources and communication in emergency situations
Step 3	Subjects	Who is involved in carrying out this activity?	Individual volunteers Teams (Scanigo, Animals in Disaster)
Step 4	Tools	By what means are the subjects performing this activity?	Skype PC, Tablets, Phones Google suits, Tin Eye, Bing, Twitter etc.
Step 5	Rules & Regulations	Are there any cultural norms, rules or regulations governing the performance of this activity?	Amplify verified official information only Verify twice Abide by operational code of conducts
Step 6	Division of labour	Who is responsible for what, when carrying out this activity and how are the roles organised?	Volunteers for general data mining Incident Report Lead for report writing Social media incident commander coordinating response Case management coordinator liaising with partners and emergency management organisations Social media listener/messenger for amplification Technical specialist for providing guidance on technical issues
Step 7	Community	What is the environment in which activity is carried out?	HR volunteers 'On-boarded' members of the Translators Without Border (TWB) Researchers/Interns
Step 8	Outcome	What is the desired Outcome from carrying out this activity?	Situation reports Resource lists Special report

Table 3.5 was generated using the same approach involved in populating Table 3.4. Likewise; I used the eight-step model from table 3.5. above to develop and fill the entire HR activity

system component in the following figure (3.5.) to combine with the model of AT developed by Engstrom (2014).

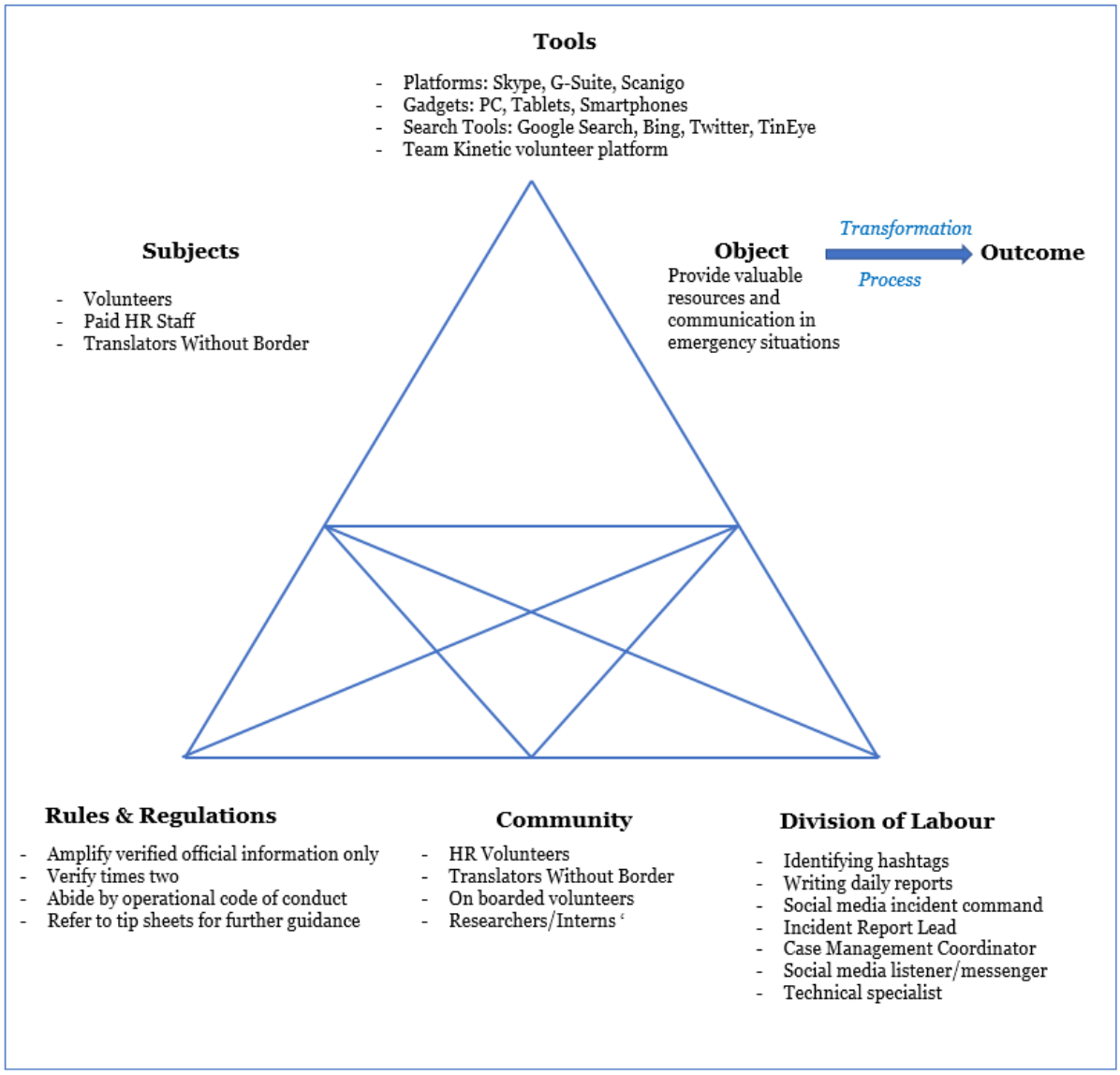

Figure 3.4. HR Activity System Components

Figure 3.4. illustrates the entire activity system components of process workflow involved in responding to humanitarian emergencies. To produce the activity system components of the response workflow, I used the eight-step model checklist to come up with content. In the first step, I put a digital disaster response as an answer to the first question seeking to know the type of activity I am interested in understanding. In the second step, I articulated the aim of the response operations. Following this, I answered all the subsequent questions in the third step as shown in table C. Having answered all the questions; the next thing is to map the answers into the Engestrom expanded triangle (Figure 3.2). It was the result of such mapping activity that produced the activity system components of the HR's process workflow.

The integration of these methods helps in making the analysis more focused. This is because; the output generated from the combination of the two methods serves a checklist on what to look for from the data.

To give context to the overall ethnographic fieldwork, figure 3.4 provides a timeline of the activities as shown below:

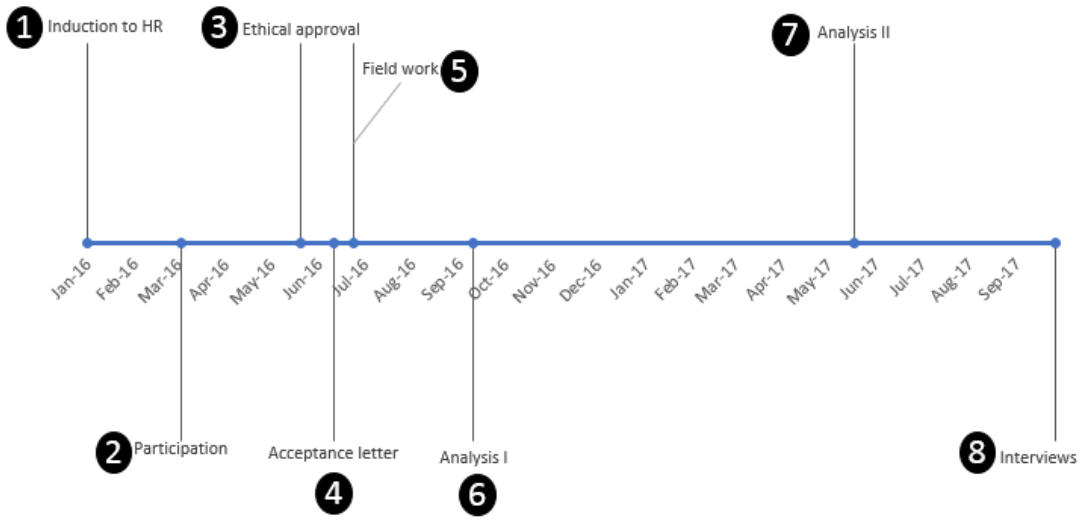

Figure 3.4. Ethnographic fieldwork and data analysis timeline

In the above figure, label 1 refers to date I formally joined HR as a volunteer while label 2 indicates the day I officially start participating in a response operation. Label 3 refers to the time I received an ethical approval letter from the University while tag 4 is the timeline indicating the day HR approved my application for the formal ethnographic fieldwork while label 5 means the commencement date. Emblem 6 and 7 show the different times for the first and second stage of the data analysis while label 8 refers to the period in which the first formal interview commences.

3.8 Summary

In this chapter, I have described the research procedures followed in undertaking this study. I segmented the chapter into six subsections beginning with the research approach where I declared my epistemological stance as an interpretive qualitative researcher. Following that, I explained the use of ethnography as a method as well as provide justification for using virtual ethnography as opposed to other competing approaches. Next, I provided an insight regarding pre-fieldwork planning and considerations in which I talked about the decision of choosing the case study organisation and strategy I employed for getting accepted. Within this subsection, I also discussed ethical considerations and procedures I followed for obtaining ethical approval. After that, I argued about the data collection procedures where I talked about Field notes from the participant observation, semi-structured interview, as well as the use of internal documents such as Skype chat logs, after action reports, annual reports among others. Next, I discussed the use of activity theory and methods for its operationalisation in research and showcased why it was useful in providing the analytical perspective of the empirical data. Lastly, I elaborated on the process involved in organising and analysing the data using a combination of inductive and deductive approach to thematic analysis.

Chapter 4: The Research Site

… [W]e have been monitoring and watching for Urgent Needs during Disasters around the clock since Hurricane Harvey impacted Texas on August 24th. Then there was Hurricane Irma on September 5th that impacted the Caribbean islands and then blew into Florida. Next there was Hurricane Maria on September 12th again hitting Puerto Rico, Virgin Island and some of the other Islands and Florida. Then on September 19th Mexico was impacted by two major Earthquakes, Japan on the 20th, Vanuatu on the 20th, New Zealand on the 20th and Philippines on the 23rd. Then Hurricane Nate came along on October 7th and impacted Louisiana, Mississippi, Alabama and Florida. As of October 9th, we are now monitoring the impacts of multiple Wildfires, burning on several counties running from Northern to Southern California" … Alice McGowen (HR Volunteer) Facebook fundraiser to HR on the occasion of her birthday (https://goo.gl/1ufv11)

4.1 Overview

This chapter sets the context for understanding the social organisation of HR's work, culture, ethics, technological mediation as well as HR's volunteers alongside their recruitment and management. The content of this chapter comes partly from fieldwork experience but also the synthesis of organisational documents on the other hand. During the fieldwork, I took part in training sessions, response operations, observed volunteers and had free access to internal documents that were not publicly accessible. In addition to these, I examined reports and corroborated claims from external links. This chapter is therefore, a product of participant observation, virtual frontline experience in response operation, training, and access to internal documents.

The remainder of the chapter is organised as follows. The first section traces the history of HR through the activities of its co-founders. This is followed by the description of HR's operational structure. The subsequent sections discuss HR's activities, recruitment process of volunteers, management and motivations, followed up with a discussion on technological platforms that volunteers use. Following this, the chapter gives a glimpse of HR's approach to knowledge management and offers a summary of the chapter.

4.2 History

HR was incorporated in 2010 as a non-profit organisation by the joint efforts of Chris Thompson and Cat Graham. The organisation's mission is to provide 'disaster preparedness

and response information to the global mobile public, before, during and, after a disaster'[18]. To achieve its mission, HR and its volunteers uses publicly accessible online chatter posted via social media and mobile-based technologies to provide information as a form of aid. HR supports natural, technological and man-made disasters. However, it refrained itself from participating in emergencies that are part of complex emergencies arising from conflict, wars, civil unrest, economic disasters and poverty.

4.3 Organisational structure

HR runs its activities using a two-tier model comprising the executive committee and a coordination committee (which derived its membership from volunteers) on the other hand. The model allows for the executive committee to serve as the custodian of the corporate records, board's committee proceedings, donors' records as well as other organisational documents. The committee is also responsible for preparing annual and financial reports among other things. The HR executive committee has eight members. The members include President, Vice President Operation, Vice President Business Development/Chief Operation Officer, Treasurer, Board Secretary and three directors. The composition of this committee involves full time paid HR staff and trustees. The full time (paid) HR staff handle the day to day running of the organisation as well as taking part in disaster response. The executive committee also employs part-time workers to support project and administrative activities.

The coordination committee provides the actualisation of the core HR activities such as disaster preparedness, response operations and process improvement. The composition of the coordination committee is derived from the HR subcommittees such as the Disaster Desk Working Group (DDWG), internal drills team, and Disability, Accessibility and Functional Needs (DAFN) team. Others include fundraising team, Animals in Disaster team, creative team, and volunteer management team. HR organises the activities of the coordination committee using the FEMA Incident Command System (ICS) roles. Such volunteer roles include social media incident commander (SMIC), case management officer, social media messenger, translator, data miner, incident report lead, training lead, volunteer manager, partner coordinator and technology lead. While the team role is open for any willing volunteer, HR encourages volunteers from the USA and Canada to enrol in FEMA online courses[19]. For example, a volunteer willing to be a social media incident commander (SMIC) should take ICS 100, ICS 200 and IS 700 courses. These courses prepare volunteers to understand the working of the national incident management system with regards to emergency planning, response

[18] http://humanityroad.org/aboutus/
[19] https://training.fema.gov/is/

and recovery. Volunteers from countries other than the USA and Canada also have the options of taking free online courses offered by Disaster Ready[20] and Humanitarian Leadership Academy[21].

4.4 Programmes

From its inception to date, HR identifies three (3) main core functional areas as part of its programs. These areas are disaster preparedness, disaster response and process improvement. In what follows is the discussion of the programmes.

4.4.1 Disaster Preparedness

The disaster preparedness programme involves disaster drills, fundraising, sharing preparedness information using posters, and bills to the global online public. The disaster drills include both internal drills for HR volunteers and outside training for emergency management organisations, first responders and military formation among others.

Since its debut, HR organises series of internal drills for its members with the view to boost their capacities on how to become more proficient in data mining actionable disaster information and finding possible solutions for urgent needs. The training also helps volunteers to enhance their communication skills, team bonding and problem-solving skills. During the past drill exercises, HR has developed hypothetical scenarios of earthquakes; disease outbreak in a refugee camp, flood, wildlife rescue, epidemic and solar storm to train volunteers. Besides internal drill training, volunteers compose disaster preparedness messages and engage in fundraising.

Externally, HR engages in training partners on how to manage and leverage social media. For instance, HR trained participants during high availability disaster recovery (HADR) exercise called "Exercise X24", California Shakeout (2010). It also offers training to Standby Task Force using earthquake scenario. HR also helped in the programme development and training in weapons of mass destruction (WMD) port exercise in the USA and New Zealand respectively (2013). HR also designed and executed social media exercise for participants during the 28th Annual Governor's Hurricane Conference in Florida and Pacific Endeavour disaster exercise in Thailand. Likewise, in 2012, it provides social media monitoring training simulation for online disaster response and management during the Rim of the Pacific (RIMPAC) humanitarian aid and disaster response (HA/DR)[22]. The RIMPAC exercise assembles multinational maritime military across the globe. The training empowers participants to learn

[20] https://www.disasterready.org/
[21] https://www.humanitarianleadershipacademy.org/
[22] https://plus.google.com/u/0/photos/103117070703965439881/albums/5764453119362073137

how to identify urgent needs and disseminate information before, during and after disasters strike.

4.4.2 Disaster Response

Disaster response is an activity that HR undertakes to support emergency management organisations, aid agencies, first responders, and global online public through the provision of verified actionable information as a form of aid. Analysis of the HR internal documents and publicly accessible annual reports have shown that in eight years of its existence (2010-2017), it has responded to 1193 events. In 2016 alone, HR volunteers contributed 11000 hours of volunteer time which can translate into a value of $271,590.00 according to a 2018 independent sector estimated national value[23]. HR has also taken part in various disaster response operations either alone or in collaboration with other sister organisations. Some of its earlier response operations include Haiti earthquake, Christ Church New Zealand earthquake as well as Gulf Cost Oil Spill in 2010. The year after, it responded to Japan earthquake, Brazil flooding and landslide as well as Tuscaloosa Tornado. Other operations undertaken between 2012 and 2013 include among others Typhoon Pablo/Bopha, Hurricane Sandy and Philippines Typhoon Haiyan.

In certain circumstances, organisations and government agencies may approach HR to help them monitor a situation. For example, in 2016, HR provided situational awareness information on urgent needs, misinformation and rumours to the Louisiana State Emergency Operations Center (EOC) during devastating floods in Louisiana. Other supports provided by HR include United Nations Office for the Coordination of Humanitarian Affiars (UNOCHA) activation during Pakistan earthquake (2013), flooding in India (2013) and Typhoon Haiyan in the Philippines (2013). It also provided support to Americares when it requested activation for locating urgent medical supply in the aftermath of Philippines Typhoon Haiyan (2013).

4.4.3 Process Improvement

As part of HR's approach to process improvement, the organisation works externally with agencies and groups to test tools, as well as support education and knowledge management programs. It is also serving in advisory roles to disaster agencies and document lessons learnt in the use of mobile and internet technologies during disasters. For example, in 2012 the White House recognised HR for their impact during Hurricane Sandy disaster response. Subsequently, HR received an invitation to participate in Department of Homeland Security/National Geospatial-Intelligence Agency (DHS/NGA) social media workshop

[23] https://independentsector.org/value-of-volunteer-time-2018/

community of practice. Later, HR was invited to participate in National Capital Region Social Media Submit.

In other engagements associated with supporting government and Non-Governmental Organisations (NGOs) in disasters, HR President co-chairs Department of Homeland Security Virtual Social Media Working Group (DHS VSMWG), while their Chief Operation Officer coordinates the Digital Humanitarian Network (DHN)[24]. Apart from that, HR is also a member of United Nations Office for the Coordination of Humanitarian Affairs (UNOCHA) Secretariat of the Inter-Agency Standing Committee (IASC) sub-Working Group on Emergency Telecommunications (WGET). Likewise, HR is also part of the founding members of Federal Emergency Management Agency (FEMA) innovation team, a group assigned with responsibility for identifying and implementing innovative solutions to humanitarian problems.

Writing books and white papers are also part of the HR process improvement programme. In 2014, HR collaborated with Statistics without Borders to co-author a book titled "A Guide to Social Media Emergency Management Analytics"[25]. The book provides a pragmatic approach to social media data handling, analysis, and management. The book features guidelines and a checklist to enable emergency managers and other stakeholders to outline and discuss relevant steps and actions while planning their social media emergency management plan. The book expounds explicitly on the baseline for communication plans among emergency managers, and aid agencies. It also contains specific examples of how emergency managers can leverage social media contents for geographic display of crisis information overtime using specific location based on urgent needs.

The process improvement activities also include networking and collaborating with partners as well attending conferences. It also involves participation as members of interest groups such as Virginia Voluntary Organizations Active in Disaster (VOAD)[26], GreatNonProfits[27], and Department of Homeland Security First Responder Virtual Social Media Working Group[28]. Others are Digital Humanitarian Network (DHN)[29], National Oceanic and Atmospheric Administration (NOA) Weather-Ready Nation[30], and Network Centric Operations Industry Consortium (NCOIC)[31].

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[24] http://digitalhumanitarians.com/team/cat-graham

[25] http://humanityroad.org/smemanalyticsguide/

[26] https://vavoad.communityos.org/cms/membership

[27] http://greatnonprofits.org/org/humanity-road

[28] https://www.dhs.gov/science-and-technology/members

[29] http://digitalhumanitarians.com/content/humanity-road

[30] http://www.nws.noaa.gov/com/weatherreadynation/current%20ambassadors.html#.U8PTCWP8Drw

[31] http://www.ncoic.org/membership/member-organization

Internally, HR has a series of training and internal drill exercises it developed to boost the capacity of its volunteers. Specifically, HR training revolved around tools and platforms use, reporting process and managing and sharing information. HR volunteers undergo training on how to use and manage Skype, Google suites (Docs, Sheets, Deck, Translation), GroupTweet and Twitter. Training and drills on the reporting process include techniques for tracking urgent needs, verifying information as well as reporting it to the right channel. Training related to managing and sharing information include understanding procedures for curating and sharing of information with the aid agencies and disaster-affected communities.

4.5 Volunteers

HR draws its membership from across the globe. During the observation period, I interacted with active volunteers from the Canada, Ecuador, Germany, Ghana, India, Nigeria, UK, and the USA. Based on my field observation, interviews and analysis of after-action reports, volunteers tended to join the organisation through periodic social media campaigns embarked on by HR. Some volunteers joined HR based on their desire to take a paid position in emergency management. As such, through their participation, they could gain experience. In certain circumstances, some volunteers started as interns while quite a few of them joined initially for academic research purposes. Likewise, some volunteers joined HR because of their passion for location when disaster sets in so that they can help. The passion may be because of the urge to help one's home country during their trying times. For example, some volunteers joined HR during past events in Ecuador, Haiti, India, and Nepal. HR President Chris Thompson also suggests that '*others come to us to understand a little bit more about what we do because they are already in disaster relief response area and they are looking to build trust in us. So, they are coming to learn what we do, and then they move on*' (Chris Thompson, interview). Other volunteers joined HR based on HR's role in facilitating aid to their communities during disasters. Sometimes, a feeling of gratitude and the need to pay back encouraged them to join HR.

Analysis of the interview scripts alongside volunteer spotlights (HR magazine) as well as internal documents revealed a range of specialists and professionals among HR volunteers. These include retired military officers, emergency managers, academics, students and health professionals. As a result, some of these volunteers bring with them additional expertise and specialisation. For example, among these volunteers are Ham radio technical specialists, cartographers, programmers, creative artists and designers, among others. In certain circumstances, some of these volunteers are contributing to the shaping and running of HR activities in its campaign, data analysis, monitoring of Ham Radio live feeds, setting standards

on issues associated with emergency response operations, crisis mapping and training among others.

Demographically, HR volunteers tended to be in their 40s and beyond. HR President Chris Thompson said in an interview that 'some of these folks have retired and had more time, so they want to give back, but they cannot physically do the work they had done when they were younger… so typically that is probably why some long-term volunteers are in the higher age group'. Chris Thompson made such a statement when she was describing the demography of HR volunteers. In her view, volunteers in their late forties and beyond tended to serve longer compared to younger (millennials) volunteers who have a short-term span working as volunteers. One interesting finding from the analysis of internal documents is the dominant contribution of women and the role they played in this humanitarian endeavour. From 2010 to the time of writing this chapter, the dominant number of volunteers that received volunteer recognition awards at both national (presidential), state, regional or organisational level for demonstrating a sustained commitment to volunteer service are women. The organisation's pacesetters and key strategic influencers are mostly women.

To join the HR as a volunteer, a prospective applicant must put a formal application through its volunteer portal[32]. During the application process, the prospective applicant will give full name, email address, location (city, state, country) as well as Skype ID. Additionally, a prospective volunteer must sign an HR code of conduct and ethics pledge. The code of conduct and ethics pledge needs volunteer's commitment to 'safety, lawfulness, professionalism, responsibility, good fellowship, loyalty and integrity'[33]. The code of conduct and ethics pledge also prohibits discrimination based on 'individual's sex, race, ethnicity, national origin, age, religion or any other legally protected characteristics. Likewise, a prospective applicant must pledge to adhere to uphold the United Nations humanitarian principles of neutrality, impartiality and humanity[34].

By signing up the code of conduct and ethics pledge, the next thing is for the prospective applicant to attend a two-hour volunteer orientation programme. The orientation allows the new volunteers to know each other and familiarise themselves with HR's work, ethics, policies, volunteer roles and ongoing response activities and projects. Moreover, new volunteers will learn the basics of navigating an HR website alongside the use of Skype and working with Google Docs. In practice, volunteers will learn how HR coordinates its work by navigating between Skype window, to Google suite (Word, PowerPoint and Excel) as well as HR website.

[32] https://volunteer.humanityroad.org/
[33] http://www.hmrd.co/code-of-conduct/
[34] https://docs.unocha.org/sites/dms/Documents/OOM_HumPrinciple_English.pdf

At the end of the training, volunteers will have their Skype IDs added to the HR's four main Skype windows.

When a volunteer starts taking a leading role in HR activities or representing HR in meetings with partners such as Standby Task Force (SBTF), HR will provide the volunteer with an organisational email. It will also encourage the volunteer to add HR label as a prefix in his or her name like 'HR Najeeb'. The HR label is used by both paid HR staff and long-time volunteers for recognition purpose. Based on the field experience, acquiring HR label takes a little bit longer (a year or two) depending on the volunteer's commitment and ability to independently come forward and start playing a more prominent role in the affairs of the organisation.

Alongside this commitment are some underlying factors that cannot easily be dismissed behind this relationship between HR on the one hand and volunteers on the other hand. Based on my field experience, trust appears to play a more significant and vital role in this relationship between HR and its volunteers. For example, volunteers who have been with HR for a long time have represented the organisation at various times in a high-level gathering. Such type of involvement where a volunteer meets different organisations and practitioners could indirectly inspire volunteers to remain with HR because of its potentials of boosting their resume and experience. Another critical factor that can make volunteers stay longer and eventually come forward to work for HR is that of recognition and award. Volunteers in the USA are regarded as "heroes" and awarded with the highest achievement recognition award by the President of the USA for those who sacrificed more than 5000 hours. Review of the past HR annual reports (2010 -2016) revealed a considerable number of HR long term serving volunteers have received one of such recognition (presidential, state, county, or HR award) while serving with HR. Related to the recognition and award factor is the altruistic factor. Some volunteers, even after receiving multiple recognition awards in HR or elsewhere, continue to work as HR volunteers because of a passion they have for a cause. For example, such passion could be in helping animals in disaster, people with disability, accessibility and functional needs (DAFN) or training volunteers.

4.6 Skype Windows

HR uses Skype as its core platform for coordinating its activities. It coordinates these activities through different windows, with each window serving a specific purpose (see figure 4.1 below). HR will grant access to four main Skype windows to new volunteers as soon as they attend the induction training. These windows are: HR Café, HR Urgent Events, HR Useful Links, and HR Work Diary (see subsection 4.6.1 through 4.6.4 for more details). Apart from the four main windows, volunteers that undertake more training or develop an interest in joining a specific

team will also have access to such windows. For example, a volunteer that developed an interest in monitoring disasters using Scanigo will have access to the Scanigo window after attending training. Volunteers that can sacrifice time to attend meetings will have access to the windows for such meetings like Disaster Desk Working Group (DDWG), internal drill team, Animals in Disaster, Project Team, Creative Design Team, Fundraising team among others.

HR creates an event-specific window whenever it is responding to any major catastrophe. The new window will have the event name like "HR Hurricane Alex", and at the top, a clickable link will be provided that will direct volunteers to an Excel Event Status workbook created explicitly for the event (see figure 4.1 label F). The workbook serves as a 'one-stop-shop' for reference and knowledge update. This Workbook has multiple tabs such as 'Event Summaries Instructions', 'Guides Tip Sheets', 'Disaster Response Team Lead', and 'Archived Summaries' as explained below:

- The 'Event summaries' tab has information on the ongoing event such as the location, the type of response HR is giving as well as the time in which the incident happened.
- The 'Guide tip sheets' tab has hyperlinks of instructions for social media guides, reporting instructions, tips sheets for monitoring the different type of disasters and after-action reports.
- The 'Disaster response team lead' tab has columns in which volunteers responding to the event will write the role they will play during the response, for example, SMIC, reporting lead, case management coordinator or data miner. Other columns allow volunteers to add their names, email address, Skype ID, Twitter handles and location as well as time zone.
- The 'Archived summaries' tab has a synopsis of the past events.

The following figure (4.1) illustrates the use of Skype as the virtual office by HR.

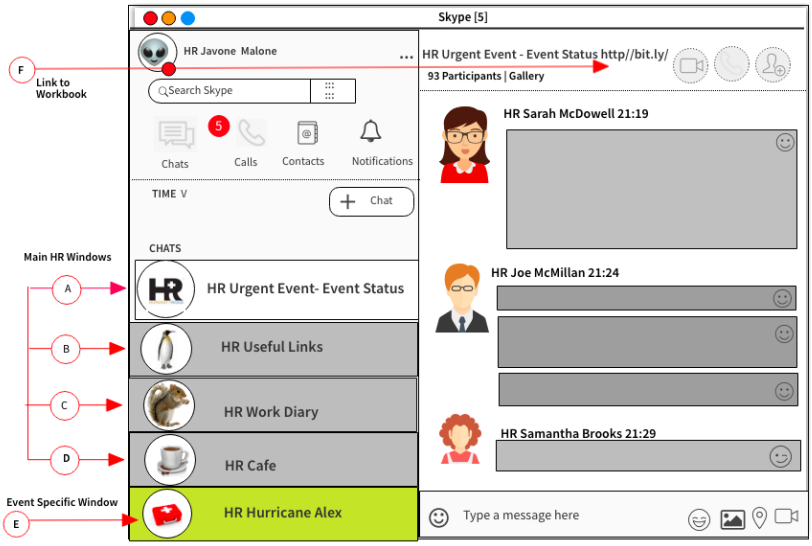


Figure 4.1. Mock-up of Humanity Road Skype operational windows.

The Skype mock-up shown in figure 4.1 illustrates different Skype windows such as Urgent Event, Useful Links, Work Diary, Cafe and an event-specific window named Hurricane Alex. The mock-up was created as a safeguard to revealing the identity of volunteers and some sensitive and strategic information of the organisation.

4.6.1 HR Café

HR created the Café window (see figure 4.1 label D) with the understanding that it will serve as a rallying point and resort for volunteers to socialise. Whenever a new volunteer joined the window, a paid HR staff member will welcome the volunteer. Besides, the welcome note will contain information telling the volunteer that the window was created to serve as an avenue for discussing social issues, throwing jokes and teasers. So, the volunteer should feel free to hang out with fellow volunteers. Consequently, such type of social encounter will strengthen the bond of friendship and encourage volunteers to be active. The chatter in the window is characterised with the use of emoticons such as coffee, dancing monkey, hug ☐, yes ☺, heart, thumb up, clapping, party, celebration, sunny, pizza among others. Volunteers use emoticons to convey their feelings, affections or approval of someone's suggestions or views. Alongside the use of emojis, volunteers also communicate using abbreviations such as brb (be right back), gtg (got -to -go), ICYMI (in case you missed it), among other things.

In the Café, volunteers tend to start their day with salutation depending on their time zone. For example, on one Tuesday, one of the volunteers wrote '*Good Morning everyone Happy*

Tuesday ', another volunteer responded with '*Good morning too! How's the weather where you all are at? It's supposed to rain & thunderstorm here all week* '. Another volunteer replied *'It's HOT here. Supposed to be in the 100s all week.* '. The volunteer asking for the weather condition then cracked a joke by posting *'I'll trade you 2 -3 hot days for rainy days* '. Sometimes, volunteers will announce their whereabouts or what they are doing. For example, one volunteer wrote *'Taking a late lunch break (brb)'* another volunteer replied with Pizza emoji by saying *'Enjoy* '. On another day, one of the volunteers narrated a story that *'As I came out of one white house building yesterday Kim Kardashian came out of the other. So how come everybody took pictures of her and just didn't even see me* '. The post was followed with all sort of emoji responses ( ) to 'sympathise' with the lone visitor to the White House. Likewise, it is part of the Café's culture for volunteers to bid goodbye to their fellow colleague when '*Signing off*'. For example, a volunteer humorously posted '*hehehhe Ok i'm sneaking out the back door…. shhhh dont' tell anyone'*.

4.6.2 HR Urgent Events

The Urgent Event window (see figure 4.1 label A) is the central hub for the monitoring and coordination of the disaster responses. HR has institutionalised communication code for sharing information in this window. For example, when posting an announcement to the window, HR encourages volunteers to start the announcement with a bell ( ) emoji. Other codes include the use of teddy bear ( )to indicate urgent needs, love ( ) for information to or from partners, and star ( ) for starting a new event, status changes or sharing summary reports. Likewise, HR encourages volunteers to use flower ( ) at the end of summary reports or stand down report as well as clock ( ) emoji when indicating training, meeting or scheduled items.

At the individual level, volunteers share information of slow moving or sudden onset of disasters to the window they received via emails or cell phones. During response operation, volunteers also post urgent needs or any information that requires further validation or immediate referral to aid agencies/emergency management organisations. For example, during the Sri Lankan flood/landslide, a volunteer stumbled on an urgent request and posted the message to the Urgent event window. S/he does so by adding the teddy bear emoticon at the beginning of the message to draws fellow volunteers' attention about the urgency of the message:

"🧸Yazir Arafath @YazirArafath 1h1 hour ago

A family is currently trapped in Sedawatte. Any rescue team around that area? #FloodSL #ExtremeWeather @rbathiudeen @cmbfav"

Excerpt 4.1 Use of Teddy bear emoji to Illustrates Urgent Needs

By adding the emoticon, the intention is that volunteers will consider such information as a high priority message and therefore needs urgent attention.

At the official level, volunteers holding official posts such as social media incident coordinator (SMIC), case management coordinator, or incident reporting lead can also share announcements to the Urgent Event window. For example, when the Disaster Desk Working Group (DDWG) decides to activate the disaster desk, the SMIC will share the information in this window. Also, as the event unfolds, the SMIC will share response summary and inform volunteers of the goal for the next 24 hours. If the need arises to stand down, the SMIC will announce to the window about the decision reached by the DDWG to stand down. The SMIC will then post a final summary report as shown in the following excerpt below.

🔔 Final Summary, Istanbul Airport Explosions - June 28, 2016. We activated at 3:20pm EDT to monitor explosions, which turned out to be suicide bombings, at the Ataturk Airport in Istanbul, Turkey. We amplified official information, and information on embassies, reunification, and airport/airline status. Volunteers responding: Claudia, Cheryl, Javone, Damian, Olivia, Sanchia and Amir. We stood down at 9:50pm EDT. 🌿🌿

Excerpt 4.2 Final Summary Report

The above excerpt offers a sketch of how SMIC shared information in an Urgent Event window through the use of convention (emojis), the summary of the activities as well as by acknowledging the efforts of volunteers that provided the support.

4.6.3 HR Useful Links

The 'Useful Links' window (see figure 4.1 label B) is another channel created to serve as a resource pool in which volunteers can share and learn life hacks, tips, notes, and links. HR encourages volunteers to start their message with the "Did you know?" so that others can easily locate information in the Skype window by using Control F and by searching for "Did you know". Information shared by volunteers in this window tended to cluster around crisis response, skills development, current affairs and geography as well as HR activities. See, for example, one of the excerpts shared by an HR volunteer:

Did you know? Here is the main page to all Facebook Crisis pages https://www.facebook.com/crisisresponse/

Excerpt 4.3 How HR volunteers share useful content in Useful Link Window

In the above excerpt, the volunteer shared important resource for fellow volunteers to be aware of so that they can be monitoring the page.

Although useful and creative, this idea of creating Useful Links window does not seem to be serving its purpose. The reason is not all volunteers and HR staff abide by the simple rule of starting the message with the 'Do you Know' phrase. Also, a majority of the contents shared do not match the vision upon which the window was created in the first place. It will not be an exaggeration to state that it will be difficult for a new volunteer to know the difference between the Useful Link window with the Urgent Event window with regards to what other volunteers are posting. This is because some volunteers habitually share urgent needs messages in the Useful link windows.

4.6.4 HR Work Diary

HR has created a work diary window (see figure 4.1 label C) to serve as a digital notice board for posting projects and volunteering opportunities. The window serves as an awareness information centre where volunteers can learn what other colleagues are doing. Analysis of the posts shared in the work diary window tended to revolve around what was happening around HR, individual tasks, work anniversaries, training reminders and completion of training announcements. On a daily basis, an HR paid staff member will share a link to the folder where volunteers can find weekly schedule of activities on in-house training, campaigns, current disaster desk status, as well as volunteer opportunities around HR. At the individual level, volunteers make use of the window to announce the work they are currently undertaking or have completed. HR also make use of the window to share volunteers' work anniversaries. The anniversary message typically has the name of the volunteer, the number of years spent working with HR as well as the day in which the volunteer joined. For example, the message will have something like '*Olivia celebrates two years with Humanity Road on Thursday, June 30'*. Also, HR staff takes advantage of the window to share training information like *"Google Docs - Forms and Reports training starts in 15 min. Let me know if you wish to join the training. Thanks!*". Whenever, the training is completed, the facilitator will utilise the window to congratulate volunteers that undertook the training. For example, when Olivia attends cyber review training, the facilitator will share a message like '*Thank you and congratulations - Olivia has completed Cyber Review Training*. In essence, the work dairy

window is the information hub where volunteers wait to learn about the events happening around HR.

4.7 Knowledge Management

Being a digital organisation, HR makes use of Google's cloud platform to index and manage working documents so that volunteers will have access to such documents anywhere and at all times. The repository holds documents such as disaster response procedures, reporting process instructions, organisational templates, best practices as well as an archive of past academic research, papers and media mention. Disaster response procedures have guidelines and tip sheets for monitoring winter storm, wildfires, volcanoes, tropical cyclone, tornadoes, public safety events (shooting, bombings and terrorist attack), floods, extreme heat, epidemics and pandemics, earthquakes and droughts. It also holds tip sheets for verifying photos and using geolocation. The folder also archives checklists for disaster events, how to, and frequently asked questions (FAQ). The reporting process instruction holds tutorials on how to write and upload SitRep on HR blog as well as a 3W (Who does What, Where) report for external organisations. It also includes a how-to manual on writing a report for ReliefWeb and All Partners Access Network (APAN). HR has simplified the process such that any volunteer can write any report at any time. A templates folder has templates of HR working documents such as Workbook, SitRep, 3W, minutes, and external correspondences. In case of an emergency, HR volunteers will only copy the type of template they want and use it without 'reinventing the wheel'. The 'Urgent Needs' tracking spreadsheet holds the history of all events covered by HR in a Google spreadsheet. The 'Best Practice' folder archives best practice files and document for using social media platforms in emergencies. The folder also holds lesson learnt generated through 'after action' reports. The HR Library includes blogs, books, news, articles, white papers, awards, and videos about HR work provided by third parties. It also includes Slideshare presentations, testimonies, bulletin or webcast.

4.8 Conclusion

This chapter explores the context for understanding the social organisation of HR work. Specifically, the chapter starts by tracing the history of the organisation. This was followed by the discussion of its organisational and operational structure as well as its core operational activities and examines approaches to volunteer recruitment, management and motivation. Finally, the chapter explores HR's work environment and its knowledge management approach. The following chapter addresses the first research question with regards to how volunteers acquire, process, validate, share and ensure the quality of the crowdsourced information.

Chapter 5: Process Workflow and Data Quality Assurance Measures

5.1 Overview

This chapter addresses the first research question on the information processing activities of HR volunteers with regards to examining how volunteers acquire, organise, verify and report crowdsourced data. It explains in detail the process involved in verifying the integrity of the data before making it available to emergency management organisations, aid agencies, disaster-affected communities and the public at large. The chapter is organised as follows: The first section explains how I applied Activity Theory Methods to analyse the empirical data through a case study of the Kumamoto (Japan) Earthquake. Following this, I offer insight into the response process workflow beginning with the monitoring and activation, listing, listening and verification, amplification and concludes the section with a discussion on the reporting phase of the process workflow. Next, I highlight the verification procedures in processing crowdsourced information and end the last segment with a summary of the entire chapter.

5.2 Practical application of Activity Theory Methods

To provide an idea with regards to how I applied activity theory methods (AODM and Martins-Daltrini Framework) while analysing the data, I recreated a summarised version of the Skype chat logs of the HR volunteers' 5-hour response of the Kumamoto Earthquake, Japan. In recreating this account, I changed volunteers' names with pseudonyms, modified date and time stamps as well as shortened URL using Google URL shortener with the view to safeguard volunteers' privacy.

The Kumamoto Incidence

On 15th April 2016 precisely at 18:38:16, a volunteer with Skype ID HR: Javon Malone posted: "⋆ *I received USGS notification in email on iPhone as follows: New Event: A powerful earthquake with a preliminary magnitude of 7.1 has struck - alert doesn't give depths – will look for that – EQ occurred at 16:25 UTC* ⋆". Later, at 18:43:41 the same volunteer sent another message "⋆ *M7.1 - 5km ENE of Kumamoto-shi, Japan… Its big, and shallow. Not good. This is Japan so its going to be hard to work but I am sure this is going to be a major event* ⋆". There and then, the Urgent Event window came alive, and a series of discussions

went on for a while. Following that, the Social Media Incident Commander (SMIC) in charge of the disaster response posted the following message in the Urgent Event Window:

> [15/04/2016, 19:10:58] HR George Simmons: 🔔🔔 We are currently activated at Level 2 - Yellow monitoring the 7.1 EQ that just hit Japan right in the same area where the EQ hit yesterday. Japan is very difficult for us to work but we will do what we can. This is the city of Kamumoto website (you will need to translate): https://goo.gl/CM8Lts . Mashiki was already pretty damaged yesterday. Their website is: http://www.town.mashiki.lg.jp/ (but it seems to be down). Please keep an eye on the tsunami advisory and try to find information on the web or social media about the towns nearest to this current quake: Kumamoto, Uto, Ueki, Matsubase 🔔🔔

Excerpt 5.1 Skype chat logs excerpt illustrating activation announcement

A few minutes later, volunteers started announcing their arrival by writing in the Urgent Event window *'Am here and available to retweet from mobile as needed'*, and *'am here now. Skype windows catching up. Task me. I can help with whatever needs doing'* as well as *'I'm here to help - getting caught up on the conversations and status workbook now. Please let me know if there is anyting in particular I can do'*. Meanwhile, another SMIC posted in the Urgent Event window that *'FYI - for our new volunteers, twitter does a pretty good job of translating Japanese tweets. If you move your cursor to the top right of the tweet over by the little globe, a "view translation" link will show up'*. A few minutes later, the same SMIC added that *'If you would like to pick a town to research, such as finding out if it has a website, please tell the group what you are researching. Thanks. ☺'*. As the disaster response operation continued, another veteran volunteer posted: *'... can someone give me a couple of good official twitter accts to follow?'* Furthermore, a volunteer manning the Disability, Accessibility and Functional needs Disaster Desk wrote: *'Also I see we have no information under Vulnerable populations, if you guys could see if you could find any Nursing Homes, Day Care for the Elderly, Seinor Centers, Dialysis centers anything for the Disabled and Elderly, that would be great ... oh also, anything about pregnet women, babies, daycare for kids to.'*. As the response continued, a volunteer posted "🔔🔔. *This house that is making the rounds is from 2012 Navin Kumar Ram @NavinKumarRam A destroyed house in Taveuni. Photo Credit: NaDraki Weather #TCWinston @IFRCAsiaPacific https://goo.gl/MXt5Q6 Here is the link to the original photo https://goo.gl/6F5v8H*". Following that, a volunteer responded with *'Going to be a reverse image search kinda day'*. In addition to that, another SMIC follows up the issue with *'Friendly reminder, please add sources to all the info'*. After five hours of the response operation, an Incident Reporting Lead posted an update: "⋆ ⋆ ⋆ *The Disaster Desk upgraded to Level 3 Red. With the potential impact of this quake we are asking for all hands to repond and assist. Email, SMS, and Social Media callouts are being made. We have*

created working SitRep and are startng to fill it in. If you cannot access the SitRep let us know 🔔 ⋆ ⋆".

Analysis of the case study

To analyse the 5-hour response, I followed the same approach explained in Chapter 3 subsection 3.7.2. However, to make the process more straightforward, I joined the AODM eight-step model alongside the Martins-Daltrini's framework into a single table as shown in Table 5.1. The essence of combining the two frameworks into a single table is to simplify the task of crosschecking to two tables at the same time while trying to make sense of how the analysis come into being. For a better understanding of how I combined the 2 frameworks, I added numbers at the top of the row (1-9) in which 1 stands for the 'Activity' column, 2 stands for 'Action' column and so on and so forth. Next, I also added another column and labelled each row with a letter starting from A and stopping at H where row A, B and C has action column, operation column, and subject column and so on and so forth for the 'Monitoring and Activation' activity. The same label applies to all the next letters corresponding to the rows and column. By doing that, I was able to find four unique activities with different outcomes. The activities are represented in the first column with the first activity (Monitoring and Activation) occupying A-C rows, the second (Listing) occupying D-E rows, the third (Listening and verification) taking F and G and the last activity (Reporting) occupies row H.

In brief, by going through Table 5.1. It will be apparent for the observer to identifies four distinct ***activities*** (Column 1) that have taken place during the Kumamoto response operation. These activities are monitoring and activation, listing, listening and verification, and reporting. The distinctiveness of each activity is identified through the number of ***actions***, and ***operations*** involved. It can also be identified based on the ***outcome*** of each activity. For example, the outcome of monitoring and activation activity is the activation of the disaster desk. Also, a further glance at the table will reveal a decomposition of each distinct activity (Column 1) into actions (Column 2) and operations (Column 3). The table also shows different actions need a different form of involvement. For instance, announcing the sudden onset of the earthquake (Column 2: Row A), activating disaster desk (Column 8: Row C), and reporting update (Column 2: Row H) needs the action of individual volunteers. Others like discussing the impact of the earthquake (Column 3: Row B), researching towns (Column 3: Row E), and data mining urgent needs (Column 3 Row F) involves so many volunteers to work in a self-directed approach. Working in a self-directed mode entails, for example, volunteers to pick a town in which they will work to find urgent needs. Furthermore, the analysis shows the coordination of more than one SMIC as we can visibly see that three SMICs were contributing to the coordination of the response.

Going through the table will further reveal the different composition of ***subjects*** (Column 4) involved in the response operation. For example, besides traditional volunteers whose role is to aid the operation, other subjects are supporting the response operation. Such subjects include researchers, interns, social media incident commanders (who sometimes could be HR paid staff) and other support staff called a technical specialist.

It is also visible from Table 5 that the response was mediated through different ***tools*** and platforms (Column 5). The table reveals tools such as emails, phone, Skype, social media platforms, websites and TinEye (reverse image website). The use of some of these tools to coordinate the response is also mediated using abbreviations. For example, USGS (for United State Geological Survey), EQ (for earthquake), and FYI (for your information), Emojis – ⭐🔔🌷, and jargons like level 2 yellow and level 3 Red (see section 5.2.1. for details).

The case study also suggests how ***rules*** and ***division of labour*** play important roles in governing the operation of the disaster response. For instance, we have seen how a SMIC explicitly scopes the work of volunteers by urging them to '*try to find information on the web or social media about the towns nearest to this current quake: Kumamoto, Uto, Ueki, Matsubase*'. In another occasion, a SMIC posted a friendly reminder by saying, '*please add sources to all the info*'. The case study also hinted to us a kind of access control in the organisational resource. We can decipher this by the statement of the SMIC in which s/he says, '*If you cannot access the SitRep let us know*'. The study also reveals division of labour among the volunteers. For example, a SMIC urged volunteers by saying '*If you would like to pick a town to research, such as finding out if it has a website, please tell the group what you are researching*'. As volunteers announced the area they are working; other members will become aware and therefore will concentrate their efforts in other areas. As such, this collaborative and cooperative work suggest an implicit division of labour as moderated by the SMIC.

The above analysis is an indication of how I applied AODM and Martins-Daltrini framework to analyse the empirical data generated from the fieldwork.

Table 5.1Combined AODM and Martins-Daltrini Framework

1	2	3	4	5	6	7	8	9	
Activity	**Action**	**Operations**	**Subjects**	**Tools**	**Rules & Regulations**	**Division of Labour**	**Community**	**Outcome**	
Monitoring and Activation	Announcing the sudden onset of the Earthquake	- Overview of the impact - Follow up to explain details of the impact	- Volunteers - Researchers/interns - SMICs - Technical specialist	- Email - Phone	-	-	- Volunteers - Researchers/interns	Activation of the Disaster Desk	**A**
	Sense making activities and discussion	Impact of the earthquake to determine the response type	- Volunteers - Researchers/interns - SMICs - Technical specialist	- Skype Urgent Event Window			- Volunteers - Researchers/interns		**B**
	Activating the Disaster Desk	- Activated to level 2 yellow	- Volunteers - Researchers/interns - SMICs - Technical specialist	- Skype Urgent Event Window	-	-	- Volunteers - Researchers/interns		**C**
Listing	Announcing availability and readiness to support the operation by volunteers	- Other Volunteers reporting to the Urgent event window	- Volunteers - Researchers/interns - SMICs - Technical specialist	- Skype Urgent Event Window	-		-	Creating resource list that will be used for listening and verification	**D**
	Finding information about the town nearest the epicentre pf the EQ	- Pick one town to research about their websites	- Volunteers - Researchers/interns - SMICs - Technical specialist	- Skype - Websites - Social media platforms	-	-pick one town at a time and inform	- Volunteers - Researchers/interns		**E**
Listening and verification	Datamining information	- By following accounts from the resource list - Urgent needs - DAFN -	- Volunteers - Researchers/interns - SMICs - Technical specialist	- Skype - Websites - Social media platforms -	-	pick one town at a time add source	-		**F**
	Verification of crowdsourced information	- Photo verification - Sources	- Volunteers - Researchers/interns - SMICs - Technical specialist	- Skype - Websites - Social media platforms - Tin Eye	- Post to Skype window	-	-	Actionable information	**G**
Reporting	Daily update	- Updating the volunteers for shared awareness	- SMIC Incident Reporting Lead	- Skype	-	-	-	Daily summary and SitRep	**H**

5.3 Response workflow

In exploring the nature of the digital disaster response activities, I recognised that even though HR has documented several guides and tips in responding to the different types of catastrophe, it does not have any codified response workflow manual to guide its operations. However, a careful observation alongside an extensive review of Skype chatter across a range of disasters revealed an implicitly structured workflow. This workflow starts with the Monitoring and Activation in the first phase and continues with Listing, Listening & Verification, Amplification and ends with Reporting.

The categorisation of the response workflow was based on the distinctiveness of each phase alongside some common sets of tightly constrained interdependent activities that are repeatedly present in every response operation I participated or observed. For example, the distinctiveness of each phase is attributed to the type of activities, actions, operations as well as the outcome of each distinct activity. Besides, the classification was also made with the full realisation of the means through which activity is carried out, as well as rules and regulations governing the conduct of such activity. In other words, the emergence of each response phase was born out of the extensive analysis of empirical data through the integrated use of Activity-Oriented Design Method (AODM) and Martins-Daltrini's Framework. Below, I explain the response workflow starting from 5.3.1 through 5.3.5 and in the course of this explanation, i used bold letters to show the AT focus, and these are linked to the AT framework elements in the bracket.

5.3.1 Monitoring and activation

In the context of the HR response work, monitoring is defined as an activity that relates to tracking the sudden onset or the arrival of slow-moving disaster. The activity serves as the first phase of its response workflow. Monitoring is usually undertaken by ***active volunteers*** (subject) who make use of a different range of ***applications and platforms*** (tools) for receiving an instant push notification on their mobile's phones, PCs and tablets among others. HR's volunteers make use of websites like the Global Disaster Alert and Coordination System (GDAC), U.S. Geological Survey (USGS), the National Hurricane Centre (NHC) and Pacific Disaster Centre (PDC) as their most preferred sources of news. However, HR volunteers are ***encouraged to avoid*** (rules and regulations) breaking news websites and traditional media outlets for reporting the sudden onset or arrival of slow-moving disaster. This is because volunteers have learned over the years that '*some of these media sources have the history of publishing information very fast, but often get their facts wrong*' (Skype Chat, Chris Thompson - HR President). Against this, HR volunteers were ***reminded*** (rules and

regulations) during orientation to subscribe to electronic notification systems such as that PDC, GDAC, USGS, and NHC. The rationale is that HR regards PDC, GDAC, USGS, and NHC as the widely acknowledge official source for disaster information and in which most of the news outlets are getting their news from such centres

Any volunteer that signed up with electronic notification will receive an ***SMS or email*** (tools) whenever a disaster happens or is about to happen. Notification received via these websites sometimes offer a snippet of the disaster impact that helps volunteers to start preparing for a response. The following snippet from the Skype chat logs illustrates how a volunteer received an instant alert and announced to the Urgent Event window about the sudden onset of Earthquake near Valparaiso (Chile):

> [24/04/2017 22:50:21] HR Joe McMillan: ⋆ New event: received iPhone app tone notification (app is not from USGS) for mag 6.7 Quake near Valparaiso, Chile ⋆
>
> [24/04/2017 22:51:11] HR Joe McMillan: am available to RT HR on mobile
>
> [24/04/2017 22:57:09] HR Catherine Graham: I'm here
>
> [24/04/2017 22:57:26] HR Lucile Mayert: I am here to
>
> [24/04/2017 22:58:42] HR Aline Carr: here
>
> [24/04/2017 22:58:58] HR Catherine Graham: It's very close to shore and USGS rates it as an orange event, shallow and near populated areas.
>
> [24/04/2017 22:59:00] HR Joe McMillan: Got two more notification from other phone apps too - one of them reported mag 7.1
>
> [24/04/2017 22:59:32] HR Catherine Graham: reviewed by Seismologist and revised to 7.1mw
>
> 10.0 km± 1.9
>
> [24/04/2017 22:59:39] HR Aline Carr: USGS link: https://earthquake.usgs.gov/earthquakes/eventpage/us10008kce#executive

Excerpt 5.2 Skype Chat Logs extract – illustration of Instant Alert Notification

The above excerpt offers a glimpse of the message received through the electronic notification system (ENS) by a volunteer. The notification shows the earthquake location (near Valparaiso in Chile) and its magnitude (6.7). However, the volunteer (HR Joe McMillan) openly declares that the source was not from the USGS. With that, another volunteer (HR Catherine Graham) shared a snippet from the USGS which mentioned the category (orange) of the earthquake and its likely impact (shallow and near populated areas). HR Catherine Graham went on to add that the snippets s/he shared was reviewed by USGS seismologist. On seeing that none of the volunteers attached a link to the information, another volunteer (HR Aline Carr) went on to share the link of the USGS alert.

From the extract, we can see that monitoring involves ***tracking of information*** (action) using smartphones, PCs, and tablets among other tools by active volunteers through a

different range of ENS. From time to time, ***SMIC***[35] (division of labour) will remind volunteers to make use of ***tip sheet*** (tool) as a form of checklist to enable volunteers to abide by HR operating procedures for responding to disasters. The tip sheet is accessible via a link on top of Urgent Event Window.

As soon as information of such nature is posted in to the Urgent Event window, available volunteers that are hanging around in the Café will start reporting to the Urgent Event window as seen in the excerpt above. In the above excerpt, we can see that within eight minutes of sharing the alert, four volunteers showed their readiness to cover for the event. Following such ***announcement*** (action), ***Disaster Desk Working Group*** (community) – a subcommittee among active volunteers – will quickly discuss whether to keep monitoring the situation or activate the Disaster Desk depending on the impact of the event.

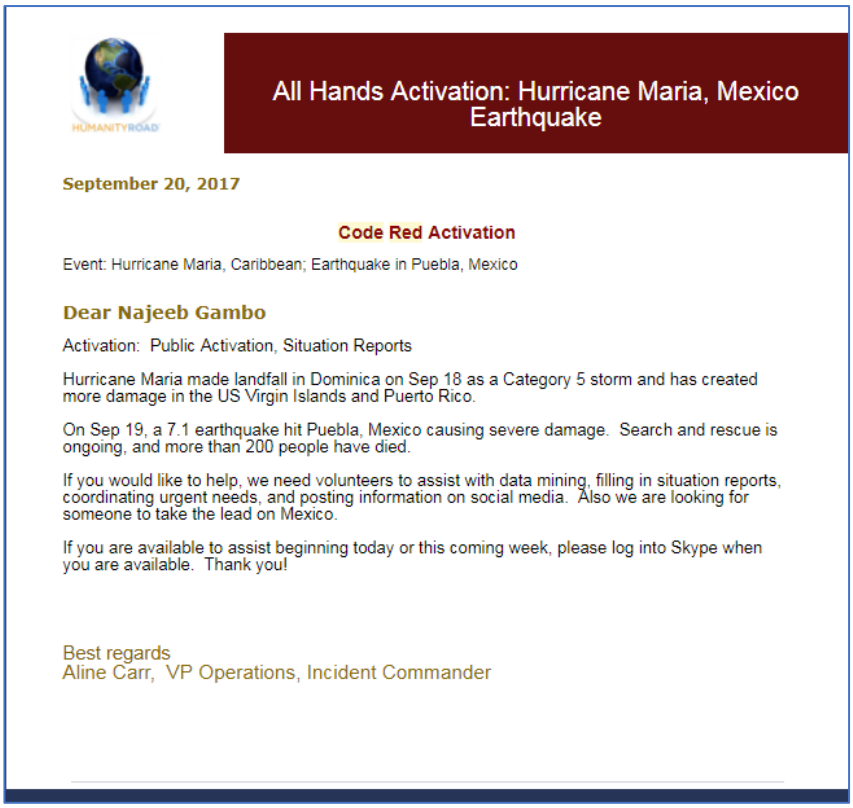
In disaster parlance, activating the Disaster Desk is guided by the likely impact of the disaster, and this impact is categorised in stages. For example, local events that are smaller in proportion is classified as Stage 1 (Green) activation. In this instance, volunteers that are available at that time can be organised under the guidance of Social Media Incident Commander (SMIC) to undertake the response operation. During stage 1 (Green), volunteers will be asked ***to datamine social media for urgent needs*** (action) and route it to those offering help and vice versa.

Stage 2 (Yellow) activation is declared when the event is severe and humanitarian emergency organisations are or are likely to be overwhelmed and could not be able to respond to urgent needs promptly. In this instance, Disaster Desk Working Group (DDWG) will advise SMIC to invite both ***active and inactive volunteers*** (subject). In the HR parlance, active volunteers are those volunteers that are socially active at 'Cafe' and shares useful information from time to time at the 'Useful Links' window. On the other hand, inactive volunteers are those volunteers that have access to HR windows and resurface only when they receive invitation requesting their participation in a major catastrophe. Available volunteers will then be asked to undertake '***general monitoring***' (action) and **collaborative authoring** (action) of a 'situation report' (SitRep). During stage 2 (Yellow) activation, all regularly scheduled meetings and training sessions of HR may be temporarily disrupted.

Stage 3 (Code Red) is named for massive catastrophe with mass fatalities usually needing international aid. Code Red activation requires a collective effort of both active and inactive volunteers. SMIC usually sends ***activation invitations*** (outcome) through text messages

[35] In certain circumstances, some post such as SMIC can be categorised as a subject while in some cases they are classified as a division of labour. The reason is while SMIC is part of the HR volunteers which are considered as subject, the SMIC's role allows for the SMIC to coordinate activities which are regarded as a division of labour.

and email to both active and inactive volunteers requesting for their help as shown in figure 5.1.



All Hands Activation: Hurricane Maria, Mexico Earthquake

September 20, 2017

Code Red Activation

Event: Hurricane Maria, Caribbean; Earthquake in Puebla, Mexico

Dear Najeeb Gambo

Activation: Public Activation, Situation Reports

Hurricane Maria made landfall in Dominica on Sep 18 as a Category 5 storm and has created more damage in the US Virgin Islands and Puerto Rico.

On Sep 19, a 7.1 earthquake hit Puebla, Mexico causing severe damage. Search and rescue is ongoing, and more than 200 people have died.

If you would like to help, we need volunteers to assist with data mining, filling in situation reports, coordinating urgent needs, and posting information on social media. Also we are looking for someone to take the lead on Mexico.

If you are available to assist beginning today or this coming week, please log into Skype when you are available. Thank you!

Best regards
Aline Carr, VP Operations, Incident Commander

Figure 5.1 Activation Invitation (email)

As can be seen from the above figure, the email has a brief overview of the catastrophe, the nature of the response HR will offer (Code Red in this instance), and a call to report to Urgent Event window. Moreover, the Incident Commander will also post the same announcement in the Urgent Event window and will create a new Skype window for managing the response. The following excerpt is a sample of activation information posted to the Urgent Event window by the event SMIC:

> [03/10/2016, 17:50:01] HR Javon Malone: ⋆ Attention team, we anticipate activation this afternoon for Hurricane Matthew. This is a very large storm that will likely impact multiple countries. The DDWG is preparing for our response now. This will likely be a Yellow and quite possibly Red event. We ask that if you are able to sta rt clearing some time in your schedule the next 3-4 days to support our activation. We have a window set up and gave designated this event as Operation Atlantis. Thank you. ⚘⚘⚘

Excerpt 5.3 Skype logs extracts. - Activation announcement.

In the above extract, the SMIC began the message with the star ⋆emoticon and ends the activation announcement with three emoticons of flower ⚘⚘⚘ (rules and regulations). The message also shows that HR volunteers have previously been monitoring the slow movement of the disaster.

In summary, ***monitoring and activation*** is an activity that starts with ***tracking of news*** (action) using smartphones, ***PC and tablets*** (tools) through an ENS. The activity is carried out by ***active volunteers*** (subject) whom upon receiving credible information will send it to the urgent event window. On receiving the news, a ***subcommittee*** (community) among the active volunteers (DDWG) will discuss the matter based on the available data and decide the type of response HR volunteers will provide. As soon as the ***decision*** (outcome) has been reached, SMIC will be asked to send invitation depending on the activation level. Following that, volunteers will begin to announce their readiness to support the response operation. The arrival of the volunteers to the urgent event window signifies the end of the monitoring and activation phase and the beginning of the Listing phase in the HR response workflow.

5.3.2 Listing

The second phase of the HR response workflow begins as soon as volunteers have announced their readiness to support the response operation. If it is a stage one (Green) response, all the activities will be carried out within the ***Urgent Event window*** (tool). However, Stage two (Yellow) sometimes begins in the Urgent Event window. However, as soon as it escalates to a full-scale disaster, then a new event-specific window will be created, and available ***volunteers*** (subject) will be added to it. HR President – Chris Thompson mentioned four reasons (during an interview) for creating an event-specific window whenever they are responding to significant events:

1. First, whenever multiple response operations are happening at the same time, creating an event-specific window will allow HR volunteers to break into various teams and distribute responsibilities.
2. Second, it helps to manage information overload so that volunteers can quickly go through the number of unread messages. This is because some volunteers are only interested in those short terms they don't want log into Skype and look at the urgent window and see 150 posts. However, with a new event-specific window, someone does not need to read all through. (Figure 5.2 gives an overview of the potential information overload that HR Chris Thompson was talking about in which a volunteer must undergo to know what is going and where to focus).
3. Third, this enables HR to archive information that is specific and unique to that one location and to that one event, so that a volunteer will not have to dig through the urgent event window to find information about that one event.
4. Fourth, it allows HR to bring in other partners who are not internal volunteers like Translators Without Borders (TWB) and Standby Task Force (SBTF)

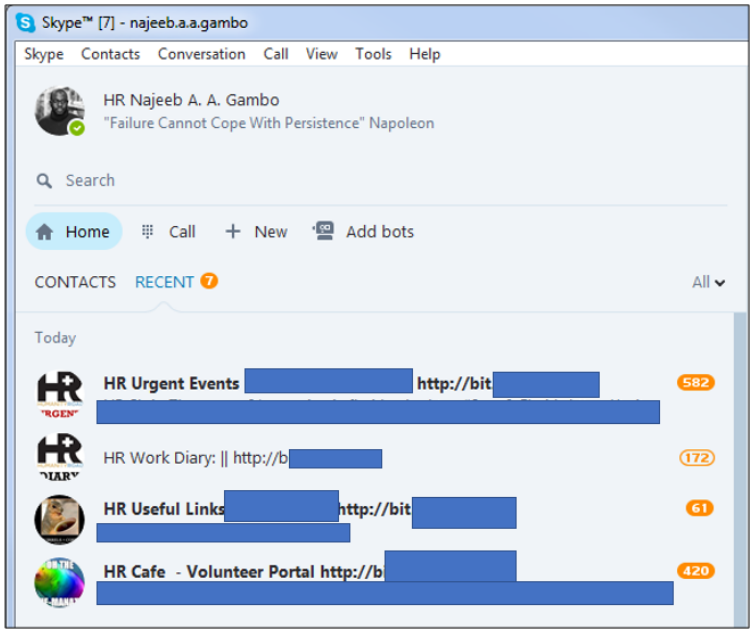


Figure 5.2 Overview of the number of unread messages (content anonymised)

From figure 5.2, we can see 582 unread posts in the Urgent Event window, 172 in the Work Diary window, 61 in the Useful Links window and 420 in the Café window.

Having understood the justification for creating event specific windows, our focus here is to understand what listing is and the activities involved in this phase. Listing refers to the series of activities that involve ***researching keywords*** (action) and ***events hashtags*** (action) which will be used in data mining ***Scanigo*** (tool)– a social media analytic toolkit for extracting disaster information. This toolkit organises tweets into categories, helps in reducing Twitter 'noise', and finds likely relevant tweets. The Listing activity also includes ***finding*** (action) addresses of emergency management organisations and aid agencies and ***adding*** (action) such addresses to the relevant HR ***Twitter list and Google Docs*** (tools). Individually, ***volunteers*** (subject) make use of search engines, Twitter and its third-party applications such as social mentions, TweetReach, and TweetDeck among others to research location keywords, and events hashtags that will be used in data mining Scanigo. The following excerpt from the Skype chatter presents an example of listing activity.

> [19/02/2016, 19:56:57] HR Chris Thompson: I am researching the locations listed to identify a Scanigo keyword list
>
> [19/02/2016, 20:48:50] HR Chris Thompson: Fiji Location Keywords Akeba, Bau, Cakaudrove, Cicia, Gau, Komo, Koro, Labasa, Laotoka, Laucala, Levu, Levuka, Lomaiviti, Macuata, Mago, Mamanuca, Moala, Moce, Nacamaki, Nadi, Namuka, Natadola Beach, Nausori, Nayau, Ogea, Oneata, Ovalau, Pacific Harbour, Qamea, Rakiraki, Savusavu, Sigatoka, Suva, Taveuni, Tuvuca, Vanua, Vanuavatu, Viseisei, Viti Levu, Wakaya, Yacata, Yasawa
>
> [19/02/2016, 20:54:25] HR Chris Thompson: @Alice the keywords and Hashtags are ready for a Scanigo event - do you wish to start it?

Excerpt 5.4 Skype chat logs illustration of 'Listing' activity on social media.

In excerpt 5.4, Chris Thompson announced to the Urgent Event window about her readiness to data mine locations. This is because in order for the automated data aggregation tools (Scanigo) to pick relevant tweets about the specific disaster, it needs users to feed it with names of the impacted areas and event hashtags. As such, HR Chris Thompson searched the names of the locations, sorted the names alphabetically and posted it to the event window and politely asked Alice (using @ symbol) on whether she would want to ***start*** (division of labour) the Scanigo job. The names Akeba, Bau, ….Yacata, Yasawa searched by Chris Thompson are the names of the nearby affected towns that will be feed into the Scanigo.

Alongside the search for location keywords and event hashtags, SMIC will ***assign*** (division of labour) some volunteers to ***find*** (action) a country's emergency number for dispatch, fire, ambulance, and police (operations). Other volunteers would be working to ***find*** (action) information about emergency management organisations and agencies including regional and local organisations (operations) that are officially responsible for updating the public. For example, in the context of a disaster in the UK, volunteers will be interested in searching the internet to find the websites, social media handles, locations, phone numbers, and email addresses of the office of the Prime Minister, Mayor, and Transport for London (TFL), among others.

Listing activities also involve ***finding*** (action) social media handles of traditional relief agencies such as Save the Children, Doctors without Borders, and Red Cross. During the listing phase, volunteers will also be working to find social media handles and contacts of critical infrastructure companies associated with communication, road, and airports, among others. Also, depending on the country, volunteers will search the internet to find websites, contact addresses, locations, and social media handles of organisations dealing with disability, accessibility and functional needs (DAFN) and a host of other interest groups such as that of animals' welfare.

In undertaking the listing activity, volunteers make use of ***search engines***, ***social media platforms*** and ***aggregation dashboards*** such as HootSuite, Scanigo, and Buffer (tools). Volunteers also use information from the CIA Factbook, Wikipedia, traditional media and Government websites to find information related to the disaster in question. The activity is sometimes ***guided*** (rules and regulations) by the HR standing rule to verify information twice and when in doubt, refer to the tip sheets or ask for help in the Urgent Event window. HR has tip sheets for the different type of disasters and emergencies and are readily accessible via a link at the top corner of the Urgent Event window.

In essence, **listing** (activity) involves series of actions which begins with the ***identification of keywords and event hashtags*** (actions). Later, volunteers will work concurrently (depending on their capabilities) to ***produce*** (outcome) a list of websites, social media

handles, locations, phone numbers, and email addresses of organisations involved in the administration of relief. Some of these institutions include emergency management organisations and agencies at federal, regional and local levels. Additionally, the activity in this phase involves finding information about traditional aid agencies (Save the Children, Doctors Without Borders (MSF), critical infrastructure companies, airports, roads, hospitals, telecommunications, and special interest groups for DAFN and animals. DAFN is a short form of Disaster, Accessibility and Functional Needs. During this phase, SMIC handles the coordination of ***task distribution*** (division of labour) to volunteers depending on their area of competence. As soon as SMIC allocates tasks to the available volunteers based on their expertise or preference, volunteers will then work in a self-directed mode to produce the required information. They do so by searching the internet, and social media platforms. Later, the SMIC will or ask a volunteer to add the Twitter accounts in to the HR's Twitter list.

Thus, the listing phase begins as soon as Disaster Desk Working Group asked the SMIC to activate the Disaster Disk and volunteers reported to the Urgent Event window to express their readiness to join the response operation. The workflow will start moving to the next stage as soon as volunteers produced a ***resource list*** (outcome) and added event hashtags to the Scanigo. With the maturity of the stage, volunteers' attention will now be directed to ***monitoring Scanigo, data mining urgent needs*** and ***listening to the social media feeds*** of emergency management organisations, relief agencies and special interest groups (actions). The commencement of such activities signals the transition to the next phase even though the listing phase activity may not necessarily come to an end.

In Summary, the response workflow starts with monitoring and activation, and connects directly to listing phase. If the response is a Stage one (Green), the workflow will move from listing step directly to the listening and verification phase. However, if it is a complex response, the workflow will behave in back and forth manner. For example, in some circumstances, disaster affects only one county. However, the same disaster can become strengthened and profoundly affect nearby provinces, and such counties need to be added to the emergency declaration list. In this regard, the listing activity will continue in back-and-forth manner with listening phase as discussed below.

5.3.3 Listening and verification

Listening and verification (activity) begins as soon as volunteers add resource list to the Google Docs and Scanigo. Listening and verification are separate activities that occur concurrently but leading to one outcome – production of actional information. Listening involves the use of automated tools, such as Scanigo, and manual approaches to datamine actionable information that is relevant to the response operations. Verification involves the

use of fact-checking using tools, platforms and search engines to determine the integrity of data sourced at the listening stage.

At the listening phase, tasks are divided among the available ***volunteers*** (subjects) according to their capabilities, interests and membership of the existing subcommittees within the HR work practice (see Chapter 4). For example, some volunteers' preference might be in finding information associated with animals in disasters, some could be in finding DAFN related needs, while some volunteers may be willing to take any task assigned to them. As for this last type of volunteers, SMIC will usually ***assign tasks*** (division of labour) bordering on ***data mining social media for damage reports*** (action), ***finding isolated and disadvantaged communities*** (action), and ***attending to urgent need*** (action) requests by affected family members as could be seen in the excerpt below.

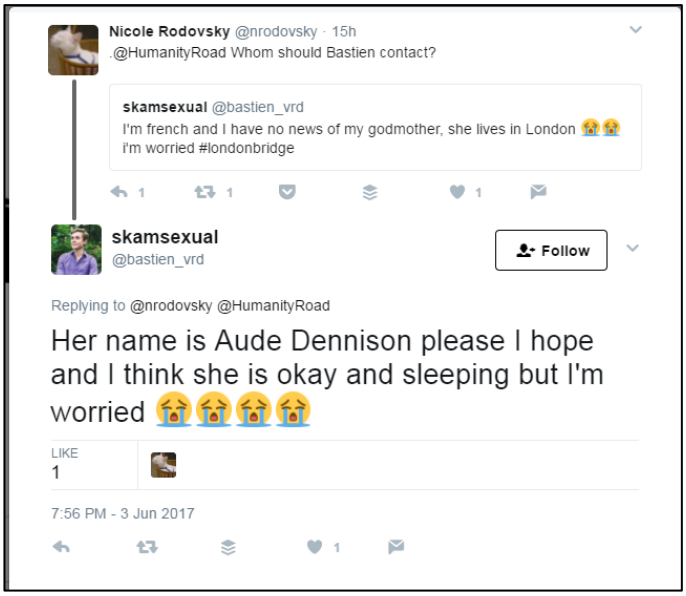


Figure 5.3 A snapshot of Urgent Need sent through Twitter

In figure 5.3, a concerned citizen with a Twitter ID @bastien_vrd tweeted that *"… I have no news of my godmother. she lives in London 😭😭 i'm worried #londonbridge*" after the London Bridge terrorist incident. On stumbling upon the tweet, a Twitter user @nrodovosky who knows about the HR's work copied the tweet to HR by asking *"@HumanityRoad Whom should Bastien contact?*"

At the listening phase, SMIC will be ***assigning more task*** (division of labour) whenever volunteers announced the completion of the work assigned to them or when a volunteer signed into the window. Some of these functions could be ***tracking urgent needs*** (action) such as a ***request for help, evacuation, medical supplies, missing person*** or ***information about reunification centres*** (operations). Figure 5.4. illustrates a typical urgent need uncovered by HR volunteer while searching Twitter.

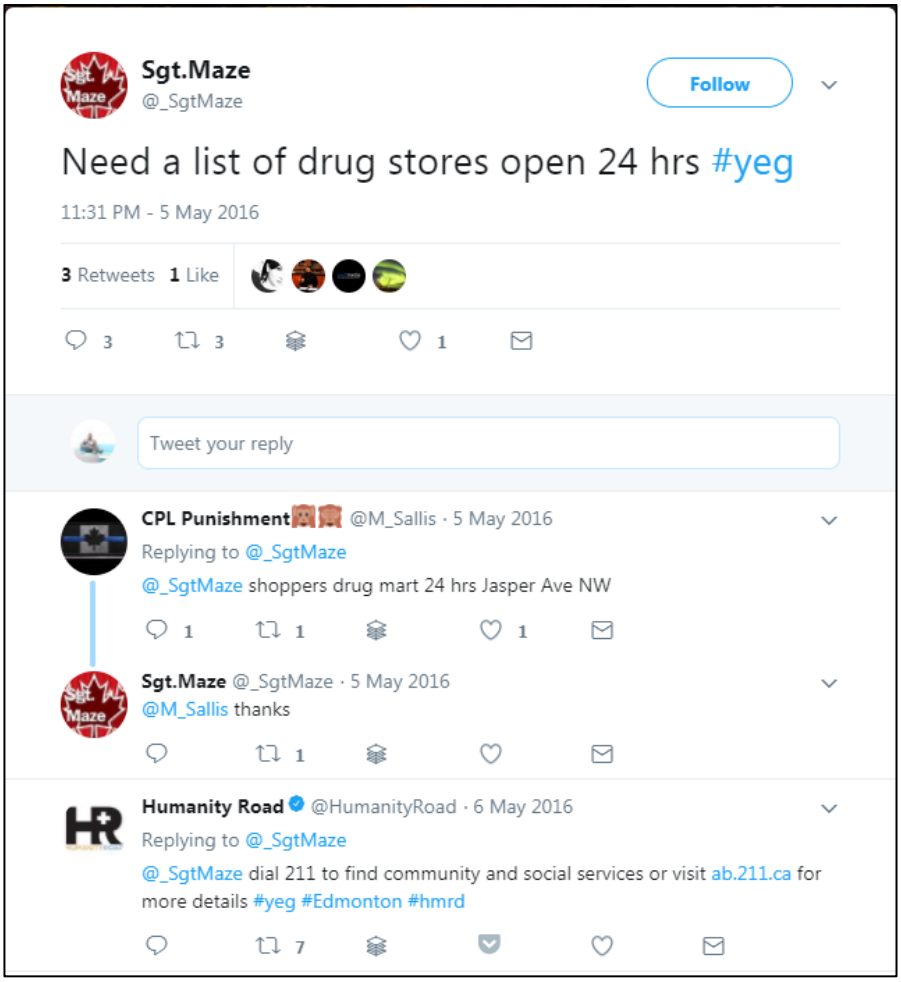


Figure 5.4 Urgent Need

The screen capture in Figure 5.4 shows a resident of Fort McMurray (with a Twitter handle @_SgtMaze) requesting for a '*list of drug stores*'. Like in any other scenario, people also use hashtags during disasters and emergencies to help the discoverability of their tweet and enables it to trend in Twitter search. By using #yeg – a popular hashtag for Fort McMurray -, the @_SgtMaze tweet was discovered by HR volunteers. However, what is not apparent is whether the tweet was discovered by a volunteer who was manually searching Twitter, or if it was uncovered by Scanigo analytic tool and selected by volunteers responsible for its monitoring and administration.

Listening also involves ***tracking*** (action) the activities of traditional and formal aid agencies and humanitarian organisations working at the frontline. This helps partner organisations such as United Nations Office for the Coordination of Humanitarian Affairs (OCHA) to know who is doing what and where. It also involves, ***tracking*** (action) the activities of online Emergency Telecommunications groups such as Amateur (Ham) Radio and First Response Radio Team (FRRT). Amateur (Ham) Radio and First Response Radio Team (FRRT) are voluntary groups that offer emergency communication during disasters when available

telecommunication networks and other conventional means of communication have failed. Also, listening activity includes ***following live feeds*** (action) such as ***Reddit discussion threads*** (operations) and ***bounded chat rooms*** (operations) for NWS and GDAC. The following excerpt is an illustration of the use of bounded chatrooms in listening activity phase.

> [09/05/2016, 23:33:09] Marcus McCarthy: If you have NWSchat, OUNchat would be the place to join 226 other folks. Otherwise, the twitter feed mentioned above is the link https://nwschat.weather.gov/live/

Excerpt 5.5 Skype chat logs - Live feeds monitoring.

The background to excerpt 5.5 was based on discussion among volunteers about the Tornado warning for Garvin and Murray County in Oklahoma (USA). A new volunteer was surprised to have seen how other colleagues were posting updates on the situation as if they were in the Oklahoma Incident Command Centre and asked for the source of information. The answer here from another volunteer (Marcus Mccarthy) directs him on where to join other partners in the NWS chat room.

In undertaking the listing activity, volunteers make use of a different range of ***technological tools and platforms*** (tools). For instance, volunteers who attended training on how to monitor social media using Scanigo and are confident in using it will be added to the Scanigo platform. Other volunteers utilise a range of application such as search engines (Google, Bing, Yahoo), social media platforms (Facebook, Twitter, Instagram), social media aggregation dashboards (HootSuite, Social Mention, TweetDeck, TweetReach), official websites and reverse image searching tools such as Tin Eye among others.

As soon as volunteers tracked actionable information, such as the urgent need discussed in Figure 5.4, they will then share it to the Urgent Event Window or Event specific window (depending on the type of response HR is providing) for validation. In short, Finding and tracking information is an activity on its own so also validating such information is another activity that requires subjecting the information to scrutiny based on HR's verification procedures. HR has procedures for verifying sources, links, photos, and locations among others (subsection 5.4. detailed HR verification process). If the information is found to be good enough, the next stage is for social media listeners/messengers among the volunteers to start amplifying (amplification) the information while other volunteers will start transferring the validated information to the SitRep (reporting). Listening and verification will then continue in a back-and-forth manner until HR stands down. The reason is that throughout the disaster life circle, volunteers will keep tracking actionable information, and verifying its authenticity. Figure 5.5 illustrates the incremental workflow from the listing phase to the listening and verification phase.

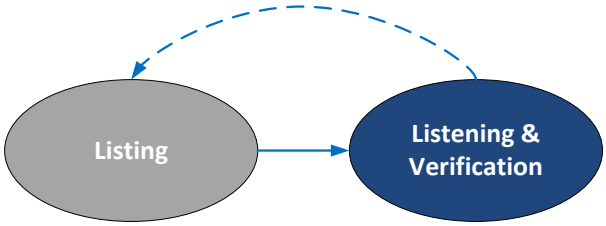


Figure 5.5 An illustration of 'Listening & Verification' workflow phase.

Figure 5.5 shows the process workflow at 'Listening & Verification phase' with the 'Listing' as a preceding activity. Listening and Verification are ongoing activities until when the disaster desk Incident Commander announce the needs for standing down.

5.3.4 Amplification

Amplification (activity) comes into effect as soon as volunteers track and verify actionable information. In the context of HR work, amplification involves carrying out four distinct activities. These activities include ***sharing verified official information*** (action), ***routing urgent needs*** (action), ***distributing survival tips*** (action) and ***encouraging ethical sharing*** (action) of disaster messages as explained in the following paragraphs:

First, whenever volunteers had tracked and verified information from an emergency management organisation supporting the response operation, HR would officially share it with the public through it social media platforms. It will further encourage volunteers also to use their social media networks to amplify the messages. Specifically, HR considered the following entities as official sources: national, regional (state) and local emergency management organisations, aid agencies, police, ambulance, fire services, NHS or other stakeholders within the emergency realm. HR amplifies information from the organisations as mentioned earlier since they are the principal actors in helping people and animals in disaster to survive, sustain and reunite. Analysis of the empirical data reveals HR volunteers tended to amplify information related to the opening of new shelters, evacuations, disruptions, and medical supplies among others.

Second, after tracking actionable information such as individual's urgent needs, volunteers will also report it to the relevant window. After it is vetted, SMIC will ***refer*** (division of labour) the matter to the ***Case Management Coordinator*** (subject). The Case Management Coordinator will then handle the task of routing the urgent needs to the organisation responsible for supporting the disaster-affected communities. In some circumstances where

the urgent needs need a referral or directing individuals to find information, volunteers usually respond to such urgent needs, as could be seen in the following screengrab (Figure 5.6).

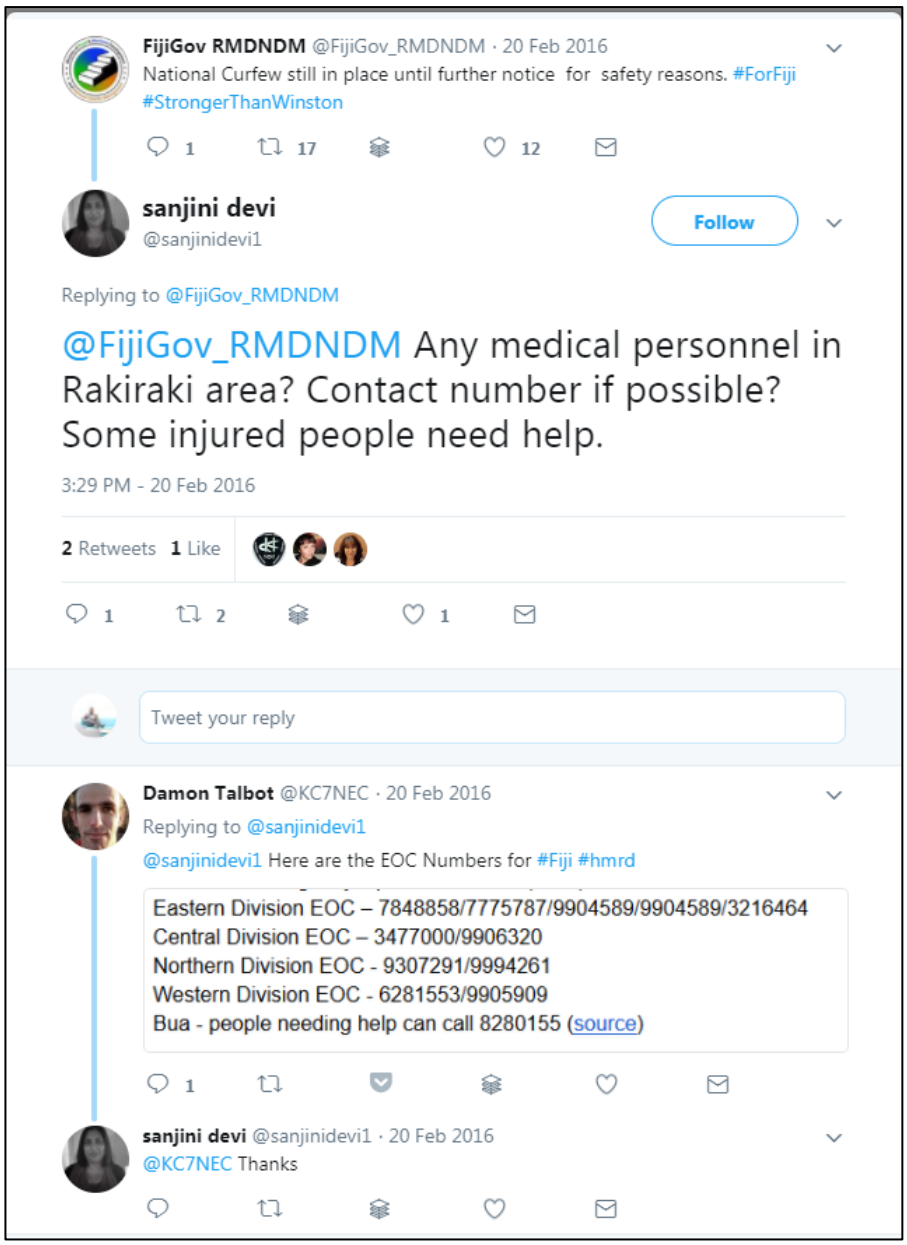


Figure 5.6 Responding to Urgent Need

In the screen capture above (Figure 5.6.) an urgent medical need was posted through a Twitter handle @sanjinidevi1 directly asking Ministry of Rural and Maritime Development and National Disaster Management (Government of Fiji) about where to find medical personnel. This is because the official handle announced that there was an ongoing nationwide curfew in place. However, after nearly an hour without receiving any response from the official Twitter handle, an HR volunteer with Twitter handle @KC7NEC tracked the urgent need and gave her the list of Emergency Operation Centres (EOC) telephones lines to call. Likewise, the volunteer

went on to add the event hashtag #Fiji and that of HR (#hmrd) to make HR's work more visible. Also, the volunteer provides the hyperlink of the source of his information to make it more credible.

Third, amplification includes posting survival tips and reassurance messages to the public by volunteers through official and individual social media accounts as can be seen in the following screen capture (Figure 5.7.).

Figure 5.7 Survival tips and reassurance message.

The above message (figure 5.7) is encouraging residents in the disaster-affected communities to use short messages of "Are you okay" and "I am okay" instead of a phone call so that emergency responders will have enough bandwidth for response communication.

Fourth, amplification also involves urging the public to be cautious of sharing photos and location of the emergency responders while at the front line responding to humanitarian emergencies. HR shares such information more especially during public safety events such as shooting, hostage situation and bombing. The tweet in figure 5.8 is a typical example of amplification showing how HR encouraged responsible sharing.

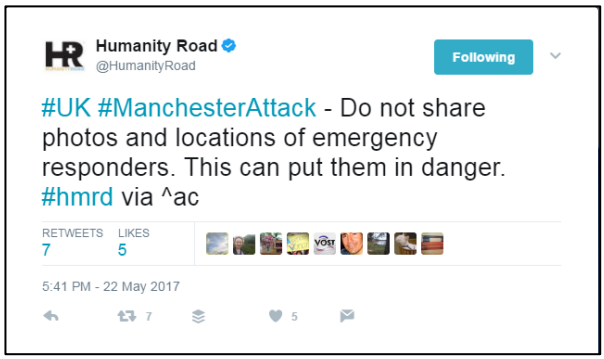


Figure 5.8 Amplification on ethical sharing

Figure 5.8 above was a Tweet from HR handle during Manchester attack encouraging members of the public to be mindful of sharing photos and locations of emergency workers.

While the responsibility for tracking and verifying urgent needs could involve any volunteer, amplifying urgent needs through HR social media platforms is only administered by designated HR ***social media listeners/messengers*** (community). This is because social media listeners/messengers are added as administrators for HR's social media platforms and undergo specialised training. They, therefore, have the administrative privilege (division of labour) to post information on behalf of the HR. However, any volunteer can post verified information through own social media account. Volunteers usually make use of ***GroupTweet*** (tool) to amplify information. GroupTweet is a third-party application where multiple contributors can tweet from the personal Twitter account, and the tweet will appear in the official HR Twitter account. Others make use of Twitter, Facebook, Instagram and other social media dashboard and aggregation tools like ***Buffer and Hootsuite*** (tools).

In summary, amplification is activated as soon as volunteers tracked and verified actionable information that will make people and animals in disaster survive, sustain and reunite. The activity is mainly centred around sharing verified official information to the public and routing urgent needs from the public to the emergency responders. It further involves sending survival tips as well as encouraging the public to avoid sharing sensitive information that will jeopardise response operations.

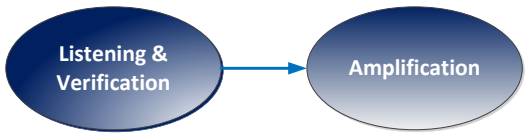


Figure 5.9 Process workflow from Listening & Verification to the Amplification phase

From the context of response workflow, the sequence that leads to 'Amplification' phase starts from 'Listening & Verification', and the iteration will continue in back and forth manner between listening and verification phase to the amplification until the disaster desk stands down from the response activity. Figure 5.9 above shows the connection between the listening and verification phase with the amplification phase.

5.3.5 Reporting

In the context of HR operations, '***Reporting***' (activity) refers to the act of producing written accounts of verified actionable information that will offer situational awareness to the emergency managers, relief organisations and disaster-affected communities to sustain,

survive and reunite. Reporting also involves producing a summary account of response activities undertaken by volunteers as a mechanism for shared awareness among volunteers. The essence is to enable volunteers joining response operation half way to quickly read through and understand what is going on and what needs to be done.

As previously mentioned at the listing stage (subsection 5.3.2.), sometimes a listing activity feeds directly into the reporting stage in which volunteers ***add*** (action) accounts of interest into the ***SitRep*** (tool) when the event escalates from Yellow to Red. In addition to that, the listening and verification phase also connects to both amplification and reporting phases once volunteers have verified information. In other words, the reporting phase workflow connects to both listing and listening & verification phases in back and forth manner when the event is in Yellow or Red. However, when the situation is in Green, the process workflow is straightforward in which only listening & verification phase connects to the reporting phase. Figure 5.10 illustrates the process workflow connecting to reporting phase in a back and forth manner.

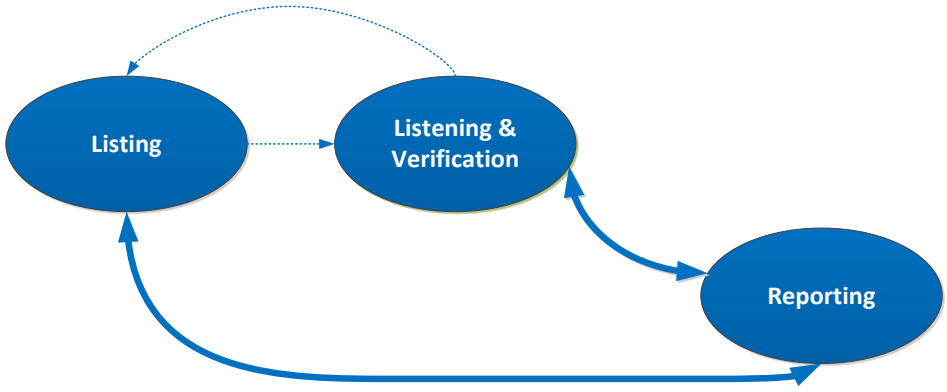


Figure 5.10 Response workflow connecting to the reporting phase

The response workflow illustrated in figure 5.10 shows three phases – listing, listening and verification and reporting. In the first phase (listing), whenever the response is in either Yellow or Red, volunteers will start ***adding*** (action) the account of interest to the SitRep (Google Docs). As such, the flow will be in the continuous back and forth manner until HR stands down. Also, at the second phase (listening and verification), the process workflow connects to the reporting phase by ***adding*** (action) verified actionable information to the reporting phase. The process is also continuous unless the response operation is called off.

HR has four different forms of reports. As these reports would be explained in the following paragraphs, they include daily reports, situation reports, special reports, and resource list:

The daily report, also known as daily summary, refers to a lightweight report that helps volunteers and staff know where they can focus to respond instead of taking one to two hours

reviewing Skype chat in order to catch up with the past activities. It is used across all response operations (stage 1 to 3). The responsibility of producing daily summary is officially designated to be handled by ***Incident Reporting Lead*** (division of labour). However, field experience has shown that any volunteer manning the disaster desk can produce the report in the absence of the Incident Reporting Lead. In other circumstances, the report is produced by either SMIC or VP operations who is a paid HR staff. As soon as the report is written, it will be shared in the ***Urgent Event window*** (tool), Event specific window as well as recorded into the ***Event Status Sheet*** (tool) for volunteers joining late to read it. The report mostly has an overview of the response, what the volunteers are currently working on, the goal for the next 24 hours as well as the names of volunteers responding to the event. The following is an excerpt of the daily summary from HR Urgent Event window while updating members about the SitRep they produced:

> [21/02/2016, 03:44:47] HR Aline Car: I posted the sitrep on FB and also sent to some partners. I need to take a break and cook something for dinner. I'll be back later tonight. Thanks everyone for helping. Sitrep #2 was published on the HumRoad website: http://humanityroad.org/tcwinston/ and was also emailed to ReliefWeb, AmeriCares, and Cisco TacOps. ☺

Excerpt 5.6 Skype chat logs extract Daily summary (report) posted in the Urgent Event Window

Excerpt 5.6 shows the SitRep that was ***published*** (outcome) on HR websites and posted on Facebook as well as sent to partners such as ReliefWeb, AmeriCares, and Cisco TacOps. The Incident Commander also uses the opportunity to thank volunteers with a smiling emoji ☺.

Situation report (Sitrep) is the standard formatted report that contains a situation overview, emergency information, maps, shelters, relief/recovery, hospitals, transportation (airports, trains, roads, bridges), communications, utilities (water, electricity, gas), and schools' situational information. It further includes the report of support relief agencies, pictures, videos, social media accounts, traditional media and blogs covering the event, and information about the animals in disasters. Producing SitRep involves the collaborative effort of volunteers and HR paid staff. It also involves division of labour and alignment of expertise from among the ranks of volunteers. In other words, the activity involves the mediation of several incidents leads such as incident reporting lead, case management coordinator, disability, accessibility and functional need lead, animals in disaster lead, data miners, and technical specialists. These roles are spread across ***volunteers*** (subject) and paid ***staff*** (subject). Sitrep usually comes to life as soon as volunteers at the listing stage begin to find the addresses, contacts, social media handles of the emergency organisations and start adding it to the Google Docs. After completing the ***report*** (outcome), HR usually converts the report into a portable

document file and publish it on its websites. Furthermore, the Incident Reporting Lead will also ***upload*** (action) the report to HR ReliefWeb[36] dedicated ***web space*** (tool) and email it to ***All Partners Access Network***[37] (community) for the consumption of aid organisations working to support the affected communities. ReliefWeb is a United Nations website giving information to humanitarian relief organisations. It also shares the report to the public through social media. Depending on the impact of the disaster, HR volunteers can author several SitReps in one disaster.

Special Report is a customised report produced for the consumption of stakeholders. For example, a regional emergency management agency might approach HR for help. The agency might request for HR to create a situation report on flooding affecting the region. As such, HR could provide a report that includes general situation updates, needs and requests for help, damage updates, questions, community organising, photos and videos of flooded areas, and a list of social media sources. In essence, Special Report is an on-demand report usually requested by organisations to help them make sense of the situation for decision making.

Resource List is another type of report that has the list of aid agencies and what they are doing to support a location. It is popularly known as a 3W report in the humanitarian parlance. 3W refers to 'who is doing what and where?': This type of report is usually requested by UNOCHA and other emergency management organisations with the view to synergise and coordinate the activities of the different aid agencies working to support the location.

Monitoring the activities of HR have revealed that, in mediating the cooperative work of authoring the SitRep, volunteers make use of four primary tools/platforms. First, volunteers make use of Skype as a central platform where all the chatter for mediation, verification, and sense-making takes place. Second, the use of 'Event Status Google Sheet' as a reference point where all the instructions, guides and tip sheets, are carefully assembled. Third, the use of Google Docs in which volunteers cooperatively work to co-author the SitRep. Fourth, the use of Scanigo for filtering, categorising and ranking torrents of tweets to reduce the time taken for data mining crisis information. Therefore, it is through the integration of the tools mentioned above and platforms, and series of discussions volunteers produce such type of reports. The tools and platforms mentioned above are central to the work of HR while coordinating the collaborative authoring of SitRep. However, at the individual level, volunteers utilise a range of tools while crowdsourcing information. Such tools include social media platforms and aggregation dashboards, translations tools, reverse image processing tools and platforms, mapping tools and customised HR's Firefox add-on among others.

[36] https://reliefweb.int/
[37] https://www.apan.org/

In summary, HR's digital disaster response workflow starts with a set of activities evolving into five distinct phases. The categorisation of the activities into stages grew out of the textual analysis of the data based on activity theory methods. The response workflow starts with monitoring and activation and connects to the listing activity in a constant iteration when the activation level is in yellow or red. Following that the workflow will continue from listing to listening and verification phase in a back and forth manner. At the listening and verification phase, the workflow connects to both amplification phase as well as reporting phase. The iteration will continue until when the Disaster Desk tells volunteers to stand down. The next subsection discusses the data quality assurance measures of the HR volunteers.

5.4 Data Integrity

In addressing the first part of the first research question, I offered insight into the response workflow of the HR volunteers in section 5.3. As such, this section will take a step further to answer the second part of the first research question.

In the context of HR, ***verification*** (activity) refers to any activity that involves volunteers collaborating to verify the authenticity of information shared over the internet and social media platforms. The primary role of HR in the digital disaster arena is to provide information as a form of aid so that it can help people survive, sustain and reunite. Against this, HR takes time to corroborate information to ensure that it does not share information that can put aid workers to harm or mislead response operations.

The verification activity involves volunteers engaging in ***validating*** (action) ***information sources*** (operation), ***photos*** (operation), ***videos*** (operation), ***links*** (operation) and ***locations*** (operation) shared during humanitarian emergencies. To do so, volunteers, track information to the primary source, discuss with people sharing such information, send SMS or in some circumstances, make phone calls. In certain circumstances, some volunteers watch live videos or follow discussion thread as well as listen to Ham radio to verify or triangulate the information shared online.

Regardless of the type of the verification activity mentioned above, the exercise is moderated by ***SMIC*** (division of labour) who could be from among the volunteers or HR paid staff alongside the helping hand of team leads. Team leads are volunteers that head the Animals in Disaster team, Disability, Accessibility and Functional Needs team, Disaster Desk Working Groups or Internal Drill team. Therefore, the role of SMIC is to coordinate the verification activity, thereby distributing work to available volunteers based on volunteers' interest and confidence level. Field experience revealed some volunteers prefer validating photos while some enjoy tracking locations or dealing with links and videos.

In some circumstances, verification activity involves the onboarding of ***third-party volunteers*** (community) such as Standby Task Force, Translators Without Border or Statistics Without Border to help HR volunteers.

At the individual level, analysis of the empirical data reveals the use of search engines such as Google and Bing. Volunteers also make use of social media platforms such as Facebook, Instagram, YouTube, Twitter and aggregation dashboards like HootSuite, TweetDeck and Social Mentions. Other tools include reverse image search tools like Google Image Search, and TinEye as well as translation tools and platforms such as Google, Bing, Twitter and Skype. Volunteers also utilise Google Maps and geolocation finders. The use of search engines is to enable volunteers to triangulate news, find and compare sources. Social media platforms and aggregation dashboards allow volunteers to track information, research past sharing behaviours of the people sharing such information and look at trending issues or current happenings. Reverse image tools help volunteers to track the history of pictures to understand whether it was on the internet before or it was doctored. Translation tools help in translating information shared in languages other than English. Maps and geolocation finders allow volunteers to trace the location. Organisationally, the activity is mediated through the use of ***Skype*** as a central clearing hub, ***Google Docs*** as a collaborative authoring environment and ***Scanigo*** as a data analytic platform (tool).

The primary purpose of the verification activity is to crosscheck and confirm information. As soon as this happens, the validated information will be added to the SitRep and amplified by social media listeners/messengers. In some circumstances where there is a potentially life-threatening case, the Incident Management Coordinator (HR paid staff) will contact aid agencies to convey the information (outcome). In what follows is an explanation on how volunteers verify information to ensure its quality and credibility. The section is segmented into three parts. The first part deals with volunteers' approach to ascertaining sources while the second part explores how volunteers are verifying photos. The last part elucidates the behind the scene activities of volunteers when verifying translations provided by the web-based translation services.

5.4.1 Verifying sources

For HR to maintain its credibility and trust among emergency management organisations, formal and traditional relief agencies, it has to devise a means of producing reliable and trustworthy information product that these organisations will act upon. To keep such standards, HR has devised a typology of information source in which it trains its volunteers to always look out for before taking any decision. HR explicitly categorises these sources into official, unofficial, trusted, untrusted and unknown sources. In a one-to-one Skype chat with

HR President Chris Thompson and HR Vice President, Operations Aline Carr they explained these terms as follows:

> Official sources include the Red Cross and Government agencies, whereas unofficial sources might consist of an off-duty firefighter or police officer who is on vacation in an area not of their 'official area'. A trusted source is a government agency, a disaster or emergency management agency, UN agencies, or a trusted NGO. A trusted source could, therefore, be a personal, official or a local source or could just be a friend of yours that you know and trust. Untrusted sources, on the other hand, include tabloid newspapers, sizeable international news agencies (they publish very fast and often get facts wrong) and individuals who are listed by HR as untrusted due to previously posting rumours and fake photos. Untrusted sources could also be personal and may include someone or an organisation known to the volunteers that have not provided accurate information in the past, and therefore, not trusted now. The unknown source can be explained as anyone else, such as local news agencies and radio, local individuals impacted by the event or with relatives/friends affected.

Excerpt 5.7 Skype Chats with CT and AC

Based on the explanation in excerpt 5.7, I cross-examined and analysed the empirical data to figure out how source verification work in practice. In what follows, I offer practical insight on how HR volunteers verify information derived from official, unofficial, untrusted and unknown sources.

Verifying official and trusted sources

Verifying official and trusted information (activity) takes place in the listening and verification phase (as discussed in subsection 5.3.2.). It is an activity that involves some volunteers (selected via division of labour) ***tracking*** (action) the information resource produced at the listing phase. In other words, some assigned volunteers will be checking the websites of interests such as fire service, ambulance, Prime Minister's office among others to find information that needs to be amplified. As discussed in subsection 5.3.2, the activity of that phase is to produce the list of websites and social media accounts of organisations and agencies that their roles are critical in coordinating the response to the disaster. The essence is to update the public with information by such organisations and agencies as soon as it is released to enable disaster-affected communities to survive, sustain and reunite. Information is ***acquired*** (outcome) through official and trusted sources that are considered reliable and trustworthy by HR. As such, it will be amplified to the public and ***shared*** (action) by volunteers who sourced the information to the event specific window or added to the Google Docs directly.

It should be pointed out that while all ***volunteers*** (subject) can partake in the verification exercise, amplifying information through HR social media platforms are performed by HR

social media listeners. HR social media listeners are volunteers that undertook training in sharing social media disaster information through HR platforms.

The activity also involves ***assigning*** (division of labour) some volunteers to keep ***tracking*** (action) information from Scanigo and other social media platforms to find information shared with third parties such as news agencies. Based on HR's tradition, third party information such as those shared by news agencies during disasters is considered as not good enough. As such, volunteers will therefore, need to ***trace*** (action) the information back to the official source before amplifying and ***adding*** it to the Sitrep (tool). Throughout the observation period, I observed that on the average volunteers tend to ***abide*** (rules) by the culture of finding information from official or trusted sources to corroborate information before accepting it as good enough. The following excerpt from ***Skype*** (tool) window illustrates a typical behind the scene activities of HR volunteers while deliberating on the WannaCry attack that hits NHS England in May 2017.

[12/05/2017 17:41:35] [Researcher - Najeeb A. A. Gambo]: Heads up: http://www.bbc.co.uk/news/health-39899646
[12/05/2017 17:42:10] [Researcher - Najeeb A. A. Gambo]: NHS cyber-attack: GPs and hospitals hit by ransomware
[12/05/2017 17:42:18] HR Aline Carr: Yikes
[12/05/2017 17:42:36] HR Joe McMillan: thanks for the link, Najeeb
[12/05/2017 17:43:31] Josephine Blair: wow
[12/05/2017 17:43:32 | Edited 17:56:28] HR Joe McMillan: oops, yes, I did retweet this: Fast Company @FastCompany Hospitals across the U.K. are being hit with a massive ransomeware attack buff.ly/2ra3zGT Media preview 8:15am (PDT) · 12 May 2017 · Link: https://twitter.com/FastCompany/status/863049954461462528
[12/05/2017 17:46:25] HR Sarah McDowell: Would we consider this verified info?
[12/05/2017 17:48:02] HR Joe McMillan: Yes, it was posted on BBC News page
[12/05/2017 17:49:35] HR Aline Carr: Its been reported by a number of outlets.
[12/05/2017 17:50:39] HR Sarah McDowell: Ok guys just checking. 👆
[12/05/2017 17:50:50] HR Aline Carr: This is the report from NHS: https://twitter.com/NHS/status/863051403727691776
[12/05/2017 18:16:09] HR Joe McMillan: I apologize if my retweet from Fast Company about the ransomeware issue was not good enough (even though it cited 3 verified sources with links in it)
[12/05/2017 18:19:09] HR Aline Carr: I did not see any tweet from you in the HR account Joe.

Excerpt 5.8 Skype chat logs – Deliberation on the official source

As can be seen from the above discussion in excerpt 5.8, as soon as the link was shared, HR Aline Carr made an exclamation of shock [12/05/2017 17:42:18] followed by others such as

'*thanks…*' and '*wow*'. Next, HR Joe McMillan shared an edited version of a tweet he has amplified. However, as soon as HR Sarah McDowell noticed that all the shared links were not from the official source, she questioned the approach by asking '*Would we consider this verified info*?'. Next, HR Joe McMillan went on to say '*Yes, it was posted on BBC News page*', and another volunteer (HR Aline Carr) added, '*Its been reported by a number of outlets*'. However, on realising the standard procedure has not been followed, HR Aline Carr went back and tracked the NHS Official press release via the NHS Twitter handle. A few minutes later, HR Joe McMillan extends apology by saying '*I apologize if my retweet from Fast Company about the ransomeware issue was not good enough (even though it cited 3 verified sources with links in it)*'.

The above discussion reveals the type of cooperative activities among volunteers as moderated by an experienced volunteer [HR Sarah McDowell]. HR Sarah McDowell moderates the discussion by saying '*would we consider this verified info*?' when she noted that the information shared by the two volunteers [Researcher - Najeeb A. A. Gambo and HR Joe McMillan] earlier on has not emanated from official sources. Besides, the information was not accompanied by a cautionary information proviso of 'not verified' as usual practice of HR volunteers when sharing unofficial information.

Volunteers make use of tools and platforms such as Scanigo, search engines, translation tools and social media platforms. The activity is mediated by the SMIC who coordinates the goal of what needs to be done and where volunteers are expected to put their emphasis on. In what follows is the explanation of how volunteers verify unofficial information.

Verifying unofficial sources

As noted in section 5.4.1, HR's definition of unofficial source refers to trained personnel working in an area outside their designated official duty, for example, when a trained London Metropolitan Police officer engaged in a rescue operation during a significant event in Manchester while off duty and tweeted about the incident. Such tweet will be regarded as unofficial information in the context of HR work. Analysis of the empirical data revealed instances across a range of responses where HR volunteers deal with such situations.

To verify such information, ***volunteers*** (subject) make use of a variety of tools by tracking the source or contacting the person sharing the information. Some of these tools include ***search engines, translation tools, social media platforms, telephone***, or ***email*** (tools).

In some cases, the task of ***contacting personnel*** (action) to confirm the information is handled by the ***case management coordinator*** (division of labour).

The following excerpt from the Skype window illustrates how a conclusion was reached about a tweet from a verified Twitter account of NBC reporter amplifying an unofficial source during Oroville Dam Spillage in California USA:

> [13/02/2017 22:05:55] HR Sarah McDowell: Has anyone heard of any sandbagging going like in Maryville?
>
> [13/02/2017 22:16:32] HR Catherine Graham: Sorry Sarah I just walked back in - I think Aline may have more insight but a quick search of sandbag and dam names doesnt return anything. Any reason you are asking?
>
> [13/02/2017 22:17:25] HR Aline Carr: @Sarah - no haven't seen anything
>
> [13/02/2017 22:17:45] HR Aline Carr: Is it Maryville or Marysville?
>
> [13/02/2017 22:18:18] HR Sarah McDowell: you are right it is Marysville
>
> [13/02/2017 22:19:10] HR Aline Sarah McDowell: Here is the link
>
> https://twitter.com/RobertNBCLA/status/831255628043558912

Excerpt 5.9 Skype chat logs – Approach to verifying unofficial sources

As a way of background, the Skype chatter in excerpt 5.9 came by because of a volunteer's (HR Sarah McDowell) scepticism about a tweet from a third party with a Twitter verified badge. 'Third party' refers to any person or entity tweeting information on disasters and emergencies that are not by law designated as officials. The tweet in question features Police from a different County (Lodi) sandbagging in another County outside their area of official function. As such, the volunteer found the tweet very unusual for two possible reasons. First, the scepticism may be born out of the earlier experience of pictures shared during disasters. Volunteers that work for HR are trained to verify every photo before sharing it. The volunteers that have worked with HR for a long time also have experience about the way people are sharing irrelevant old pictures and faked photoshopped pictures. Sometimes, people share such pictures unintentionally due to some altruistic urge of helping people. Second, HR Sarah McDowell's scepticism may be due to the unusual nature of the picture and status of the person sharing it. Ordinarily, a Twitter verified account holder is expected to tweet a 'good enough' information. However, in this circumstance, the volunteer finds such information does not make sense at all. Following this, she refers the issue to the event specific window by asking '*Has anyone heard of any sandbagging going like in Maryville?*' Some few minutes later, another volunteer (HR Catherine Graham) responded that '*… but a quick search of the sandbag and dam names doesn't return anything. Any reason you are asking*?' Again, another volunteer (HR Aline Carr) asks '*Is it Maryville or Marysville*?' On checking HR Sarah McDowell responded with '*you are right it is Marysville*'. It is possible that HR Aline Carr's

question on whether it is '*Maryville or Marysville*' was because of HR Catherine Graham response in which she mentions '*but a quick search of sandbag and dam names doesn't return anything. Any reason you are asking*?'. It may also be that Aline realised what HR Sarah McDowell wrote differs from what is written in the hashtag *#Marysville*. Below (figure 5.11) is the screen grab of the tweet in contention.

Figure 5.11 Lodi Police responding outside their official jurisdiction

The chatter continues below with the first volunteer asking, '*Something is not right about that post, I think?*' After nearly 14 minutes (22:35:57 to 22:21:35), HR Catherine Graham then shared a link on the Lodi Police Facebook's page to prove that indeed the Lodi Police was in Marysville helping with sandbagging (excerpt 5.10).

> [13/02/2017 22:20:16] HR Aline Carr: Oh ok.
>
> [13/02/2017 22:21:35] HR Sarah McDowell: Something is not right about that post, I think?
>
> [13/02/2017 22:35:57] HR Catherine Graham: I tracked it back to the Lodi Police Facebook page https://www.facebook.com/lodipolice/posts/10154947661043864 Its confirmed. They are in a Northern location helping Yuba County with evacuations and apparently sandbagging.
>
> [13/02/2017 22:36:37] HR Sarah McDowell: Thanks Cat

Excerpt 5.10 Skype chat logs - Tracking information.

This extract offers a typical glimpse of how volunteers verify unofficial information shared by a third party. The process involves sense-making among volunteers, cooperative work and experience. This could be attested from the way HR Catherine Graham skilfully used two terms

- sandbag and dam names – to find information and later went on to track the official source and verifies the authenticity of the incidence.

Next, I will address HR's approach to ascertaining untrusted sources.

Verifying untrusted source

In HR context, an 'Untrusted source' is someone or an organisation known to you that has not given accurate information in the past. However, throughout the observation period, I have not come across an instance in which HR as an entity explicitly declared a source as untrusted. I have also not overheard any volunteer, describe any person, a news organisation or an entity as part of the HR basket of the blacklist. Nonetheless, I was able to understand the process in which volunteers personally feel that someone is 'untrusted' during a tropical cyclone in Fiji, flood in Louisiana USA and Fort MacMurray wildfire in Canada.

Considering a source as 'untrusted' by volunteers involves a series of activities such as ***Keeping*** an eye on the people sharing information (action), and ***corroborating*** finding (action) with other volunteers. To do so, volunteers ***use*** (tools) search engines, social media platforms for background checking and tracking the past activities of the people sharing information (i.e. as they do with any other checking). The following excerpt (5.11) is one among many examples that offers an insight into the sense-making activities when vetting the credibility of information:

> [20/02/2016, 23:23:17] HR Javon Malone: Trying to track down info on the Nadi International Airport, saw a report from a reporter that building are fine but runway may be blocked. I have tweeted him to get further details or a source
>
> [20/02/2016, 23:36:25] HR Sarah McDowell: This is the account he is posting from Liam Fox @liamfoxabc
>
> [20/02/2016, 23:56:15] HR Javon Malone: 👊
>
> [21/02/2016, 00:06:39] HR Javon Malone: The info on the airport was from a local resident so unconfirmed at the moment
>
> [21/02/2016, 00:47:09] HR Aline Carr: The reporter who said the airport was ok is now asking for info:
>
> [21/02/2016, 00:47:32] HR Aline Carr: Liam Fox Verified account @liamfoxabc · 14m14 minutes ago hey @JacqueeSpeight, @VijayNarayan4, @MonishNand any news on the status of Nadi airport? Thanks and keep up the great work. https://twitter.com/liamfoxabc/status/701172494518976512
>
> [21/02/2016, 00:48:44] HR Sarah McDowell: I think that is what he does, he collects information and then posts it. I looked at his site and he has been doing that for many hours

[21/02/2016, 00:49:46] HR Aline Carr: Yeah, I had RT'd his tweet about the airport being ok. I deleted it. Looks more like it is damaged.

[21/02/2016, 00:53:44] HR Sarah McDowell: Well I will not use any of his posts anymore!

Excerpt 5.11. Skype chat logs - 'Blacklisting' a source.

In this instance, HR Javon Malone informed other respondents about what he was working on. Some few minutes later HR Sarah McDowell posted the account of the person the first volunteer was tracking. HR Javon Malone affirmed HR Sarah McDowell message using a fisted hand (👊) emoticon. Next, the 'listening' went on for about five minutes, and HR Javon Malone reported to the window that, based on his observation, the information was still not verified. After nearly forty-one minutes, a third volunteer HR Aline Carr showed that the person who posted the information was asking for further details which suggests he was not on the ground. At this juncture, HR Sarah McDowell retorted with '*I think that is what he does, he collects information and then posts it. I looked at his site, and he has been doing that for many hours*'. HR Aline Carr then says she retweeted his tweet, but on realising she was only crowdsourcing information from other people, she removed the tweet. HR Sarah McDowell at that point concluded with an exclamation mark that she will ***never use*** any of his posts at all (outcome).

This episode suggests an element of cooperative work in which volunteers undergo before 'blacklisting' a source as untrusted. The cooperative work was made possible with the first volunteer announcing to the window at the activity he was engaged with. It is also worth noting to state that even though the person tweeting the message is a reporter with a Twitter blue verified badge, it had taken more than one hour for volunteers to decide on amplifying his message or adding it to their SitRep. Additionally, the incident also reveals the Twitter handle has been 'put on watch' based on the discussion involving the three volunteers.

Verifying unknown sources

An 'unknown source' can be explained as information shared by anyone else, such as local news agencies and radio, local individuals affected by the event or with relatives/friends affected. Throughout the observation period as well as the analysis phase, the bulk of information acquired by volunteers mostly came from unknown sources. Such information can appear in various forms, ranging from urgent needs, situational information, goodwill messages and rumours, among others.

Verifying unknown sources tended to be the most time-consuming task among the work of volunteers since there was no prior contact between the HR and these sources. As such, the response is guided by the HR's ***in-house verification procedures*** (rules and regulations).

The procedure includes '***verify times two'*** (operation), ***location factor*** (operation) as well as ***content elements*** (operation), as explained by HR President (excerpt 5.12), during an interview:

> 'Verify times two' is a concept that we say if you only have one source and it is unknown find another source so that we have two sources that are unrelated. Make sure they don't tie back to the same source and if you have two separate sources saying similar things then the reliability increases (Interview with P7#03T7-5).

Excerpt 5.12 Interview with P7#03T7-5

Furthermore, P6#03T6-8 offered more clarification on the concept of 'verify times two' as follows in excerpt 5.13:

> If somebody says the boat is on fire in the harbour and I know what harbour they are talking about, and I find ten other people saying the boat is on fire in the harbour *uhm* and if those sources are all independent, there is good chance that there is a boat on fire in the harbour. But if you look at that statement and you found out that all ten-people got that information from the same sources, it just happens to be tweeted ten times by these ten different people, but they are all looking at the same sources then you really didn't verify that piece of information. So, when Chris and I talk about verify times two, we are looking two different sources to corroborate the story, and if that one chain follows you back to the same sources, then you haven't found that second corroborative piece of information. So, that is one way - ensuring that you verify times two (Interview with P6#03T6-8).

Excerpt 5.13 Interview with P6#03T6-8

Sometimes corroborating the source of information may not give the needed details for figuring out the credibility of the information. Therefore, the next step is to find out the location of the person sharing the information. For HR, location is a strong factor in deciding the credibility of any source. P6#03T6-9 explained the concept of location during the interview as follows in excerpt 5.14:

> If somebody says the boat is on fire in Sacramento bay, and that person is in Moscow, thus my trust factors go down immensely. But and if I see that person is in Sacramento bay and the account is coming from that location, and I can see that they have a history of living in Sacramento bay I go back to look at their timeline and If I can see they are living at that area my trust factor goes up. So, I am looking for not only the source of info times two but also the location of the reporter to make sure that this information is coming from at least the local level. Now if that on the third - if that person is not local and *uhm* and they are providing that information, or there may be another reason for that and in certain areas that I have higher trust factors than others. If they are news reporters my trust factors don't automatically go up. If it is relative, they are talking about and you know they are saying, my son, Joe is in Sacramento, and he says his boat is on fire, to me that is starting to sound a little bit true. I

> might look at that person's timeline for Facebook entry and go visit that person on Facebook and see if they have a brother Joe or son Joe and verify some of the other information they have in their profile (Interview with P6#03T6-9).

Excerpt 5.14 Interview with P6#03T6-9

Beside the use of verify times two and location, the other dimension for verifying unknown source is by looking at the content element of the information. For example, through verifying the link, the picture, the video or the messaging itself against the date, day, time and location of the event. P7#03T7-9 explained this concept during an interview as reproduced below in excerpt 5.15:

> Based on the likelihood of an event when something happened, we know of course the 3 things: the day, date, time and where it happened. So, if someone is sharing information about the earthquake and the photo and it is a daytime photo, and we know that it is still night time at the location, then that is a flag to us, that says that may not be an accurate source. Just understanding what that location is like at the moment that happens help us to identify viability of information. We also used tools that help us confirm whether those sources are original or not. Example, like TinEye, help us identify on whether that photo appears in other location (Interview with P7#03T7-9).

Excerpt 5.15 Interview with P7#03T7-9

Verification of the unknown sources process workflow can be visualised as a flowchart (Figure 5.12).

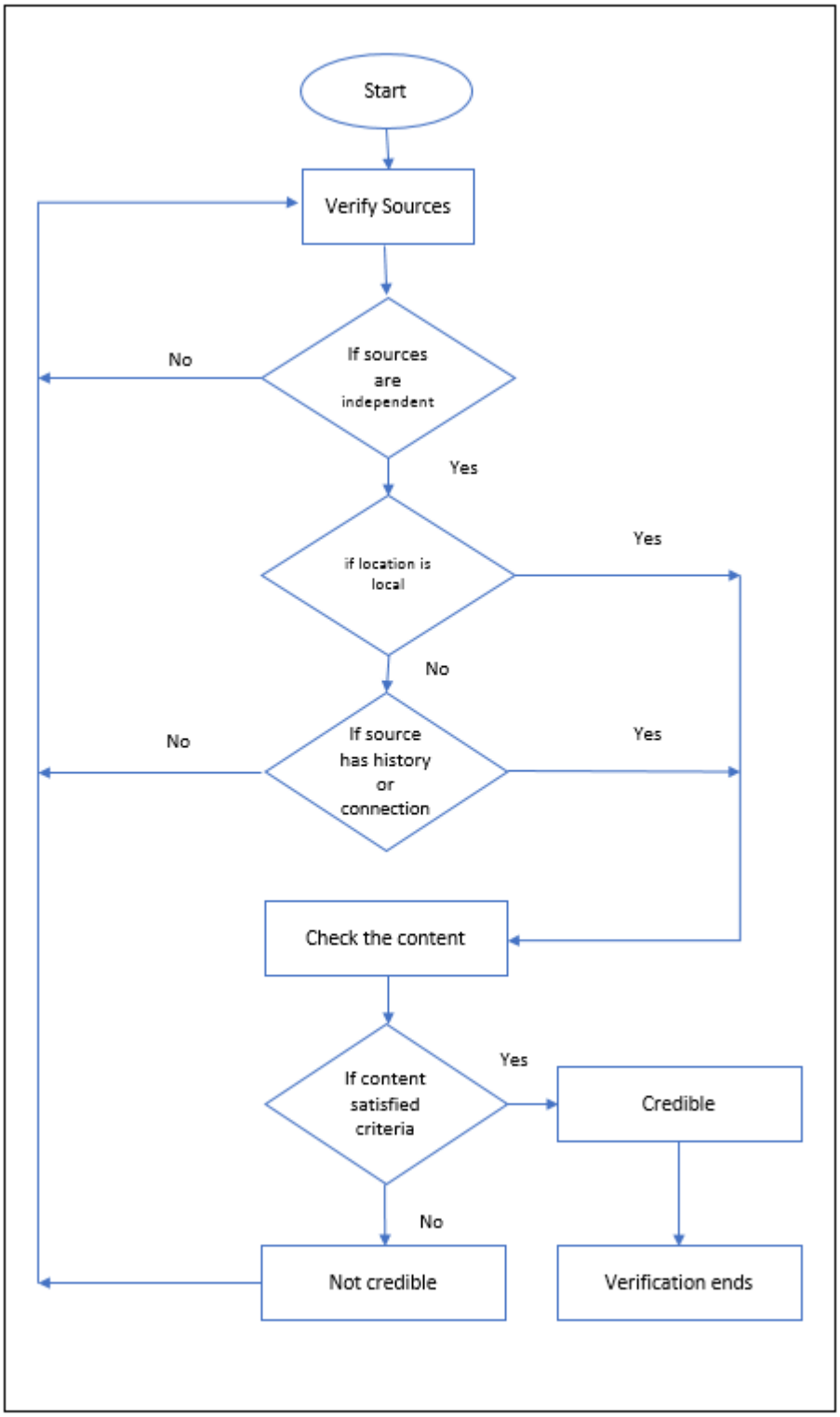


Figure 5.12 Process workflow of verifying unknown source.

In brief, the process workflow starts with ***finding*** (task) the source of information. If the information shared online tie to the same source, then volunteers will invoke the ***verify times two*** (operation) by looking for another source. If the sources are found to be independent, then the verification will move to finding the ***location*** (operation) of the people

sharing the content. If the location of the people sharing the content is local, the next step is for the volunteers to verify the ***content*** (operation). However, if the location is elsewhere, volunteers will, therefore, ***check*** (operation) to see whether the person(s) sharing the information has a history of residing around the place or connection with regards to the family members or friends. If there is any linkage or existence of history, then volunteers will still go ahead and ***verify*** (operation) the content. Otherwise, the concept of verify times to will be enforced. In essence, volunteers will be required to ***look*** (task) for another source to corroborate the information. At the 'check the content stage', volunteers will be looking at the photos, links, videos or content information and crosscheck the information against the day, date, time and location of the event.

The above explanation typifies the ideal HR procedure for verifying contents shared by the unknown sources. However, it is worth noting to state that this has not always been the case with every volunteer. The ability to internalise the procedure comes with time and experience as we have seen in the case of WannaCry (excerpt 5.8) in which one of the volunteers [HR Joe McMillan] shared the news through HR's social media platforms. By doing so, HR Joe McMillan has unintentionally circumvented the procedure by sharing the content without getting the news from the designated trusted source. Although Joe argued that the content 'cited 3 verified sources with links in it', in HR protocol, it is still not regarded as good enough. The reason for this was that Joe had not traced the information back to the NHS England who is in this case supposed to be the official mouthpiece of the government.

On the other hand, one may wish to interrogate further on whether there are exceptions in the process workflow for verifying the 'unknown source' and what those exceptions might be? Moreover, if there are exceptions, would the order change? Alternatively, what about in the case of urgency and severity? To answer these questions, it is important to say that HR takes the issue of data quality and credibility at the core of its operation. As such, it will wait rather than offer information that may not be good enough for its standard. During an interview with HR President, Chris Thompson, she alluded that *'some folks have called us the Snopes of disaster response and others have called us OnStar for social media'*. Snopes is one of the widely popular fact-checking website that has been described by the Wikipedia as a 'well-regarded source for sorting out myths and rumours'[38] on the internet. OnStar is a company that is an ancillary of General Motors that offers subscription-based communications, in-vehicle security and other emergency services. It described itself as a firm that 'lets you drive with confidence, knowing someone can be there to help no matter what happens out on the road'[39]. With that thinking of being 'the Snopes of disaster response' and 'OnStar for social

[38] https://en.wikipedia.org/wiki/Snopes.com
[39] https://www.onstar.com/us/en/home/

media', it will be difficult for HR as an organisation to circumvent the procedure that it set for itself and has been training its volunteers and 'preaching' to the global online public. HR has some templates for messages in which it uses for disaster preparedness and education. In one of those messages, HR ''preaches 9 Twitter commandments for responsible sharing. The first commandment carries a message of – '**Do No Harm – It is safer to share no news than to share the inaccurate news. Rumours put lives at risk'** (Starbird and Palen, 2013, p. 493). However, as shown in the WannaCry case (Excerpt 5.8) and that of Nardi Airport (Excerpt 5.11), one cannot rule out the possibility of circumventing the laid down procedures by an individual volunteer. Such volunteers could be those that are likely to be newly initiated or volunteers who have been overtaken by emotion or affected psychologically.

Verifying unknown sources involves the use of range of tools. Such tools include reverse image search tools (TinEye, Google Image Search), translations tools (Google translate, Bing translator, Skype translator), search engines (Google, Bing) and social media platforms (Facebook, Instagram, Twitter). Others are Maps (Google), Phone (mobiles and landlines), emails, SMS or by requesting additional details through the social media handle of the person who shared the information (tools). Additionally, SMICs will from time to time ***remind*** (action) volunteers to refer to disaster checklist guides or tip sheets through the link provided on the top left corner of the ***Urgent Event window*** (tool). The tip sheet provides useful direction on how to go about solving or unravelling issues professionally using tools and other fact-checking platforms. HR have separate tip sheets for photo verification, geolocation, monitoring earthquake, drought, extreme heat, public safety events, tornadoes, volcanoes and wildfire among others.

The following excerpt (5.16) from the Urgent Event Window shows how HR teams tried to verify information from an 'unknown source':

> [13/02/2017 22:53:56] HR Sarah McDowell: This is not verified - Don Krysakowski @donkrys68 25m25 minutes ago WTC operated FNRC emergency trailer delivered to local Oroville dam evacuation centre to support persons with disabilities https://twitter.com/donkrys68/status/831268720446099456
> [13/02/2017 22:59:42] HR Aline Carr: Wish I knew what the acronyms are in that last tweet
> [13/02/2017 23:00:11] HR Aline Carr: Oh WTC is Work Training Center
> [13/02/2017 23:00:39] HR Sarah McDowell: Work Training Center not founf the other yet
> [13/02/2017 23:03:31] HR Catherine Graham: Sarah - I found nothing to confirm the tweet about the emergency trailer - havent checked facebook yet
> [13/02/2017 23:04:30] HR Catherine Graham: I tweeted him to ask for a confirmation link
> [13/02/2017 23:08:59] HR Sarah McDowell: The man who sent the tweet is the Executive Director of Work Training Center. in Chico so hopefully, he can verfiy

Excerpt 5.16 Skype logs extracts. Verifying an unknown source 2

From the chatter in excerpt 5.16, HR Sarah McDowell posted a message that began with '*This is not verified*' and quoted content of the tweeter message about the emergency trailer along with the source link. Then HR Aline Carr retorted with '*Wish I knew what the acronyms are in that last tweet*' and later on quickly figure out what the abbreviation means. A minute later, HR Catherine Graham says she found nothing to confirm the tweet about the trailer and then informed the volunteers that she tweeted him to ask for a link. It is evident from the Skype chatter to conclude the absence of prior contact with the person who tweeted the message since the WTC acronyms confused one of the volunteers at the initial stage. Secondly, his inability to provide a link or attach a picture as could be seen in Figure 5.13. raised further questions of trusting his source.

Figure 5.13 Verifying unknown source

In the above screenshot, HR volunteer Cat Graham replied his tweet by asking him on whether he could provide a link to confirm his story. The respondent [Don Krysakowski] says there was no link, only that he was a witness when the trailer was delivered and set up. On receiving the feedback, HR volunteers resolved not to amplify the information unless they have additional credible information from other sources.

5.4.2 Verifying Photos

One of the most prominent activities among the volunteers while responding to disasters is the work of ***verifying photos*** (activity). People share pictures during disasters for possible reasons related to sympathy or request for donations among others. Several times such images

are shared with the view to exaggerate the situation. To avoid sharing such unsubstantiated images, HR created ***procedures*** (rules) alongside a ***tip sheet*** (tool) for verifying pictures. It also trains its members through internal drill exercises on how to check images.

Besides the training and tip sheet, I observed how volunteers verify such information especially during Fiji tropical cyclone Winston, Ecuador earthquake, Fort MacMurray wildfire and flood in Peru. HR's approach to ascertaining images involves four stages. First, they use the ***reverse image search*** (task) technique using ***Google image search platform*** (tool) or ***TinEye*** (tool) website to find similar pictures shared on the web. The method involves uploading the image to Google Image search engine or TinEye website to see whether there are existing similar images on the internet. If there are similar images, volunteers will search to know the date it was first uploaded and compare it with the image in contention. In the event the search did not give useful information, volunteers will then move to the second step to ***research the online digital traces*** (task) of the person who shared the picture from social media platforms and search engines. The rationale is to make sense from the digital traces the person who shares the content is associated with. If this stage did not offer any clue or yield any positive outcome, volunteers will then ***use BBC 5Ws[40] questioning approach*** (task) in the third phase of their investigation. Such questions include who they are? Where are they? When did they get there? What can they see (and what does their photo show)? And why are they there? Finally, volunteers will ***use Google map*** (task) to compare images focusing on signs, landmarks, terrain and clothing styles. Otherwise, volunteers will invoke the 'verify X 2' rule of thumb. A typical example of how HR team are verifying pictures is shown below in excerpt 5.17:

> [20/03/2017, 15:57:00] HR Sarah McDowell: 🔔 This is a FAKE picture it has been used at least 34 times and as early as 9/24/2014 checked with Tineye. https://www.tineye.com/search/4a62d8e9e0144d5b147020ce973b6b30d3b8a983?page=4&sort=score&order=desc laura @laumg292 Esta foto me rompe el corazón. Ellos también necesitan nuestra ayuda, no los dejemos solos 😭 #PrayForPeru #FuerzaPeru #PerúNosHacemosCargo https://twitter.com/laumg292/status/843318515268435968

Excerpt 5.17 Skype chatter extract. Use of TinEye platform for reverse image search.

The above excerpt represents a typical message from an experienced HR volunteer. As mentioned in Chapter 4, HR has an in-house communication protocol in which it is training its volunteers to inculcate while working on the disaster desk. For example, HR protocols emphasise on the use of emojis and cautionary words to convey important information. In the

[40] http://web.archive.org/web/20160415185838/http://www.verificationhandbook.com/book/chapter4.php

excerpt above, ***HR Sarah McDowell*** (subject) begins her message with a bell (🔔) emoji in an attempt to draw volunteers' attention. In addition to the use of the bell emoticon, Sarah uses a very punchy and attention-grabbing message - 'This is FAKE picture it has been used at least 34 times and as early as 9/24/2014 checked with Tineye" - to further reinforce her message about the appearance of a fake picture. Likewise, on stumbling upon the fake picture, Sarah went on to use a reverse image processing website (TinEye) to ascertain the authenticity of the information. Figure 5.14 is the screen grab of the message HR Sarah McDowell was referring:

Figure 5.14 Fake photo

In the above picture, it is evident that it was retweeted 179 times and received 224 sympathetic likes by the unsuspecting and sympathetic public as at March 16, 2017.

From time to time, SMIC will remind volunteers to consult tipsheets for verifying photos when in doubt. It is worthy to note that, the work of HR does not only stop at ascertaining pictures, but they also ***engage in civic education*** (task) about responsible sharing. For example, HR tweet the following message (figure 5.15) on responsible sharing by encouraging the global online public to share only verified facts from official sources during Manchester 22nd May 2017 public safety event.

Figure 5.15 Verify campaign

The essence of the verify campaign is to appeal to the conscience of the people sharing images to always check before putting it on social media platforms. This is because although sharing content can help in bringing to the limelight the urgent needs, but when shared incorrectly can also help in diverting relief aid to the wrong place. The consequences which can cost lives.

In summary, verifying photos is one of the core tasks of volunteers, and it involves the use of reverse image search techniques, researching the credibility of content sharers, invoking BBC 5Ws and the use of Google image search to corroborate location and landmarks. It is mediated by rules of 'verify times two' and coordinated by the SMIC. Next, is an explanation on how HR deals with verifying translations.

5.4.3 Verifying translation

In disaster response, it is common for volunteers to respond to disasters taking place in non-English speaking countries. During such events, volunteers mostly depend on translation offered by ***web-based platforms*** and ***software*** (tools) that are powered by machine learning and natural language processing such as Bing, Google translates and Skype. However, since translation provided by such technological platforms is far from being exact, HR will therefore need a human to review the translation. In the context of this research, verifying translation refers to the use of manual (human/native) translators to cross-check machine-generated translation of disaster information before it is shared to the global online public.

Although HR team is diverse, most of its volunteers came from English speaking countries or use English as their second language. As such, coordinating disaster response outside their comfort zone present challenge to the HR's operation. Participating in disaster response across Japan, Ecuador, Fiji and Peru as well as during an internal drill exercise called Summer Scavenger Hunt revealed the kind of problems associated with machine-generated translation. The following excerpt from Skype chatter shows a ***SMIC's*** (subject) reaction to Kumamoto earthquakes in Japan (excerpt 5.18).

> [15/04/2016, 18:43:41] HR Javon Malone: Its big, and shallow. Not good. This is Japan so its going to be hard to work but I am sure this is going to be a major event

Excerpt 5.18 Skype chat logs - Expressing likely challenges of responding to Japan earthquake.

In the above excerpt, the SMIC message indicates the possibility of facing challenges while responding to the disaster in Japan. From the message, it is possible to adduce two likely challenges. For example, '*Its big, and shallow, Not good*' as well as '*I am sure this is going to be a major event*' might be perceived as an event that could take days volunteers will be responding before they will be asked to stand down. Also, by asserting that '*This is Japan so its going to be hard work*', the volunteers will read that statement as a kind of response that will involve finding information in a language that most of the volunteers are not familiar with or understand. As such, it will involve the dual effort of using machine-generated translation tools which will mean spending more time while trying to make sense of what is going over there. To confirm the perceived language difficulty, the same SMIC posted "*Spanish is just as hard as Japanese …*" when earthquake hits Ecuador two days after the Kumamoto incidence as could be seen in the following excerpt (5.19):

> [17/04/2016, 02:59:47] HR Javon Malone: Spanish is just as hard as Japanese….

Excerpt 5.19 Skype logs extract. Expressing likely challenges of responding to Ecuador earthquake.

The excerpt (5.19) has further reinforced the interpretation of the perceived difficulty that will arise as a result of the language barrier. Both Japan and Ecuador nationals share content online based on their local language – Japanese and Spanish - rather than English which is a language in which all volunteers are familiar and confident in using.

To avoid sending inaccurate or misleading information, HR mostly ***collaborates with Translators without Borders*** (Community) to review translation before making it available to the aid agencies as well as the public. Translators Without Border (TWB) is part of the expert network communities of digital volunteers that specialised in offering translation services. In some circumstances, HR will ***find*** and ***onboard any active/native spontaneous volunteer*** (community) that has been sharing information related to the disaster at stake. However, as part of HR ***policy*** (rules), translators must undergo orientation training before they can have access to the Event specific window. The following excerpt from the morning update offers a glimpse of such orientation training in which translators must attend (excerpt 5.20):

> [17/04/2016, 17:05:56] HR Aline Carr: ⋆ Disaster Desk Morning Update Cat and Chris trained about 5 or 6 Japanese translators this morning. They will be working to verify and add information to the Japan SitRep.

Excerpt 5.20 Skype chat logs - On-boarding of translators.

In the above instance, the Report Incident Lead for Japan Earthquake response (HR Aline Carr) reports to the Urgent Event window that Catherine Graham and Chris Thompson have trained translators. The translators' responsibility is to ***verify*** (task) information gathered by volunteers. The use of translators offers an added filter for writing credible SitRep rather than depending on translation tools that are still far from being accurate in sensitive circumstances. The following excerpt (5.21) from the Peru response illustrates the advantage of onboarding translators:

> [20:23:54] Dixie Schwartz: Hi everyone! I´m glad to meeting you all and to join Humanity Road
>
> [20:25:09] HR Willie Quigley: Hi Dixie, it is so good to see you here, I was hoping you would join us 👋.
>
> [20:26:43] Dixie Schwartz: Thank you! Hey, so i've been reading the situation report and i found some little mistakes
>
> [20:35:43] HR Chris Thompson: Dixie you can paste the correct translation here and we will replace it in the form
>
> [20:41:36] Dixie Schwartz: De MapAction: El mapa muestra los departamentos de Piura, Lambayeque y La Libertad con el total de personas afectadas al nivel del distrito, y las instalaciones colapsadas o inhabitables por departamento, según la INDECI el 21 de marzo del 2017. fuente
>
> From MapAction - map shows the departments of Piura, Lambayeque and La Libertad with the total number of people affected at the district level, and the facilities collapsed or uninhabitable by department, according to INDECI on 21 March 2017. source
>
> [20:42:07] Dixie Schwartz: This is the correct translation from that paragraph of the report
>
> [20:43:24] HR Chris Thompson: 👍 done - updated thanks Dixie

Excerpt 5.21 Skype chat logs - Illustration of how translators work.

The above excerpt illustrates an example of how HR onboarded a translator to help with cross-checking and correcting translation errors. As earlier mentioned, the translator received training before giving access to Event specific window. Next, the translator's role was ***delimited*** (rules) to only event specific window as pointed out by HR Catherine Graham – '*Dixie you can paste the correct translation here, and we will replace it in the form*'. The excerpt also reveals the flaws in the machine-generated translation as Dixie Schwartz mentioned '*Hey, so i've been reading the situation report and i found some little mistakes*'. Lastly, the excerpt shows the translator understood the instruction and thereby restricted her work to cross-checking and correcting as well as posting the update to Urgent Event Window (outcome).

All in all, verifying translation is an approach to crosschecking machine-generated translation of disaster information by human translators. The process involves onboarding translators from partner organisation such as TWB or any active/native spontaneous volunteer. During the process, translators undergo training before they can access the event specific window and their central role is to review the translation, correct the translation and post it to the event specific window. The process is coordinated by SMIC.

5.5 Summary

This chapter attempted to answer the first research question on the information processing activities and data quality assurance measures of HR volunteers. To do so, the chapter is segmented into three parts. The first section draws from Kumamoto (Japan) earthquake to show how I applied activity theory methods to analyse response operation efforts of HR volunteers. Next, I offer insight into the process workflow of how HR volunteers crowdsourced, organised, verified, amplified, reported and curated crisis information. In the last segment, I discussed the data quality assurance measures of HR in which I further categorised it into three subsections. The first segment expounded on how HR volunteers verify sources such as official/trusted, unofficial, untrusted, and an unknown source. Next, I explained the procedures involved in ascertaining photos where I elaborated on the use of reverse image search, background check, BBC 5Ws as well the use of the Google map. Lastly, I showed how HR makes use of partners and active/native spontaneous volunteers to crosscheck and correct machine-generated translation. The next Chapter will focus on answering the second research question.

Chapter 6: Technological Platforms and Practices of Use

6.1 Background

The focus of this chapter is to offer insights into how technological tools and platforms are enacted by HR volunteers to undertake response activities discussed in the previous chapter (5). Using some theoretical elements of AT methods, the chapter explores the affordances, constraints, suitability, problems and workarounds in appropriating these tools and platforms while responding to emergencies across all phases of activities (monitoring and activation, listing, listening and verification, amplification as well as reporting). The use of AT methods allows for understanding the context in which various collaborative technologies are entangled for volunteers to enact coordinated response. To do that, the chapter is segmented into two sections. The first part focuses on providing insights into these affordances, constraints, suitability, problems and workarounds in appropriating tools and platforms. The section further highlights the implications of appropriating some of these tools and platforms and what that means to the overall disaster response. The second part takes a comprehensive approach to provide more profound insights into the broad-ranging nature of the tools and platforms used by HR volunteers. Lastly, the chapter concludes with a summary and a signpost to Chapter 7.

6.2 Practices of use

This section offers insight into the workplace realities on the use of collaborative technologies among HR volunteers while responding to disasters. Specifically, the section covers practices of use to highlights how volunteers manipulate, circumvent, abandon or workaround challenges while using such mediating tools and platforms at individual and group level. The focus will mainly be on the volunteers' interaction with Google Docs, GroupTweet, Twitter, Skype and translation search engines. Three considerations derived the rationale for choosing these tools in highlighting the implication of their deployments. First, HR leadership internalised the use of these tools and platforms as part of the adopted software product of the organisation. HR staff therefore make use of the tools for discharging official duties including the coordination of disaster response. Second, the organisation dedicates much effort in conceiving, developing, and improving training manuals, programmes and drill exercises for teaching volunteers how to use the tools and platforms during disaster response. Although the emphasis is on these tools and platforms, their internalisation by HR does not prevent volunteers to choose and use other tools or platforms of their choice at an individual and personal capacities while contributing to the overall success of the response coordination. Last, based on the analysis of the empirical data most of the discussions about the capability and constraints of such tools and platforms revolved around such tools (Google Docs, GroupTweet, Twitter, Skype and translation search engines). The rationale of providing these

insights into the volunteers' practices of use is to show how these affordances and constraints affect the overall response activities discussed in chapter 5 across all phases of the process workflow.

6.2.1 Working with Google Docs

Google Docs (***tool***) is a web-based word processing platform that offers users the capability to collaborate and co-author documents in both synchronous and asynchronous way. HR adopted Google Docs as part of its core platform for coordinating its operational activities. Its choice as a mediating platform for disaster response evolved because of its functional advantage of enabling up to 50 users to collaborate and work on a project. Also, Google Docs allows users to track changes in real time and offers the flexibility of reverting to earlier versions when the need arises. Historically, HR makes use of Skype and WordPress blog to coordinate the production of reports such as sitrep, Special reports and the 3W (who, where, what) report as shown in excerpt 6.1. HR President Chris Thompson states that:

> Prior to the use of Google Docs, we would be collecting information in the Skype window itself, and one person will be directly adding in our blog because in the blog you cannot have more than one blog editor editing at the same time. Moreover, we have new people joining the window to help us, and then we have to orient that person to enter the window. We have to stop and all of a sudden, the volunteers were dropping more and more information, so it became a real data, so we had challenges keeping up with the docs again. In the middle of that response, I inserted a message I said insert new process here. Because we knew it was not effective to do the way we were doing it and Cat look at the overall process and found the google docs. Therefore, within an hour she dropped the google docs link in the window, and she says instead of putting your update in the window, please update it in the Google docs - instant improvement in our process. Now, we had our conversation on Skype windows, and all the information goes to the google docs. So, it allows us to work more effectively and all of a sudden it got whole easier to manage. (P7#04T7-8)

Excerpt 6.1 Interview with CT

Going by the above explanation, Google Docs gives a better alternative compared to the old way of using Skype and WordPress blog while authoring a SitRep during disaster response operation. Consequently, HR ***institutionalised*** its use (rules) whenever it is co-authoring a report on any activity that needs the collaborative effort of volunteers. It also makes use of Google Docs during internal drill exercises, training, archiving of official documents, meeting notes, policy documents, white papers and end of the year reports among other things.

HR as an organisation is responsible for the creation, management and administration of organisational resources. Therefore, creating and managing resources such as Google Docs for

producing reports (outcome) such as ***SitReps, 3W reports, after action reports*** and ***resource list*** (tools) is handled by the Vice President Operations. As a result, access to such document is ***granted*** (rules) by the Vice President Operations. Therefore, producing documents such as SitRep involves the collaborative efforts of ***volunteers*** (subjects) holding different ***roles*** (division of labour) within HR. A typical Sitrep production needs the inputs of SMIC, case management coordinator, incident reporting lead, social media data miners and listeners (subject). SMIC ***coordinates*** and ***manages*** (division of labour) the entire collaborative activities by guiding volunteers on what the goal of the response is and what everyone needs to do to carry out the task. For example, it is the responsibility of the SMIC to announce the operational plan and guide the volunteers on what to do. The SMIC will, therefore, give the list of tasks such as ***finding*** (action) information on isolated communities, airports, roads, bridges, reunification shelters or hospitals and encourage volunteers to pick one task at a time and announce to the window the area they will cover. However, since HR is using Incident Command System model for coordinating response as discussed in section 4.3, roles and job descriptions are delineated. For example, it is the responsibility of the Case Management Coordinator to ***manage*** (division of labour) the ***documentation, tracking*** and **resolution of urgent needs** (action) in the ***event workbook*** (tool). Incident Reporting Lead **liaises** (division of labour) with emergency management organisation, aid agencies, disaster-affected communities and partners such as ***translators without borders*** (community) while social media data miners and listeners ***data-mine*** internet and social platforms for finding disaster-related information and urgent needs (actions).

Alongside the division of labour, the collaborative work of co-authoring reports goes hands in hands with HR's ***standard operating procedures*** (rules). For instance, it is a common practice for SMIC to remind volunteers working on SitRep always to provide source and add the source links to the reports. Likewise, SMIC takes time to remind volunteers to drop information to the Urgent Event or Event specific window when in doubt (rules).

The above discussion mainly centred on the affordances offered by Google Docs to HR and its volunteers in a broader context. However, Google Docs is ***mostly used*** (action) at the 'listing', 'listening and verification' as well as at the 'reporting' phase during response operations. At the ***listing phase*** (activity) of the response workflow, volunteers make use of Google Docs by collaborating to ***produce a list*** (outcome) of relevant agencies, organisations and critical stakeholders as an information resource for tracking the activities of such organisations (see chapter 5 subsection 5.3.2). Likewise, at the '***listening and verification phase***' (activity), volunteers transfer verified contents from Urgent Event window/Event-specific window to the Google Docs (SitReps/Resource List) when the event is designated as a

Yellow or a Green event. Also, Google Docs is used at the '***reporting' phase*** (activity) to produce SitRep or Resource List when responding to a yellow or a Red event.

While the preceding discussion relates to the affordances offered by Google Docs, nonetheless, the analysis of the empirical data revealed that it has its downside. Furthermore, the analysis across a range of disaster responses revealed some level of dissatisfaction and frustration with some volunteers while interacting with the Google Docs. Lamentations such as 'Google docs is lagging', and 'is unresponsive' are replete across major disaster responses such as Japan and Ecuador earthquakes as well as Fort MacMurray wildfire. During Louisiana flood response operation, two volunteers exclaimed (excerpt 6.2):

[14/03/2016, 19:44:15] HR Samantha Brooks: for some reason the google doc is lagging
[14/03/2016, 19:44:51] HR Kayla Baxter: I'm having weird problems with it, I can't highlight anything in order to add a link or cut or paste.
[14/03/2016, 19:45:29] HR Samantha Brooks: neither can I

Excerpt 6.2 Skype logs excerpt – issues with Google Docs.

Excerpt 6.2 suggests, apart from the delay, a few of the volunteers find it difficult to execute some tasks. Such tasks relate to 'adding', 'cutting' or 'pasting' as mentioned by Kayler Baxter and affirmed by Samantha Brooks taking into the consideration the time the first volunteer spoke and the response from the second volunteer.

Hence, it is worth noting that the discovery of the Google Docs has no doubt helped and enabled HR's response operations. However, the 'lagging' and 'unresponsiveness' challenge cannot be dismissed as something inconsequential within the realm of humanitarian emergencies. It is something that its implication can affect the speed of the HR response in some ways. For example, when some volunteers became incapable of participating in an ongoing response as a result of some of the mentioned challenges it will affect the overall response goal where HR would be unable to publish the Sitrep and share it with emergency management organisations and partners working on the frontline. The impact will be more profound if partner organisations are waiting for HR to send them the report so that it can help them in their programming, and decision-making process. For aid agencies and emergency management organisations, speed and appropriateness of information are vital. As such, if they cannot get the information at the appropriate time, it will certainly slow down their capability to provide aid. Also, such type of challenge can frustrate and kill the morale of new volunteers who may not be well acquainted with the approach to overcoming such problems. In practice, some volunteers tended to overcome the 'lagging' and 'unresponsiveness' challenge through the 'log out and login' approach (outcome). The 'logout

and login' approach is a general troubleshooting technique where users exit from the document and log back.

By and large, this subsection highlights the work practices of volunteers around the use of Google Docs. The section discusses background information about Google Docs, why it is used by HR, how it is used, who uses it, its advantages, challenges of its use and its associated implication. The section also discusses how the affordances and constraints of Google Docs are situated within the response workflow of volunteers at the 'listing', 'listening and verification' as well as at the 'reporting' phases. Finally, the section offers insight into how volunteers make use of troubleshooting approaches to overcome the challenges. Next subsection explores the practices of use related to GroupTweet.

6.2.2 Working with GroupTweet

GroupTweet (***tool***) is a third-party application that allows for the operationalisation of one Twitter account through multiple contributors. The application works when the contributors make use of their individual (Twitter) accounts to post directly to the official Twitter account owned by an organisation. As an example, a volunteer with Twitter account @TheNajeeb who is among the HR's GroupTweet contributors can tweet through his account, and the message will appear in HR's Twitter handle (@HumanityRoad). GroupTweet developers made this possible when a contributor adds the hashtag of the organisation at the end of the message. For example, whenever the contributor uses @TheNajeeb to share a message such as '***Heavy Rain #warning in different states of #India***' and add the ***#hmrd*** hashtag, the message will appear in the HR's twitter handle. The only difference is GroupTweet will add the contributor's initial (first name and last) at the end of the message to enable the organisation knows who send that message. The following figure illustrates a typical message sent by a GroupTweet contributor.

Figure 6.1 Illustration of how GroupTweet works

In figure 6.1, the GroupTweet automatically generates the credential of the contributor by picking the first and last name of the volunteer.

To understand the relevance of this, we need to ask what advantage the use of GroupTweet offers compared to the use of the standard Twitter account. In practice, GroupTweet allows for multiple contributors to share information using one account without the contributors knowing the organisation's Twitter password. It also allows for task sharing among members which can lead organisations to reduce workload, improve efficiency and allows for 24-hour operationalisations of its account. During an interview with HR Vice President and COO, she emphasises that *'GroupTweet, is the only tool right now that we can give to our volunteers since many hands can be doing a GroupTweet at the same time*'. She also added that '*the thing that I like about the GroupTweet is that it tells me exactly who puts that tweet out*' (P6#04T6-5). Therefore, the ability to allow multiple contributors to work seamlessly as well as the capability of sharing task could be an added advantage of using GroupTweet compared to the use of Twitter.

It is worthy to note that unlike Google Docs, GroupTweet does not provide a freemium service that goes beyond the 14-day trial period. As such, HR had to subscribe to the premium version. Like Google Docs, HR Vice President Operations also handles the administration and management of GroupTweet. As such, access is ***granted*** (rules) to volunteers that attended training for using ***GroupTweet*** (tool). For this reason, to qualify as a contributor (***subjects***), a volunteer must attend an in-house practical training session for the use of GroupTweet. The training exposes volunteers to learn the HR's twitter rules and ethics as well as to a practical, real-life scenario on responsible tweeting. As such, not every HR volunteer is a GroupTweet contributor. At HR, GroupTweet contributors are labelled as social media listeners, and at the end of the training, the account manager will add contributors' personal Twitter account to the GroupTweet list and allow for volunteers to publish content on behalf of the HR.

In the context of the disaster response workflow phases, GroupTweet is mostly appropriated at the 'amplification' phase in which ***social media listeners*** (subject) ***share*** (division of labour) verified official information to the disaster-affected communities and the global online public. At this phase, the ***amplification*** (activity) through the use of GroupTweet will continue until the disaster desk called for the discontinuation of the response operation. The use of GroupTweet takes place at all levels of activation – Green, Yellow and Red.

In spite of the affordances offered by GroupTweet, analysis of the empirical data reveals some challenges associated with its deployment. The findings reveal instances across a range of responses in which volunteers decried that GroupTweet *'isn't working'*, *'does weird things sometimes*', *'doesn't even show up*' or *'sometimes my tweets don't even show up at all*'. At

some point in time during M6.3 Earthquake, the Aegean Sea near Greece and Turkey, the Incident Commander had to stop using it as shown in the following excerpt (6.3):

> [12/06/2017 13:37:34] HR Catherine Graham: Grouptweet isnt picking up my tweets
>
> [12/06/2017 13:37:49] HR Catherine Graham: logging in to tweet from HR and I'm going to cancel grouptweet it fails too often - we need a better solution.

Excerpt 6.3 Skype logs excerpt - Issues with GroupTweet.

In the excerpt 6.3 above, the SMIC had to abandon the use of GroupTweet and logged into an HR account to tweet. In this instance, it is fair to assume that there was no quick fix solution to the problem considering the way an experienced volunteer had to abandon the use of GroupTweet. Again, the inability of the GroupTweet to share the tweet during response implies an essential implication towards the smooth running of the HR work. It could mean several volunteers have been sharing valuable information that might not have seen the light of the day, thereby making the response work ineffective. Likewise, important information that could help in making disaster-affected communities sustain, survive and reunite might escape the attention of those that are in dire need of it since the GroupTweet did not share the tweet. The quick fix solution of abandoning the use of GroupTweet could not only be said to be employed by only one volunteer. Another experienced volunteer has re-echoed the same approach during an interview as shown in excerpt 6.4:

> Our staff will usually go on and sign for the HR twitter account. I have given the login and password information to volunteers when we run into a problem. You know we trust our volunteers, and I cannot remember one of the recent disasters on the past couple of months I gave the password and login details to Tatiana because you know there was GroupTweet problem, so I said go in and sign…(P1#04T1-6).

Excerpt 6.4 Interview excerpt with AC

In brief, this subsection offers insight into the practices of use related to GroupTweet. In particular, the section covers what the GroupTweet is, how volunteers use it during response operation, and the unique advantage it offers. It further highlights problems associated with its deployment and discusses how volunteers can abandon its use whenever it fails.

6.2.3 Working with Skype

As highlighted earlier in Chapter 3 and 4, HR makes use of Skype as its core operational platform for monitoring, coordination, communication and training purposes ***(tool***). The platform allows HR to carry out its operational activities using its freemium services. Although other available platforms such as Slack and Facebook Workplace can compete with Skype, HR

sticks with the use of Skype. For HR, Skype is its virtual headquarters, where all operational activities take place. As a way of giving context for understanding how HR makes use of Skype, I excerpted a chat log to illustrate a typical example in coordinating response using Skype platform:

> [16/04/2016, 03:51:30] HR Javon Malone: 🔔🔔 Briefing Call Notes: The entire team did a great job today. We have sent the first Situation Report to Partners and has been posted. We are going to set up a Work Window for the event and move from Urgent Events. We will be creating a Workbook in the morning. We have set a deadline for 6:00pm EDT for SitRep #2. We want to continue looking for information to add to the SitRep including information for foreigners in Japan. We have a request in for Translators without boarders and hope to have them available sometime this weekend to assist. If you are available to work on the Japan Earthquake let us know to be added to the new window. Great job by everyone that has worked today! 🌹🌹

Excerpt 6.5 Skype logs excerpt - Use of Skype for communication and coordination.

A thoughtful reflection from the above excerpt can reveal the use of Skype to convey a message that was aimed at achieving three things. First, the opening sentence - '*the entire team did a great job today*', - was aimed at boosting the morale of volunteers so that they can stay committed and motivated while carrying out the response activity. Second, the SMIC leverages Skype to update volunteers about two crucial decisions. One of this decision relates to the sending of the Sitrep #1 produced by the volunteers to partners such as Red Cross and Doctors Without Borders and the other decision deals with requesting the services of the TWB (***community***). Last, the excerpt conveys a specific request and goal-oriented directive on what needs to be done. For example, the SMIC requests available volunteers to show interest so that they would be given access to the new event-specific window. The message also explicitly says the time for publishing the Sitrep #2 and the priority areas in which volunteers will be looking when taking part in the response operation.

Further analysis of the excerpt can reveal two underlying things. First, by saying '*If you are available to work on the Japan Earthquake let us know to be added to the new window*' implied ownership and coordination responsibility. By ownership, it means that HR holds the access right for granting permission and adding volunteers to join Skype window. For HR to grant the access right, it also entails volunteers must fulfil the criteria needed to join the window ***(rules***). For example, a volunteer can have access to urgent event window but might not have access to Scanigo or GroupTweet since joining Scanigo, and GroupTweet needs a volunteer to attend a special training. Also, the statement involves a division of labour among volunteers responding to the event. The fact that, someone takes charge of briefing volunteers about the decisions reached and the goal for the next activity implies a clear demarcation of

roles among volunteers (***subject***). Likewise, by saying '*We have set a deadline for 6:00pm EDT for SitRep #2*' further reinforce the existence of the demarcation of roles among volunteers since the decision to activate, stand down or set goals for any disaster response activity lies with the DDWG (***division of labour***). Second, by saying '*We have a request in for Translators without boarders and hope to have them available sometime this weekend*' *to assist*' implies that the response operation involves outside partners from different organisations such as TWB (***community***).

Having discussed the general use of Skype by HR and its volunteers in their day-to-day routine interaction, the discussion will now focus on its application within the context of the response workflow. HR and its ***volunteers*** (subject) utilise Skype for ***reporting*** (action) the sudden onset or slow-moving disaster. This activity happens at the 'monitoring and activation phase'. In essence, as soon as volunteers received the alert from ENS, the first thing they do is to ***share*** (action) the notification to the Urgent Event window. As a result, the deliberation will commence in the DDWG window to determine the type of response HR will provide. As soon DDWG arrived at a decision, the SMIC will ***communicate*** (division of labour) the decision to ***Urgent Event window*** (tool) where available volunteers will start expressing their readiness. Depending on the type of activation, Skype is sometimes used for making a briefing (audio) call. In some circumstances, during the briefing call a SMIC can use Skype to ***share*** (action) the screen and in other times can use slide deck to ***make*** (action) a presentation on what needs to be done. At the 'listing' phase, volunteers also make use of Skype to ***distribute work*** (division of labour) and determine who is doing what and when. Skype is also utilised at the 'listening and verification' phase for ***sharing*** (action) urgent needs, verifying information, guiding volunteers on the most important task at hand among others. When the response moves to 'reporting' and 'amplification' phases, volunteers leverage Skype for ***transferring*** (action) verified contents to SitRep. Social media listeners/messengers will also ***agree*** (division of labour) among themselves who will share what and at what time throughout the response lifecycle. In brief, Skype is utilised at every stage during the response operation regardless of the type of activation- Green, Yellow or Red.

In contrast to the advantage offered by Skype for enabling HR to conduct activities, it is worth explaining that sometimes such opportunities are not without challenges. Analysis of the empirical data reveals some unique challenges associated with the use of Skype. First, through my participation, I have come across at least five occasions in which the Skype experienced service outages. One of such technical challenge occurs while HR volunteers were responding to London Westminster attack on 22nd March 2017 as shown in figure 6.2:

Figure 6.2 Skype technical issue (https://heartbeat.skype.com/2017/03/)

Whenever there is service outage, volunteers experience delays in sending and receiving messages shared through Skype windows. Delays in sending and receiving message impacts response operation in several ways. For example, latency in receiving messages can cause interruption of the conversation flow, duplication of efforts, and constrain volunteers to offer help at the time they are responding to a humanitarian catastrophe. The analysis of empirical data has revealed a series of lamentations by volunteers whenever Skype experience such technical challenge. In one of such instances, a volunteer posted, "*thanks Bullock your moessages posted after mine because Skype was slow to load for me today. Excuse any duplicated work"* (Donald). In another response operation, a volunteer mentioned "*It looks like Skype needs a little help in the Urgent window today. My comment about being unable to check out the 2 quakes was posted at 10:42 AM Eastern. (when there were no monitoring posts after Muhsin's two posts). Now my comment is listed after Javon's post at 1:17 PM. 😟)" (Bernard).* Another volunteer wrote, *"Irritated that Skype did not post the work" (Jamie).*

Hence, the above excerpts revealed implication of service outages to the response operations as earlier pointed out. The outages hamper the ability of the volunteers to make sense of the information shared by fellow volunteers. It does so by making volunteers duplicate efforts since shared knowledge was absent.

Apart from the service outages, the field experience reveals challenges associated with dropped calls and difficulties in joining group calls during briefing sessions. During significant events, SMIC tends to organise a briefing call for available volunteers in which it discusses goals for the operation and reminds volunteers about operational guidelines. The briefing usually discusses how to access event status sheets where volunteers can find tip sheets, log hours, and access the link for documenting urgent needs. Thus, the challenge of not being able to join the briefing call or that of dropping calls in which a volunteer's call stops unexpectedly is a challenge that can have an impact on the overall response work. For example, once a member is disconnected, one of the two likely scenarios could happen. First, the entire briefing call will be put on hold or cancelled, and a new call will be initiated to see whether the problem has been rectified. Second, the meeting will continue while one of the Skype administrators abandons the meeting to see how they can work around the problem with the volunteer. Either

way, the problem delays volunteers' work which invariably slows their capability to offer help at the time their effort for providing information as a form of aid is much needed.

Another notable challenge in working with Skype is that of information overload which is a significant area of concern among HCI and CSCW scholars (Quarantelli, 1997; Abdul-Rahman and Hailes, 2000; Hiltz and Plotnick, 2013). The information overload challenge mostly affects volunteers joining the on-going event in the Skype window half-way through. Thus, the late joiners tended to struggle with reading long Skype thread to enable them to understand the response context. Figure 6.3 illustrates the number of unread messages in which volunteers ideally must read to understand the context

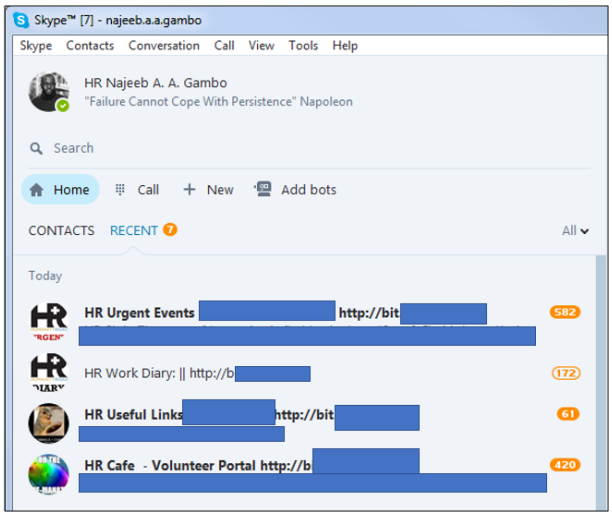


Figure 6.3 Overview of the number of unread Skype messages

In the above figure, one can visibly see the number of unread messages that the researcher has received after taking a day off without accessing the HR windows. Within the leave period, there were 582 unread messages from Urgent Event window, 172 from Work Diary, 61 from Useful Links and 420 from the Café window. The question that the volunteer needs to resolve is how many of the unread messages will a volunteer have to read when s/he decides to join a three-day-old ongoing response operation? How will it look like when a volunteer takes a 3-month leave and suddenly received an activation invitation in which his/her help is needed? Having highlighted challenges associated with the use of Skype during response operation, the following paragraphs will offer practical insights into how volunteers work around these challenges.

Since the service outage issue is a developer-centric problem, volunteers will, therefore, must wait for the Skype services to be restored before they continue with the response work. The service outage experience has at one time motivated a volunteer to call for the adoption of an alternative platform during the DDWG meeting in which I was in attendance. As at the time of writing this chapter, the idea has not been revisited or put into practice. Nonetheless, Chris

Thompson provides insight into the behind-the-scenes approach to working around the problem after acknowledging that *'we don't have a successful plan that we can easily launch. Skype outages don't hamper HR responding especially from the paid staff perspective. To help us manage our volunteers, it hampers us, but we are still able to respond even without a skype if we needed to'*. By requesting further explanation, Chris mentioned that '*HR uses the conference bridge and talk with one another to make sure who is doing the monitoring and who is sharing in the social media'*. 'Conference bridge' allows users to participate in a virtual conference call using their telephones. It is made possible when the conference host calls the intended participants and add them to the conference call. As smart as this explanation is, a deeper and thoughtful analysis can reveal a fundamental organisational dysfunction that needs to be interrogated. For example, why is it that HR cannot be proactive enough to find alternative platform? Does this have to do with the 'media stickiness' syndrome, or it is a merely an issue that HR does not see as a priority? What will happen if a significant disaster strikes and Skype services are impacted? Will 5 or 6 paid staff be able to handle the response operations using the conference bridge? What if the disaster takes place in a non-English speaking country, will the conference bridge allow for the paid staff to handle such challenges? Hence, a detailed follow-up discussion on this issue will be presented in Chapter 7.

Returning to the issue of drop calls and inability to join Skype call challenge, findings from the study show that HR administrators tended to overcome the problem using a 'remove and re-add approach'. 'Remove and re-add approach' is a technique in which the Skype call host will remove the volunteer from the Skype window and re-add the user back to the conference call. The following excerpt illustrates the type of experience a volunteer faced while trying to join a group call.

> [27/02/2017 20:52:32] HR Catherine Graham: Hi Joel - I tried removing and adding you again - see if that works. Can you see this message
>
> [28/02/2017 00:40:48] Joel Murphy: Why was I ejected and then added back???
>
> [28/02/2017 00:43:48] HR Amber Burton: [27 February 2017 20:52] HR Catherine Graham: <<< Hi Joel - I tried removing and adding you again - see if that works. Can you see this message
>
> [28/02/2017 13:28:11] HR Catherine Graham: Oh good it worked. Sometimes when Skype stalls that fixes it.
>
> [28/02/2017 21:50:29] Joel Murphy: never mind

Excerpt 6.6 Skype log excerpt - Resolving Skype drop call challenge

In the above excerpt, a volunteer [Joel Murphy] was unable to join a Skype group call, and one of the volunteers with administrative privilege [HR Catherine Graham] removed and added

the volunteer back. On re-joining, the volunteer seems to be confused about the reason for the first ejection and subsequent re-admission. On realising the communication gap, another volunteer [HR Amber Burton] copied the chat sent to Joel earlier to help Joel understand the reason for his ejection. This type of problem is known in CSCW where common misunderstanding in remote communication occurs (Ruhleder and Jordan, 1999; Herbsleb *et al.*, 2000). Nonetheless, it could be seen, that the 'remove and add' approach resolved the issue. Furthermore, the statement made by HR Catherine Graham in excerpt 6.6 suggests the use of 'remove and add' approach among volunteers.

Also, as previously mentioned in Chapter 5 subsection 5.3.2., the creation of an event-specific window by HR was partly influenced by four primary factors. One among such factors is the need to manage information overload. However, despite the creation of an event-specific window, a challenge still exists when volunteers are responding to significant events. For example, volunteers must read torrents of Skype chatter to make sense of the response context. Against this, HR has devised another means of summarising the report in an 'Event Status and Information Sheet' so that volunteers can directly find the report without necessarily going through the chatter. HR has attached a link of the 'Event Status and Information sheet' on top of the Urgent Event window so that volunteers can easily find the Google sheet as illustrated in chapter 4 figure 2.1. The following excerpt (6.7) posted by SMIC illustrates an approach to working around the Skype information overload using the 'Event Status and Information Sheet'.

[04/05/2016, 19:05:23] HR Aline Carr: No time to read all the skype posts? Dropping in and wondering what we are monitoring or looking for summaries and goals of a response? Check out our Event Status document (link also at top of this window): https://docs.google.com/spreadsheets/d/10zSSJ_66yCY/edit#gid=0

Excerpt 6.7 Skype log excerpt - Guides on how to overcome Skype overload

The SMIC in the excerpt above (6.7) was directing volunteers to refer to the links at the top of the Skype window whenever they want to read the summary of the ongoing operation. The link contains an up-to-date summary of the operation alongside some specific goal-oriented deliverables. As such, volunteers will no longer need to read through the torrents of Skype chatter to update themselves.

In summary, this section explained how HR and its volunteers make use of Skype as a tool for monitoring, coordination, and communication during response operations. This was followed by highlighting some of the crucial challenges' volunteers used to meet during response operations as well as the approach they took for working around some of these problems. In what follows is the explanation of the practices of use related to Twitter.

6.2.4 Working with Twitter

Alongside Skype and Google suites (Docs, Sheet, Slide Deck, Forms, Drawing, Maps), Twitter also belongs to the core tools and platforms that HR uses in its day to day operations (***tool***). The HR President mentioned that they make use of Twitter because '*that is where the data and public reside – Twitter and Facebook*' (P7#04T7-7). As at the time of writing this Chapter, HR has a verified Twitter badge with more than ten thousand followers. Among these followers are formal and traditional aid agencies, emergency management organisations, volunteer and technical communities, government agencies, as well as members from research and academic communities. HR paid staff manages the administration and access right of its official account. The analysis of the empirical data shows that, apart from the HR paid staff, some long-term serving volunteers also have access to the HR's twitter account. The rationale is to allow for the continuous operationalisation of the account when HR is responding to significant events (***division of labour***). However, HR grants access to these volunteers only after undergoing training on the official policy governing the use of HR social media handles. The training exposes volunteers on the rules for sharing and retweeting pertinent messages from local, regional and national officials as well as volunteers, partners, and aid agencies (***rules***). The HR social media policy explicitly categorises how to provide public with information that will connect those who need aid to those who can provide it to enable disaster-affected communities survive, sustain and reunite. As such, users will tweet, or retweet messages only related to:

- evacuation, first aid, hospitals (survive)
- shelters in place, food, water (sustain)
- and how to reunite with loved ones (reunite)

Other guidelines include the use of hashtags for the country, state, region, or city as well as the inclusion of the event hashtag if available. The following screen grab illustrates a typical HR retweet during the Philadelphia heatwave campaign embarked by HR:

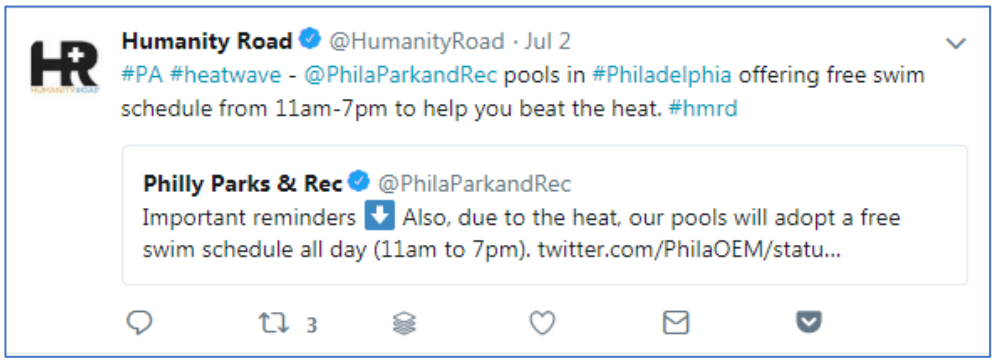


Figure 6.4 illustration of typical HR retweet

The retweet starts with two hashtags #PA and #heatwave where #PA stands for Pennsylvania, which is the state headquarter of Philadelphia and #heatwave as the event hashtag (for the heat wave). Next, the message includes the official handle of the organisation that shared the original tweet (Philadelphia Park and Recreation) and followed by #Philadelphia the headquarters of the organisation as well as the designated HR's hashtag (#hmrd). In any case, HR guidelines encourage volunteers to always include country, region, state, and events hashtags. The rule also requires anyone using an HR official handle to restrict their activity to sharing information from local, regional and national officials as well as partners (SBTF), and aid agencies (Red Cross, MSF) only.

Both HR paid staff and its volunteers take advantage of Twitter while responding to emergencies. However, a more profound reflection and analysis of their mode of use show some differences and similarity. For example, at an organisational level, HR takes advantage of Twitter to undertake the following functions (***action***):

- To share situation reports, announce public safety information, and encourage responsible sharing so as not to put humanitarian workers at risk.
- To amplify pertinent information from local, regional and national officials as well as volunteers, partners, and aid agencies.
- To reach out to people requesting urgent needs via Twitter with the intent of linking them to the agencies responsible for giving aid.
- To curate Twitter accounts of relevant bodies such as emergency management organisations, formal and traditional aid agencies and partners like Cisco, and Virtual Operation Support Teams (VOST) using 'Twitter list'. Twitter list is a functionality that allows for the curation of Twitter accounts into groups which could enable the curator to monitor tweets from the curated accounts.

On the other hand, volunteers (subjects) that feel more comfortable with finding information using Twitter rather than the third-party tools such as Scanigo, social mentions, Tweet Deck, and Hootsuite among others tended to use it for the following (action):

First, volunteers leverage Twitter for ***data mining*** (action) urgent needs (such as medicines, evacuation, shelter, among others) and information that will help disaster-affected communities to sustain, survive and reunite. Second, they utilise it for ***amplifying*** (action) HR official tweets and partners and aid agencies' retweets shared by HR. Third, they leverage its translation capability to ***make sense*** (action) of tweets shared by non-English speaking users. Twitter integrates Microsoft translation API to allow for the automatic translation of messages. The API appears with a little dark globe icon followed by a phrase – Translate Tweet – at the bottom of the original message as shown in figure 6.5 below.

Figure 6.5 Screengrab of Tweet showing Microsoft translation API

The first box (labelled as A) from the figure above illustrates a tweet in Spanish language with translation API icon below the message. The second box (labelled as B) shows how the API translated the tweet from Spanish to English. To enable the API translates the message, a volunteer must click the 'Translate Tweet' link.

As the preceding discussion centred on the general use of Twitter among volunteers, we can now focus on the affordances Twitter provides during the response workflow. In the context of the process workflow, volunteers make use of Twitter mainly in three main phases of the operation. At the '***listing***' phase (activity), volunteers use Twitter to ***find*** (action) Twitter handles of organisations that are responsible for providing critical information update. Regardless of the type of activation, SMIC will identify some volunteers who will be responsible for ***adding*** (action/division of labour) the addresses to the Twitter List if the addresses do not exist in HR's list before the current event. At the ***'listening and verification***' phase (activity), volunteers will work independently in a self-directed mood after ***picking*** (division of labour) the areas of their choice identified by the SMIC. At that phase, volunteers will use Twitter to ***search*** (action) the latest news, people, photos, videos, news or broadcasts associated with the event using hashtags. Also, when volunteers identify potential information, they will share it to the window (event specific or urgent event) for deliberation. If the information requires further verification, some volunteers will be ***assigned*** (division of labour) to corroborate the information. Sometimes, volunteers make use of Twitter to verify information. Volunteers also use Twitter at the '***amplification***' phase (activity) to ***share*** (activity) information or ***retweet*** (action) a tweet from partner organisations or aid agencies. In brief, volunteers utilise Twitter for 'listing', 'listening and verification' as well as 'amplification' when processing crisis information during a response operation.

Overall, HR uses Twitter for communicating official information, amplifying partners' messages, curating relevant accounts and responding to urgent needs. On the other hand,

volunteers make use of Twitter for data mining urgent needs, translating tweets and amplifying HR tweets and retweets. Thus, the only semblance between the use of Twitter by HR as an organisation and that of individual volunteers is on the use of Twitter for retweeting disaster messages.

Despite the many advantages listed above, finding from the analysis of the empirical data reveal design-related challenges that continue to hamper the effective use of Twitter by HR volunteers. For example, when Twitter refined the design of 'reply', 'retweet' and the 'like' icon, the update became a source of concern among some HR volunteers with some specific needs. The new design came with a light grey colour such that when a user hits the retweet icon, it changes to a light green. The way the refined design changes to a light green colour makes it difficult for people with some functional needs to know whether their retweet is retweeted. The following excerpt (6.8) epitomises the concern of a volunteer that the new improvement affects.

> [29/06/2017 23:48:02 | Edited 23:49:07] HR Lea Knowles: I really don't like how Twitter shows the retweet icon now days on Twitter. It is very hard for me to tell if I got everything retweeted, the thin line arrow and the very light green colour is hard to see. 👎
>
> [29/06/2017 23:48:43] HR Kayla Baxter: Yeah it is harder to see. I've seen other people complaining too.

Excerpt 6.8 Skype logs excerpt - Tweeter redesign issue.

According to the Twitter official blog post[41], the new design aspires to make the update more 'intuitive and seamless for interaction'. However, in real and practical sense, the new design has not been inclusive enough to allow for people with age-associated impairment and disabilities to easily navigate the new topography without putting extra effort. HR Lea Knowles expresses concern by saying that '*it is very hard for me to tell if I got everything retweeted*'. Likewise, Kayla Baxter reinforced Lea Knowles concern by saying '*… it is harder to see*' and went to say, '*I've seen other people complaining too*'. In retrospect, one may need to ask why is this a problem? In other words, what is the implication and why should we care, and how does that become a challenge when a volunteer is unable to know whether the message has been shared or not? The answer that volunteers believed that they were giving an important service to humanity by sharing information as a form of aid. For them, 'people need information as much as water, food, medicine or shelter'[42], and sharing important information can help shine the light in giving succour to those in need. Therefore, any obstacle can hamper

[41] https://blog.twitter.com/official/en_us/topics/product/2017/Check-out-our-new-look.html
[42] http://www.ifrc.org/Global/Publications/disasters/WDR/69001-WDR2005-english-LR.pdf (pg. 12)

the speed at which they can provide aid and that might lead to putting people and animals' lives in danger.

The above design challenge is specific to the refinement of 'retweet', 'like' and 'reply' icons. Moreover, another challenge relates to the inability of the Twitter design team to include a search bar or sorting functionality in the 'Twitter List'. As mentioned earlier, Twitter list is a functionality that allows for the curation of Twitter accounts into groups which could enable the curator to monitor tweets from the curated accounts. Therefore, whenever the need arises for finding specific accounts within the curated groups, a volunteer must take the burden of finding the account manually since there is no search bar or sorting functionality. By way of example, the following screen grab (figure 6.6) holds 134 different lists with each list having some accounts called members.

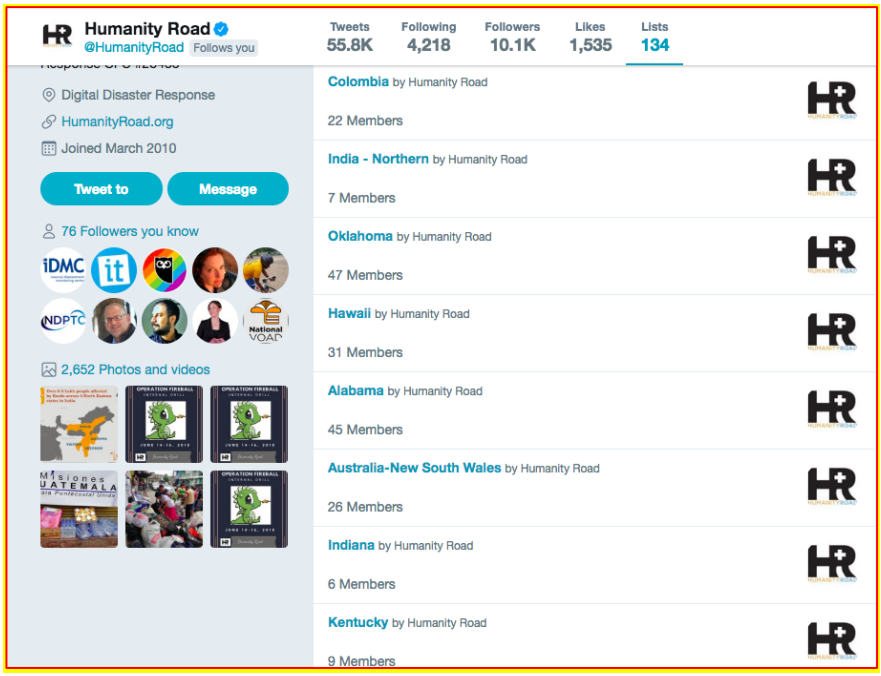


Figure 6.6 Illustration of The Twitter List showing the absence of search and sorting options

The above Screengrab holds only 8 lists from the existing 134 lists. The list starts with Colombia and ends with Kentucky. Ideally, the list would have been easier to follow if someone could quickly search or sort the list. However, since the design does not include search bar, a user must take the burden of manually scrolling the list to find the information. The implication for this is its hampering the ability of volunteers to contribute to the response operation swiftly. In HR work, speed, appropriateness of content and accuracy matters. As such, the conspicuous absence of search bar and sorting option means volunteers will have to put extra effort and spend more time in their attempt to find accounts within the list. To put this in context, consider a Twitter list called 'Pacific Northwest' among the list in which HR subscribed and added it to its list. The list has 421 members, and when a volunteer is looking

for 15 accounts from the list, this means that the volunteer will have to scroll through to find each account one by one. By including a search bar or a sorting capability, volunteers might find using the Twitter List more user-friendly which have the potential of making them work efficiently. The absence of such capabilities can hamper the ability of volunteers to make practical use of a tool whose central preoccupation is to make the work of people more easier. In disaster response, time is of the essence. Any hindrance can affect the smooth running of emergency coordination.

By and large, the main challenges arising from the use of Twitter mostly revolve around design as we have seen with the case of refinement of icons, and absence of a search bar and sorting capability. At the time of writing this chapter, volunteers with functional need work around the issue of icon redesign by using the Safari reader view to enhance the colour contrast. As innovative as this approach is, this further raises the usability, accessibility and inclusivity concern for people that do not own IOS devices. Also, up to the time of writing this chapter, the search bar and sorting option issue have not been addressed by the Twitter.

In summary, this subsection discussed how HR and its volunteers make use of Twitter functionality to communicate, respond, retweet and curate compelling social media accounts. The segments also gave insight into the design related challenges that are hampering the work of volunteers. In what follows is the discussion with regards to how volunteers work with the translation platforms.

6.2.5 Working with translation tools

In the context of HR's work, translation tools and platforms are technologies that enable volunteers to translate and make sense of disaster messages. Findings from the study reveal the use of Google Translate (search bar options or Google Docs translator), Bing translator, Twitter, Facebook and Skype (***tools***). Unlike Skype, Google docs and GroupTweet, the use of translation tools do not need the permission of any HR staff for volunteers to gain access since these tools are publicly accessible. As such, volunteers could take advantage of any translation tools to contribute to the response operation. Nonetheless, HR has dedicated sessions for training and improving volunteers' skills on how to use translation tools and platforms while responding to disasters.

It is natural to ask how these volunteers are making use of such tools and how these tools work in practice (since everyone can use any tool). Responding to disasters entails switching between working in a self-directed mode to find urgent needs on the one hand and joining other fellow volunteers in Skype windows to collaboratively work in a team. Thus, while working alone, a volunteer can use any translation tools to make sense of crisis information

and share such information with the Skype window (***subject***). In responding to an event that is outside the confines of an English-speaking audience, SMIC coordinates the activity by encouraging volunteers to use any available tool to find urgent needs. Likewise, available multilingual volunteers will be asked to concentrate on correcting any anomaly that may arise from the machine-generated translation shared in the Skype window (***division of labour***). The following excerpt is an illustration of how volunteers divide such kind of responsibility during M6.2 Italy Earthquake.

[24/08/2016 16:21:18 | Edited 16:21:38] HR Chris Thompson: ☐ Needs translation but then can be added to sitrep - I think this group is collecting medicine in Rudiano Italy and needs volunteers and donations

https://www.facebook.com/nicola.marenzi.1/posts/10208756487663784

Excerpt 6.9 Skype chat logs excerpt showing division of labour

From the above excerpt, Chris Thompson stumbled on useful information written in Italian on Facebook (***object***). Although Facebook integrates a tool that allows users to translate the message, Chris Thompson still says '*needs translation*' before it is '*added to sitrep*'. The following figure (6.7) is the (Facebook) Screengrab of the message Chris Thompson was referring:

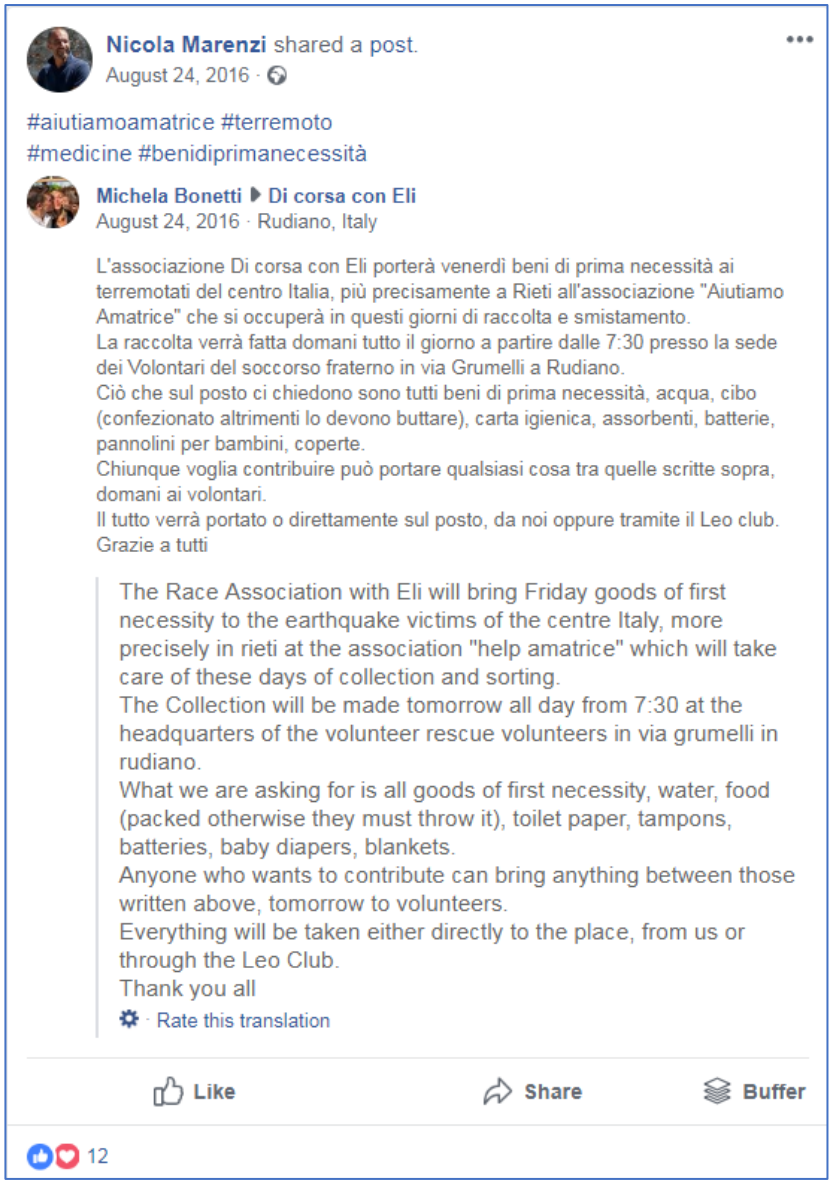


Figure 6.7 Facebook Screengrab of the machine translated message

From the above figure, it is likely that Chris Thompson makes use of 'See translation' to understand the content of the message. 'See translation' is a Facebook integrated tool that allows for translating content into other languages. However, in seeing the lack of precision from the machine-generated translation, she then decides to call for added translation. To put it differently, volunteers make use of translation tools and platforms to find urgent needs and make sense of crisis information that will be used in developing SitRep or amplifying information. However, as helpful as these platforms and tools, the potential lack of precision in a translation provided by some of these tools has been a source of concern for volunteers. The ethos of sharing credible information mostly motivates these concerns, and these machines generated translations tended to produce a low-quality translation that sometimes can distort the understanding of the entire message. The following is an excerpt from Skype chat illustrating the perceived lack of precision from the machine-generated translation:

[24/08/2016, 19:01:29] HR Aline Carr: @Cataldo - the machine translation for this is a bit weird. I put the Italian post in the Sitrep but it would be nice to have a good English translation. https://www.facebook.com/simone.petrangeli.1/posts/10206874936618680?pnref=story

Excerpt 6.10 Skype chat logs excerpt showing the imperfection of Facebook translation

In the above excerpt, Aline Carr used an @ sign to call the attention of Cataldo, who is both fluent in English and Italian to make the translation more comprehensible. Below (figure 6.8) is the screen grab of the entire text alongside the Facebook translation highlighted in a box:

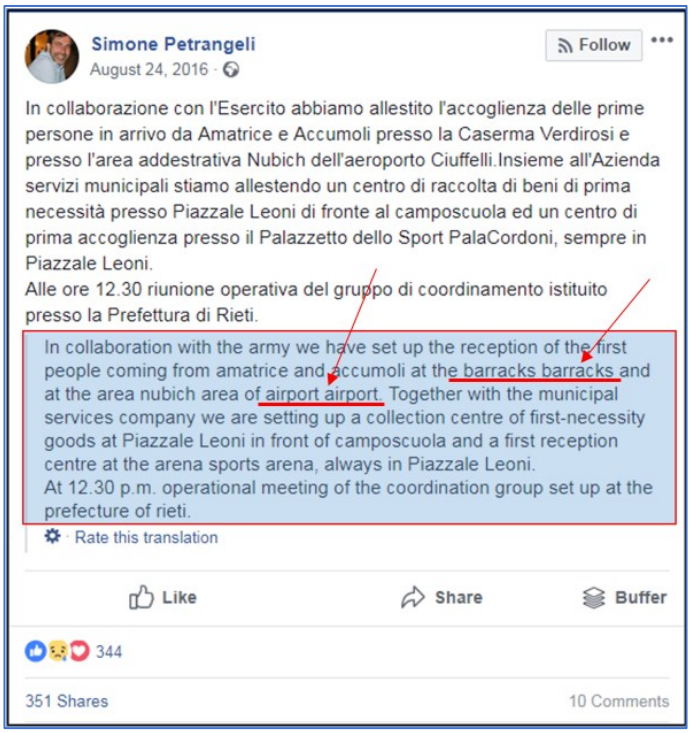


Figure 6.8 Facebook machine generated translation

From the machine-generated English translation, one can easily reason with Aline Carr's frustration. For example, in the first sentence, two words – barracks and airport – were repeated twice. The duplication could arise due to the difficulty of the machine learning algorithm to understand how to translate compound nouns from Italian to the English language. For a better understanding of the machine-generated challenge, I used a Google Translate Add-on to translate the same message as seen in figure 6.9 below:

Figure 6.9 Google Translate adds-on translation

In comparison with the Facebook generated translation, Google Translate rendering of this text seems to be more comprehensible. It also shows clearly the limitation of the Facebook generated translation in rendering compound nouns from Italian to English. For example, in comparing the two translations, one can easily discern the repetitions – barrack and airport – could be because of such difficulty. Google Translate renders Caserma Verdirosi as 'Verdirosi Barracks' while Facebook translates it as 'barrack barrack'. Likewise, Google Translate renders dell'aeroporto Ciuffelli to Ciuffelli airport while Facebook translates it as 'airport airport'. Also, in the same sentence from the Facebook generated translation, the word '*area*' was repeated twice with the first one placed before 'nubich' and the second one after 'nubich'. Moreover, the Facebook generated translation ignores the word Verdirosi and Ciuffelli that are in the Italian text and changed the manner of writing the name of places (Amatrice, Accumoli, Nubich) from a proper style to small letters.

Problems such as repetition, wrong placement of words in their proper places, elimination of essential nouns as well as distortion of styles as evidenced in the Facebook generated translation could make the translation loss its essence and challenging to convey the needed and relevant information. It is also possible for someone to argue that since Google Translate appears to do a better job compared to Facebook, why can't volunteers stick to the use of Google Translate. As important as this argument, field experience has shown that machine-generated translation is yet to be reliable enough without the supervision of human translators. For a better understanding of the challenge, the following excerpt (6.11) from the internal drill exercise typifies the problem associated with relying on the machine-generated translation:

[26/06/2017 17:28:17 | Edited 17:32:14] HR Aline Carr: Google translate is giving me weird translations for Question #3.

[26/06/2017 17:29:27] HR Chris Thompson: aw - I almost had it translated using Skype Translation

[26/06/2017 17:29:34] HR Aline Carr: Translate the following sentence: کیا رساں ادارے پاکستان میں ہوا کے معیار ہینڈل؟.

[26/06/2017 17:30:40] HR Aline Carr: Google gave the right translation when we set up the drill. It should say: What agency handles air quality in Pakistan? Now I'm getting "What is the quality of air in Pakistan?"

[26/06/2017 17:31:34] HR Aline Carr: I tried again and it gave me this: "The air quality handle in the media?"

[26/06/2017 17:32:05] HR Chris Thompson: the problem is that English words are not very specific - so the English word 'handle' is not precise enough

[26/06/2017 17:32:12] HR Chris Thompson: try - responsible

[26/06/2017 17:32:31] HR Chris Thompson: In Pakistan, what agency is responsible for monitoring air quality?

[26/06/2017 17:33:46] HR Aline Carr: Yep that work, thanks!

[26/06/2017 17:33:54] HR Chris Thompson: (muscleman)

[26/06/2017 17:34:31] HR Chris Thompson: plain English vs. proper English

[26/06/2017 17:35:27] HR Aline Carr: Its strange because it worked before, but maybe Google is changing algorithms or its language learning or something.

[26/06/2017 17:35:41] HR Chris Thompson: yes quite possibly

Excerpt 6.11 Skype chat logs excerpt showing Google generated translation

The above excerpt reveals the use of different translation tools such as Google Translate and Skype among volunteers. Also, the excerpt shows the need for caution in sharing machine-generated translation. For example, in the excerpt Aline Carr pointed out that when they translated the text from Urdu to English, while preparing the drill exercise questions, Google Translate gives the translation as '*What agency handles air quality in Pakistan*?'. However, during the drill, the same Google Translate changes the translation to '*What is the quality of air in Pakistan*?'. For making another attempt, the translation transmuted to '*The air quality handle in the media*?'. Hence, in expressing concern, Chris Thompson acknowledged the difficulty of machine-generated translation challenge associated with understanding the difference between plain English with proper English.

The primary concern here for this thesis (RQ2) is to ask how does this machine-generated translation challenge affects the work of volunteers and what does this mean for response work? First, without human translators from among the rank of HR volunteers or other surge support team such as TWB, their work will be limited to giving information as a form of aid to English speaking countries only. Second, the coordination of response across partner organisations will be affected since HR would be unable to give situational awareness information to the partners at the frontline. Third, the dearth of situational awareness information will mean more delays in coordinating relief efforts by the aid agencies.

From the preceding paragraphs, the discussion centred on the volunteers' general work practice of using translation tools such as Google Translate, Bing and Twitter (tool). However, in the context of response workflow, the use of translation tools tended to be in the first three phases of the operations. At the 'monitoring' phase (activity), volunteers use translation tools to keep monitoring the situation. This typically happens when there is little information about an ongoing event taking place in non-English speaking countries, and the DDWG (community) needs more information to decide on the type of activation required. As a result, SMIC will outline the area of priorities such as hospitals, ambulances, transportation and advise volunteers to indicate areas they will want to cover. The activity will continue until the DDWG have enough information to decide the type of activation they will provide. At the 'listing' (activity) phase, volunteers make use of translation tools to search and find (action) addresses of the relevant stakeholders critical to the event. At the 'listening and verification' (activity) phase volunteers take advantage of the translation tools to find and verify (action) urgent needs from disaster-affected communities and share it to the formal and traditional aid agencies supporting the event. In brief, translations tools provide affordance for the volunteers during the 'monitoring and activation', 'listing', as well as 'listening and verification' phases in the context of the response workflow.

On the other hand, to overcome the challenges of inaccurate translation, HR has resorted to requesting the services of TWB or on boarding and trained native translators (as discussed in Chapter 5 subsection 5.4.3). The translators mostly work with HR to edit and confirm the information sourced from volunteers (***outcome***). In addition to that, translators support HR with messaging and translating SitRep written in English to the language of the disaster-affected communities.

The preceding discussion focuses on the work practices of volunteers with regards to the use of Google Docs, GroupTweet, Skype, Twitter and translation tools. However, by taking a step further to look at the work practice from a broader perspective on how volunteers' appropriate technologies to enact their work will reveal the following:

First, Skype appears to be the most used platforms in the context of the response workflow. Based on the analysis, volunteers appropriate Skype to enact their work at all the phases of the response. Conversely, the study further revealed GroupTweet as the least platform volunteers make use of while responding to disasters. GroupTweet is utilised only during the 'amplification' phase. On the other hand, volunteers make use of Google Docs, Twitter and Translation tools at three different stages of the response workflow.

Second, the analysis has also revealed the interaction and integration of these platforms and tools across different phases of the response workflow. For example, At the 'monitoring and activation' phase, volunteers make use of Skype and translation tools. At the 'listing' and 'listening and verification' phases, volunteers utilise Google Docs, Skype, Twitter and translation tools to undertake the response operations. At the 'amplification' phase, GroupTweet, Skype and Twitter are the primary tools for the response, while during the 'reporting' phase, volunteers leverage Google Docs and Skype for coordination and collaborative authoring of SitReps or Resource list.

By and large, this section provides an insight into the social organisation of HR volunteers with regards to how they appropriate technological tools and platforms. In particular, the discussion covers affordances and constraints as a result of the use of such technologies as well as highlights the approach volunteers use in overcoming some of the challenges. The summary of the volunteers' work practices while appropriating Google Docs, GroupTweet, Skype, Twitter and translation tools are encapsulated in Table 6.1below.

Table 6.1 Summary of volunteers' practices of use

Tools/Platforms	Use	Challenge	Solution
Google Docs	- Collaboration - Authoring of SitRep - Coordination	- Lagging - Unresponsiveness -	- Log out and log in - Remove and re-add the user - Clear cookies
GroupTweet	- Task sharing - 247 operationalisation of HR Twitter account	- Fails, too often - Tweets not showing - Isn't working - Does weird things	- Log in to Twitter and share information
Skype	- Monitoring - Coordination - Communication - Briefing call	- Service outages - Drop calls - Inability to join the calls - Information overload	- Use of conference bridge among HR paid volunteers - Remove and re-add users - Use of event status and information sheet
Twitter	- Amplifying official information - Data mining urgent needs - Responding to urgent need requests - Connecting victims to aid agencies	- Difficulty in recognising retweet outcome - Absence of search bar and sorting option in Twitter List - Twitter Moment retweet challenge	- Use of Safari reader view for IOS users only - Manual scrolling
Translation tools	- Translating messages - Sense making - Researching urgent needs	- Duplication of words - Repetition of compound nouns - Wrong placement of words - Elimination of essential nouns - Distortion of style	- Onboarding of new volunteers or partners - Onboarding native spontaneous volunteers

Having discussed how volunteers make use of such tools and platforms as encapsulated in table 2.1 (above), it is important to point out some of these challenges here. To sum up, these challenges could be categorised into four: developer centric, symptomatic, user centric and process-centric challenge. Developer-centric challenges include issues arising mainly due to design enhancement of the product such as that of Twitter or server outages as experienced by Skype during the London Westminster attack. Symptomatic challenges are scalability and performance related problems that occur because of the pressure put on the system as seen in the use of Google Docs during response operations. User-centric challenge refers to challenges that evolved because of cookies interference or low internet bandwidth which sometimes hampers the volunteers' ability to take part in briefing calls or result in unexpected drop calls. Process-centric challenge arises because of the process put forward by the organisation in managing the activities of volunteers and response operations. For example, the policy of creating an event specific window when responding to a major catastrophe, though helpful, but such action also succeeded in creating another challenge such as that of information overload.

6.3 Classification of ICT tools

The earlier section (6.2) covers the findings of the second research question that seeks to understand the workplace realities of using technological tools and platforms in digital disaster response. Accordingly, the focus of this section is to address the remaining part of the same research question that aims to understand the broad-ranging nature of these tools and platforms.

To start with, tools and platforms in the context of this study could be a mobile app, desktop apps, web-based platforms or a combination of one or both. It is also worth clarifying here that the classification of these broad-ranging tools and platforms evolved based on the analysis of the empirical data, such as Skype chat logs, field notes, tip sheets alongside interviews. The finding, however, is delimited by the observation period, and the number of volunteers interviewed as mentioned in Chapter three.

In the context of this study, the analysis reveals four distinct categories of these broad-ranging tools. The categories include collaborative tools and platforms, live feeds and notification systems, social media, management and aggregation dashboards as well as 'non-integrated' verification tools and platforms. The classification evolved through the use of subthemes generated during the first stage of data analysis, AODM/Martins-Daltrini framework for dissecting activities into actions as well as by answering the following questions: What is this tool used for? How is it used? When is it used? Where is it used? Who uses it and for what purposes? The following steps highlight how the classification of one of the categories evolved in practice:

During the analysis phase, the concept of verification as explained earlier in subsection 3.7.2 appears several times, and after a detailed analysis, the word emerged as one of the adopted subthemes. Later, while applying AODM/Martins-Daltrini framework to understand the process involved in processing crowdsourced information, verification also features as a major activity at the listening and verification phase. Its emergence as a subtheme and a major activity in the process workflow of processing crowdsourced information led to the identification of some tools and platforms volunteers make use of when undertaking verification work. However, to get a comprehensive list of these tools and platforms from the general lists as shown in Appendix VII, the questions mentioned above were used as a lens. By answering such questions, the following inclusion criteria for identifying any tool or platform that can perform one or a combination of the verification activity emerged and any tool or platform that satisfies the criteria is included as part of 'non -integrated' verification tools and platform:

a) General internet searches

b) Reverse image searches

c) Locations finding using maps

d) Language translation

Comparing each tool and platform with the above dimensions led to the inclusion of some tools and platforms such as Google, Skype and Tin Eye. For example, under this group, the classification allows for the inclusion of a tool (Google - search engine, image search, map and Google Translate) that can perform all the actions mentioned above. The criteria also serves as a lens for the including tools and platforms that can perform one only action out of the four actions listed above. For instance, Skype is included as part of the verification tools since volunteers take advantage of its translation capability to verify and make sense of disaster information. Likewise, the criteria allow for the inclusion of TinEye platform since it can perform a reverse image search. Thus, the above description offers a hint about the criteria used to classify these tools into four distinct categories. In what follows is the brief explanation of each category.

6.3.1 Collaborative platforms

This category includes technological tools and platforms that are enabling volunteers to collaborate and carry out the coordination of tasks when responding to a disaster. Tools and platforms under this category include, among others Skype, Google Docs, Google Form, Google Sheet, and Google Slide Deck. By way of example, volunteers are using Google Docs to co-author SitRep, or Resource List (***action***). Google Forms are used by social media listeners (volunteers) to log Urgent needs in which the entry will be collected automatically through Google sheets (***action***). Volunteers such as SMIC, reporting lead and case incident commander (***division of labour***) will then utilise the information obtained through the Google sheets to add it to the SitRep or relay it to the emergency management organisation/aid agencies or amplify the information where necessary (***action***). Google Slide Deck is used for presentation during briefing sessions while Skype is used as a conversation space where all the activities are coordinated (***action***).

6.3.2 Live feeds and notification systems

This category includes live feeds and electronic notification systems. The live feeds are platforms in which volunteers monitor the platforms for situational awareness about the ongoing response operations. HR volunteers are using a range of tools and platforms depending on the user's interests and professional background. For instance, some volunteers will prefer to use bounded chat rooms for NWS and GDAC respectively, for an instant update

from volunteers at the Frontline. Other volunteers make use of Reddit to learn about what the disaster-affected communities are discussing. On the other hand, electronic notification systems include mobile applications and email notification systems that send an automatic alert whenever there is a sudden onset of disaster or a prediction of the appearance of slow-moving catastrophe. Our analysis shows the use of ACAP mobile apps (CrisisAlert) and PDC apps (Disaster Alert) while others subscribed to the email alert of GDAC, PDC, NHC and USGS (***action***) (see chapter 5.3.1 for more details).

6.3.3 Verification platforms

Tools and platforms that enable volunteers to search the internet, translate disaster information from one language to another, verify photos, videos as well as locations are classified as verification platforms in the context of this study. Examples of such tools and platforms include Bing and Google search engines, TinEye website for reverse image search as well as Virus Total for analysing suspicious files and URLs. Other verification platforms include Media Bias Fact Check website, and HR Firefox adds-on. Media Bias Fact Check is an independent website that educates people on issues related to media bias and deceptive news practices. The site has a dedicated space in which it lists questionable news outlets around the world. HR-Firefox is a one-stop shop adds on that integrate all the verification platforms mentioned above alongside all the relevant tip sheets and resources such as list and addresses of embassies around the world. The adds-on is akin to HR's encyclopaedia. As such, some volunteers prefer to use it as a one-stop shop for all their verification activities.

6.3.4 Social Media, Management Platforms and Aggregation Dashboards

This category includes social media and networking websites, social media management platforms as well as social media aggregation dashboards. Social media and networking websites include, Facebook, Twitter, and Instagram while the social media management Platforms are one-stop shops for managing social media platforms. Platforms such as HootSuite, GroupTweet, Twuffer and Buffer allow organisations and individuals to schedule and post messages to social media sites such as Facebook, Twitter and Instagram. Social Media Aggregation Dashboards are platforms such as Scanigo, Social Mention and TweetDeck that enable users to filter social media messages using event keywords and hashtags.

In the context of HR's response workflow, volunteers make use of ***social media, management platforms*** and ***aggregation dashboard*** (tool) at four levels of the response phases. For example, they are used at the '***monitoring***' (activity) phase when DDWG urge volunteers to keep ***monitoring*** (action) the situation as a result of insufficient

information upon which the committee will decide the type of response HR will provide. They are also used at the '***listing***' (activity) phase for ***finding*** and ***enlisting*** (action) the addresses of organisations and agencies responsible for managing the event. At the '***listening and verification***' (activity) phase, volunteers take advantage of the affordances provided by these tools to monitor and verify information shared during the event. When useful information is ***sourced*** and **verified** (outcome), ***social media listeners*** (subject/division of labour) will then use some of these tools to ***amplify*** (action) the information to those who need it. In brief, volunteers make use of social media, management platforms and aggregation dashboard at four levels of the response phases.

6.4 Summary

This chapter addresses the second research question that sought to understand the type of tools and platforms as well as the workplace realities for their appropriation by the volunteers while responding to complex emergencies. The chapter addresses this question by providing detailed insights into the volunteers' work practice on how these tools and platforms enabled and hampered digital disaster response work as well as the implication of such challenges. Later, the second section highlights the classification of tools and platforms volunteers make use of while responding to disasters. The next chapter discusses the implication of the study findings from chapter five and this chapter by relating the findings with the literature (in Chapter 2) and introducing a process workflow model.

Chapter 7: Synthesis and Reflections on Collaborative Work in Digital Disaster Response

7.1 Introduction

The preceding chapters (5 and 6) present the findings of the research arising from the first and second research questions respectively. This chapter consists of the summary of the research findings, discussion of the findings, and implications from the research findings. Its purpose is to expand upon the findings to provide a broader understanding of what these findings mean and their associated implications for future practice and design.

7.2 Process workflow

The first research question in this study sought to examine the activities involved in processing crisis information. In addition to this, the question sought to determine how volunteers ensure that the information product they provide is good enough for humanitarian organisations and aid workers consumption. As demonstrated in Chapter 5, analysis of the empirical data revealed five (5) distinct activities involved in processing crisis information. These activities are: 1) Monitoring & Activation, 2) Listing, 3) Listening & Verification, 4) Amplification, and 5) Reporting. Interestingly, such list of activities appeared in every disaster response studied in this research. The distinctiveness of each activity is identified and defined through an interpretive frame of Activity Theory. The approach allows for the classification of each phase through the number of actions, operations and outcomes involved in each activity. It is in the light of these findings; this section will discuss some critical insights derived from the first research question.

7.2.1 Response Workflow Model

Having identified the activities involved in processing crisis information, this study proposes an analytical framework for understanding digital volunteers' response process workflow. The proposed workflow as shown in figure 7.1 holds the essential steps to understanding digital disaster response activities. These steps were carefully analysed and cross-checked across eight (8) disaster types in thirteen (13) countries during seventeen (17) response operations as explained in the finding section. The conceptualisation of these phases gives an exciting insight into the activities of HR. This model is high-level enough to allow academics,

practitioners and system designers make sense of HR's response workflow. At the same time, it provides detailed interpretations of each step in the process and how they are dynamically and reciprocally related to one another. The proposed model is both flexible and scalable in such a way that it can be followed as a roadmap and applied in different contexts across diverse disaster types with different impacts and scales. This scalability covers the disaster type, impact, affected region and the country. The disaster impact refers to the number of casualties, property and infrastructural damages. The affected region could be isolated communities or urban areas. Countries could take the form of developed or developing nations since the HR response lies entirely on the information available online and the emergency response system of the country in question.

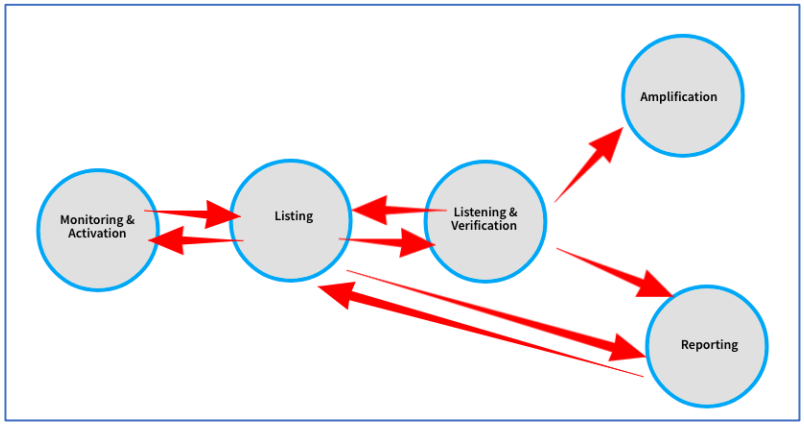


Figure 7.1. Response workflow model.

Figure 7.1 provides a broader view of the activity phases involved in processing crisis information across disaster types by HR volunteers. Regardless of the type of response HR is providing - Green, Yellow, Red - the initiation phase begins with Monitoring & Activation and connects directly to the Listing phase. If the activation is declared to be Green, the response workflow will be in sequence. For example, the process will entail listening and verification of crisis information. Once volunteers discovered and verified urgent needs or official information, it will be amplified and later reported. However, if the activation is Yellow, Listing activity will connect to Listening & Verification phase in a back and forth manner. If the event is Red or was in Yellow and later escalates to Red, the listing will connect to both the Listening & Verification phase as well as Reporting Phase. At that stage, the activity will involve adding the resource list to the Sitrep (Google Docs). At the Listening and Verification phase, the response workflow connects simultaneously to both amplification and reporting phases until the disaster desk asks the volunteers to stand down.

As noted in the literature review, past studies that examined workflow on the use of ICTs in humanitarian emergencies tended to cluster around Volunteered Geographic Information (VGI) and Management Information Systems (Bui and Sankaran, 2001; Bui and Tan, 2007;

Sebastian and Bui, 2009b; Sell and Braun, 2009; Schade *et al.*, 2010; Ostermann and Spinsanti, 2011). Unlike in this study, most of these studies are technical and typically focus on studying decision support systems alongside their development and deployment. However, this workflow model shares some commonalities and differences about task initiation and completion with most of these earlier studies. In this workflow, I highlighted that volunteer crowdsourcing activities began with the monitoring and activation of the disaster desk. Later, the activity will move into the listing phase. From the listing phase, the activity will keep moving in back and forth manner to the listening & verification as well as amplification and reporting phase. By juxtaposing this workflow with that of Ostermann and Spinsanti (2011) in which the authors evaluated the credibility of Volunteered Geographic Information (VGI), one can observe some similarities and differences. For example, Ostermann and Spinsanti's conceptual workflow includes four steps that begin with 'retrieval' and move through 'processing', 'integration' and ended at the 'dissemination' phase. At the retrieval phase, the system retrieves relevant social media and other disaster information using keywords. Next, when the data is retrieved, the workflow will continue with the processing phase where the location and source profile data will be picked and later use to determine relevance, credibility and analysis of the information. The workflow will then continue to the next phase (integration) in which the output generated from the processing phase will be combined with the information from official and authoritative spatial data infrastructures. Lastly, the result of the integration will then be shared (disseminated) across the stakeholders. In other words, both workflows have initiation and completion phases. The phases also share some commonalities. For example, the listening & verification phase in this workflow can be likened to Ostermann and Spinsanti's second and third phases, and their final phase also can be likened to the reporting phase in this current study. Both studies also aspire to evaluate the credibility of the information produced using crowdsourcing. However, the parting point is that the central concern of this PhD study is offering insight into the activities involved in processing crowdsourced information from digital volunteers related to social media and data aggregation communities while their studies focus was on the Volunteered Geographic Information (VGI). The next section will move on to discuss elements of the standard procedures used in producing crisis information as a form of aid.

7.2.2 Professionalisation and Awareness of Humanitarian Principles

A closer and thoughtful look at the findings of this study could potentially reveal some elements of professionalisation and knowledge of awareness of humanitarian principles with regards to the activities involved in processing crisis information. This outcome is contrary to

some earlier studies findings positing a 'marked lack of understanding of operational aspect of emergency response' (Morrow *et al.*, 2011, p. 25) and being less equipped in respect of understanding their boundary of operations (Foran *et al.*, 2012; Sandvik *et al.*, 2014). Others have argued about a lack of professional training and an inability to maintain a professional standard (Resor, 2016). In the finding sections, this study identified the following:

a) As a good practice, HR encouraged it volunteers to subscribe to PDC, GDAC, NWS, NHC and USGS alert notification systems. According to HR officials, the sites tended to provide a more reliable source of information compared to news agencies and online breaking news site. In certain circumstances, these sites are considered to be part of the US government official source of disaster information. Therefore, by choosing to use the ENS provided by these sites and upholding the culture of 'verify X2', it implies some levels of standards and professionalism among the work of HR and its volunteers. Such type of approach and practice may likely be absent among spontaneous and unaffiliated groups.
b) Volunteers receive reminders to use the pre-made tip sheets and checklists prepared by HR while responding to disasters.
c) The existence of a standing committee called DDWG that deliberates and decides on the type of response HR will provide during response operation also implies an element of professionalisation and standards.
d) The continuous development programme institutionalised by HR which include training and internal drill exercise. Some of these programmes allow for skilling, reskilling and upskilling of volunteers' proficiency in responding to the different type of events. Moreover, the fact that external partners invite HR to provide training and participate in exercises such as Pacific Endeavour Exercise as discussed in Chapter 4 suggests the recognition of their activities and added credibility of their work as subject matter experts in the field of the digital disaster response work.
e) The gate-keeping culture of allowing people to have access to their Skype operation rooms only after attending HR internal training and understanding its operational rules as well as signing its code of conducts. This code of conduct demands a volunteer to abide by its principles of safety, lawfulness, responsibility, good fellowship, loyalty, and integrity. Also, the code requires the volunteer to pledge and agree with UN humanitarian principles of neutrality, impartiality and humanity. By doing so, HR ensures that only trained volunteers are allowed to join their response efforts. A provision such as signing a code of conduct and attending important training is consistent with laid down criteria for several national and international professional organisations.

f) The decision to include campaigns of sharing survival tips, reassurance messages and cautionary messages in their response workflow during operations is another step towards making themselves subject matter expert in digital disaster responses sphere. The campaign targets and encourages the global online public to share only verified facts from official sources as well as discourages sharing photos and locations of emergency workers. By embarking on such campaigns, HR volunteers differentiate their conduct with that of an unaffiliated and spontaneous group in the aftermath of the Boston marathon bombing for crossing the ethical lines.

The above attributes imply understanding and awareness of humanitarian values, knowledge areas and level of skills proficiency. These attributes are what past studies have described as a core set of competencies required by humanitarian actors (Walker *et al.*, 2010). A possible explanation for the submission of some past studies that argue about 'marked lack of understanding of the operational aspect of emergency response' and 'being less equipped in respect of understanding their boundary of operations' may be due to the lack of broader understanding of the different roles community of digital volunteers play. For instance, some of the studies criticising lack of professionalisation and standards focus mostly on exploring the crisis mappers activities (Morrow *et al.*, 2011; Resor, 2016). This lack of a broader understanding of the work of different digital volunteer communities could also offer a clue to the possibility that digital humanitarian literature is yet to recognise the existence of emergency telecommunications communities (ETC).

This community, as argued in Chapter 2 Section 2.3.2, provides a different type of service to other digital communities. However, their activities have not been captured in Milner and Verity (2013) or Gorp's (2014) classification of Digital Volunteer Communities. A possible explanation could be either the group's impact has not been noticed when they first emerged, or that such communities have not aligned themselves with the Digital Humanitarian Network as at the time of publishing their studies. Against this background, an opportunity exists for updating Gorp's (2014) taxonomy to incorporate Emergency Telecommunication Communities. This community is distinct in their activities and the scope of their intervention. From the Gorp's (2014) delineation of these communities, software platforms and development communities' activities' include the development of tools and providing platforms for responding to disasters. Mapping communities focus on providing a live crisis map to support aid agencies and responder organisations. Expert networks provide specialised services such as translation and statistical analysis, and Data aggregation communities offer information as a form of aid through processing crisis information shared on the internet and social media platforms. Likewise, Emergency Telecommunication Communities as identified through this study (Chapter 5, subsection 5.3.3) focus on providing

rapid response telecommunication services to affected communities where infrastructure is no longer accessible. With this proposition, the updated taxonomy will include the ETC as shown in Figure 7.2 below.

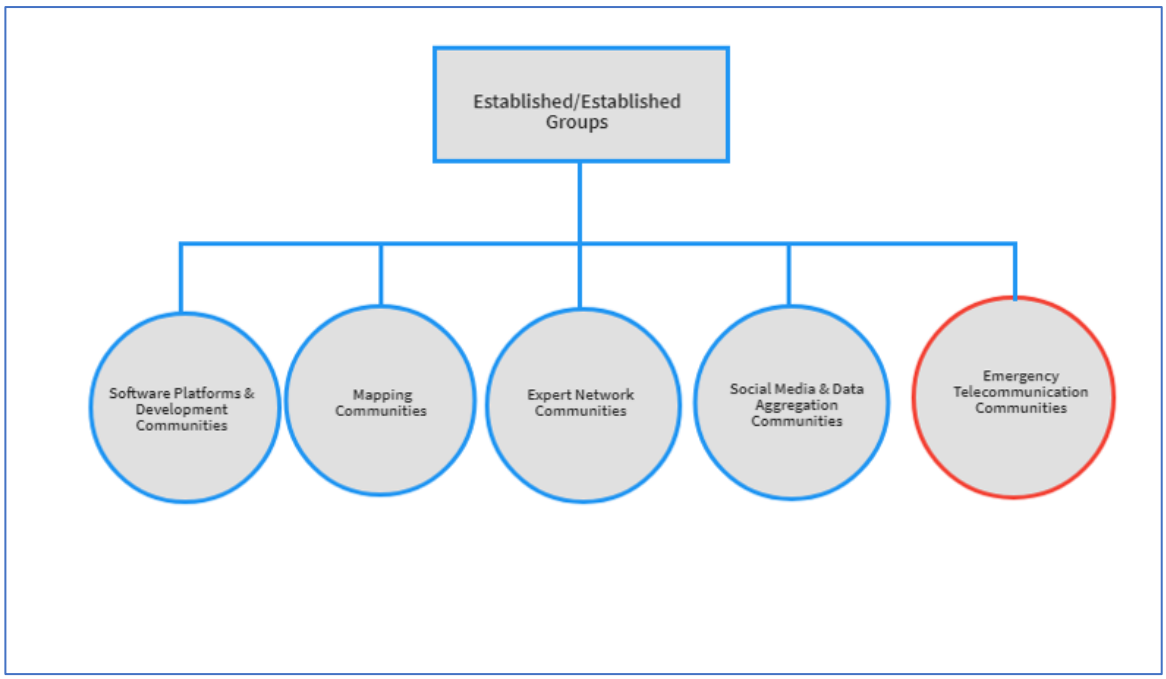


Figure 7.2. Extended Digital Volunteer Communities Taxonomy

7.2.3 Data Quality Assurance Measures

Section 7.2.2 of this chapter provides insights into the first segment of the first research question. This section covers the second part of the first research question that sought to determine how the process involved in ensuring the information product provided by HR is deemed to be good enough for use by humanitarian organisations. As demonstrated in Chapter 5 subsection 5.4, analysis of the empirical data revealed an established in-house process/practice of verifying the credibility of the crowdsourced information. Depending on the type of information source, the process starts by classifying the information to determine whether it is official, unofficial, trusted, untrusted, or it belongs to an unknown category. As soon, as the class of the information has been determined, volunteers will verify the content of the information (text, links, pictures, videos) against the date, day, time and location of the event based on some established procedures. Following that are the two-verification phases in which in the first phase volunteers subject the content against the day, date, time and location. If volunteers believe the information shared falls within the day, date, time and location, then, the verification will move to the next phase. Depending on the category of the information, volunteers will subject the content to HR in-house validation procedures. These procedures

include ‘verify X 2’ in which volunteers are supposed to track the information from 2 or more independent sources. If volunteers are successful in establishing a 2 or more independent source, then they will be encouraged to check the location of the sources. In trying to verify the location of the person sharing the information, volunteers will be interested in knowing about whether that person is within the location where the incident happened or was previously a resident in the area. In some circumstance, volunteers will try to find out whether the person sharing the information has a relative or someone related to living in that location. The trust usually increases when volunteers discover that such a person is an eyewitness or currently within the location of the event or in some circumstances has the previous history of living in the area. Also, volunteers combine their verification with the use of tip sheets or human and machine translators in some specific circumstances to make sure that the information is verified and is considered good enough for amplification and reporting.

Having recapped the findings of the second part of the first research question, it is important to deliberate on what these findings mean in the light of the earlier studies as discussed in Chapter 2 subsection 2.3.3. As pointed out in Chapter 2, several dimensions have been proposed upon which information quality can be understood. For example, such dimensions include the credibility of the content sharer, the link contained in the message, information up to datedness, the degree of dissemination and the location of the user-generated content (Ludwig *et al.*, 2015). Other vital dimensions consist of independent confirmation of the information, factoring the proximity of the source to the situation and in-depth local knowledge (Coleman, Sabone and Nkhwanana, 2010; Latonero and Shklovski, 2010; Shanley *et al.*, 2013). By juxtaposing these dimensions against the HR established verification criteria, one will discover a close match between those dimensions in one hand and HR procedures on the other hand. Understanding the credibility of the content sharer and the link contained in the message dimensions are among the first thing HR volunteers determine as soon as they stumbled or data-mined crisis information. They do so by looking at the source of information. If the volunteers discovered that the source of information, does not fall under official or trusted source, the next step is to verify the content of the messaging – photo, links, videos – using other steps as demonstrated in Chapter 5. Determining up-to-datedness takes effect at the first phase of validation in which the information will first be verified against the day, date and time. Likewise, determining the degree of dissemination takes place at the ‘verify X 2’ stage as demonstrated in Chapter 5, Excerpt 5.13 and Figure 5.12, in which volunteers will look at the source of information to determine if it ties to one person. As such, HR ‘verify X 2’ two procedure addresses the dimension proposed by Ludwig et al., (2015) that seeks to determine the degree of dissemination. Other dimensions such as the location of the user, the proximity of the source as well as local knowledge have all been captured in HR verification process (Figure 5.12). This step comes up after the content passed ‘verify X 2’ scrutiny. The next step

is to check the location of the person sharing the information. If the location is local, the degree of trust is improved, otherwise, the next step is to check on whether the person sharing the news has history or connection with the location. Therefore, it can be assumed that HR internal verification procedures tally with some dimensions set forward by the earlier studies on determining the quality of social media crisis information. Against this, a conclusion can be drawn that there are visible manifestations of some elements of quality standards in the activities of HR and its volunteers in processing crisis information.

In addition to the above discussion on dimensions for assessing the quality of social media data, there is also a need to interrogate further how did HR, as an organisation, develop such procedures? Have they been deriving their inspiration by consulting literature or attending external training? The answer to this is such procedures evolved because of field experience in digital disaster response. HR has been responding to disasters since it was established in 2010. Analysis of the internal documents revealed that such knowledge was developed from HR's culture of documenting lessons learnt from after-action review of some of its major response operations. Other possible reasons include its continuous engagement in in-house internal drill exercises as well as its desire to leave marks on the field of practice and align with the larger ecosystem of emergency response (Starbird and Palen, 2013). Altogether, the development of verification procedures could be said to evolve partly because of frontline experience, continuous improvement programme and the urge to be recognised as the subject matter expert and global leaders in digital disaster response. Following on from this, the discussion will now turn to examine the collaborative and social computing activities performed by volunteers while responding to humanitarian emergencies.

7.2.4 The social organisation of collaborative work

Coordinating disaster response among HR volunteers constitutes a series of actions and operations. As shown in Chapter 5, before the commencement of any response operation a decision must be reached by DDWG to determine the type of response HR will provide. It is also part the DDWG's work to determine specific deliverables for the response effort. It is a common practice for the SMIC who chairs the DDWG to inform volunteers that HR will publish the first SitRep for the response operation at 10:00 PM EDT. Likewise, the announcement sometimes will urge volunteers to concentrate on finding information on specific territories as shown in Chapter 5, Excerpt 5.1. During a significant event, the DDDWG decides typically on the name to call the operation. For example, HR named its response effort during Hurricane Matthew as Operation Atlantis. When the response operation begins, SMICs will be coordinating the response through a series of the announcements, and reminders on what needs to be done in specific areas that require intervention. For example, in the Listing

phase, the SMIC will encourage some volunteers to concentrate their work in finding information on health facilities, while others will be encouraged to work on embassies, telecommunication companies, emergency management organisations and relief agencies among others. At the Listening & Verification phase, some volunteers will be encouraged to data mine isolated communities, while others will focus their attention on providing information about reunification and data mining urgent needs. When it comes to Amplification, some volunteers will be asked to take the role of posting information to HR Twitter account, while others will work on Facebook or Instagram. However, how SMIC work out whom to do what while responding depends on the available volunteers, their skills, knowledge of contexts, and the nature of the response – slow moving or sudden. This type of approach in which the coordinators have a clear understanding of who will do what and when is what Kreps and Borworth (2007) described as formal organising as discussed in Chapter 3 subsection 2.3.1.

Alongside the coordinating efforts of SMICs, volunteers typically announce what they are working on to make other volunteers aware of this. The essence is to allow for cooperation and avoiding duplication of efforts – a central concern of CSCW. Excerpt 5.11 from Chapter 5 offered a glimpse of the importance of such an announcement when a volunteer made it known to everyone about what he was working on:

> [20/02/2016, 23:23:17] HR Javon Malone: Trying to track down info on the Nadi International Airport, saw a report from a reporter that building are fine but runaway may be blocked. I have tweeted him to get further details or a source

Following HR Javon Malone's announcement, the ensuing chatter indicated two other volunteers were also monitoring the account in which the first volunteer is monitoring. Thus, one can suggest that the announcement made by Javon has helped in bringing awareness among volunteers so that others can focus on a different area. Likewise, the announcement helped in generating dialogue among the three volunteers, which led to a decision on not to use his information.

Conversational exchanges between HR volunteers during response operations are also characterised using hedging, reinforcement, self-correction, and moderation. Experienced volunteers tended to begin their messages with some phrases or terms such as '*Heads up*' '*This is not verified*', '*This is Fake*' as illustrated in Excerpts 5.8, 5.16, and 5.17 respectively. This is to possibly bring the attention of their fellow volunteers to be mindful of the type of content people share during a crisis or to remind them of the need always to verify information. Likewise, HR's collaborative work is characterised by motivation and reinforcement phrases. The use of emojis and phrases such as '*thanks*', '*good job*', and '*thumbs up*' among others, to acknowledge the effort of volunteers permeates the collaborative activities of HR. In a like

manner, the conversational exchange among the volunteers is characterised with moderation and self-correction. For example, when volunteers were deliberating on the NHS England WannaCry cyber-attack incidence without providing an official link, a volunteer asked a question politely "*Would we consider this verified info*?". By asking such a question, the volunteer was indirectly moderating the chatter. Following that, another volunteer retorted that "*it was posted on the BBC News page*'. Another volunteer mentioned that "*Its been reported by some outlets*". However, on realising the standard protocol had not been observed, the second volunteer quickly went and found the report from official sources and shared it in the window. In summary, the activities are characterised with task delineation, shared awareness, reinforcement, collaborative authoring, teamwork, and self-moderation among the virtual team which are the central concern of the CSCW.

7.3 Use and appropriation of collaborative tools and platforms

Concerning the second research question, this study sought to determine how the appropriation of collaborative technologies can contribute to the success and failure of volunteers' participation in response operations, and how such tools work in practice. As detailed in Chapter 6, volunteers' appropriate collaborative tools and platforms as a means for providing information as a form of aid. Specifically, the chapter documented the use of Google Docs, GroupTweet, Skype, Twitter and translation tools in terms of how their appropriation helped and constrained their response efforts. Specifically, the chapter documented the use of Google Docs, GroupTweet, Skype, Twitter and translation tools. The appropriation of these tools provides both benefits and challenges. For example, these tools and platforms enabled volunteers to coordinate activities and communicate with fellow volunteers, aid agencies, EMOS, disaster-affected communities and global online public. Also, volunteers take advantage of the tools and platforms to collaborate with partners when the need arises, and co-author reports. The tools enabled volunteers to share situational awareness information as well as allow for volunteers to manage and administer organisational resources. On the other hand, the appropriation of these tools also come with challenges that are user-based challenges, system-based challenges, symptomatic challenges and process-centric challenges.

Based on the above findings, it is worth taking a reflective stance to ask some questions about how this work builds on previous studies. Likewise, different countries have varying socio-historical, cultural, and political contexts, so how might this factor into the story being told here?

In answer to the above questions, this study shows that HR and its volunteers experienced difficulties associated with the restructuring and organisation of information in Skype. For example, difficulties arising from the amount of information shared through Skype is in line

with Kaptelinin's (1996) work on the appropriation of technology among Mackintosh users. As discussed in Chapter 2 (subsection 2.3.5), the author established that the users have problems with structuring file systems, and challenges in reorganising information that has been captured into the system. Other challenges include a mismatch between the system's persistence in keeping information in one place and a user's understanding that information can be placed in different locations and can play different roles and tasks in certain circumstances.

Equally important, findings from this work are in accord with previous studies that reveal how the use of technology enables users to recreate, adapt and develop new patterns of action for work and interaction. Through Chapter 4 and 5, this study has revealed the new patterns of action for work and interaction. For example, volunteers enacted the use of emojis, abbreviations, and hedging among others as a form of communication pattern and inculcate the culture of 'verify X 2' with the purpose of providing good enough information. This study supports evidence from previous work that argues about Twitter as a predominant data source in disaster response (Reuter and Scholl, 2014; Reuter and Kaufhold, 2018). Other areas in which this study corroborates with earlier work is on how the use of technology influenced the transfer of social behaviour into the virtual space. This type of use reflects those of Mark and Seeman's (2008) who also found that the use of virtual meeting has made interactions far more personal with non-work-related issues such as 'dress preference', 'potential vacation destination' among others. Furthermore, it corroborates with Mark, Al-Ani, and Semaan (2009) findings that suggest how virtual team members reconfigure their social life by transferring their social behaviour into the web space. Similarly, the creation of Café Skype window as documented in Chapter 4 subsection 4.6.1, in which volunteers socialise and exchange personal information provides a glimpse of how technology extended interaction beyond the digital disaster response work. By its creation, the Café has, to some extent facilitated the creation of a sense of community among volunteers where personal matters such as relationship, birthdays, bereavements, changing jobs and migrations among others are discussed freely from time to time. In essence, the creation of Café has made interaction to be personal which is beyond the initial purpose of disaster response work.

This study also takes into consideration the differences in socio-historical, cultural, and political contexts across countries. It was for this reason that in Chapter 3 subsection 3.7.1, I argued about the justification for the identification and choice of cases used in the thesis. The choice, as highlighted, was to uncover whether the type of response operations provided by HR differs from one country to another. This decision was made to cover thirteen countries across eight different disaster types to find out whether there exists any difference in the process workflow, use of technology or factors that enable and hamper the activities of HR

volunteers. As documented in Chapter 5 and 6, the findings revealed a consistent process workflow across all disaster types in which the study covers. However, the findings also revealed a stark difference in digital disaster response *readiness* across developed and developing nations. The discovery of such differences in digital disaster readiness presents an exciting implication for researchers, developing nations and disaster practitioners. For example, researchers can begin to think of how to establish a benchmark for digital disaster readiness by studying digital disaster ready nations and comparing them with the available online information on the developing nations. Likewise, developing countries can learn from the study insights on the capabilities and constraints of the available tools and how such tools and platforms can augment their work. It is also possible for practitioners to learn how to improve their response workflow by developing information resources list of disaster-prone countries. By forming such resource list, volunteers will not have to spend time in the event of any disaster to work on producing a new list. This has the potential of reducing the process workflow by eliminating the listing phase as discussed in Chapter 5 subsection 5.3.

It is worth pointing out that since ethnographic findings are time-dependent and technology changes at an unprecedented rate, a central concern that might arise is on how is the key findings related to the use and appropriation of technology be valid in the light of the of the volunteers' disaster response work? The question raised here is vital since both HR, and its volunteers make use of a different range of tools and platforms, and from time to time they adapt to new ones and abandon the use of old ones. For example, in subsection 6.2.1, it was reported that HR abandoned the use of WordPress when they discovered that Google Docs provides more collaborative affordances while authoring SitRep. In section 6.2.2, it was shown that HR volunteers quit the use of GroupTweet because of its inability to pick tweets shared by the volunteers. Likewise, 6.2.5 features the practices of use associated with translation tools such as Google and Bing Translate. Against this backdrop, it can be argued that there is no doubt that development of collaborative tools and enhancement of translation tools will make digital volunteers work more efficiently, but the general approach to the response workflow will continue to be the same for a long time to come except for listing activity. The reason for this is that regardless of how sophisticated and smart technological tools and platforms became, the activation of response operation will always start with the receipt of notification about the sudden onset or slow moving of disaster. However, it is possible that technology can be developed in the nearest future that can crawl the internet to curate addresses and social media handles of critical emergency response stakeholders so that the listing activity can be eliminated. But as for the listening, verification, amplification and reporting, these activities can only be optimised in terms of time taken to data mine, verify, organise, share, curate and disseminate such information.

Moreover, even if the precision of translation tools become more reliable, there is a tendency that not every language can be captured and translated. As such, the need for human translators cannot be eliminated. Against this, it can be argued that the technological advancement can only improve the efficiency of the response, but the workflow could remain nearly the same for a long time to come with the possible exception of the listing stage.

7.3.1 Challenges in the use of collaborative technologies

In Chapter 6, I highlighted a wide range of benefits and challenges of using collaborative technologies. The chapter concludes by categorising these challenges into four groups. These challenges include a user-centric, process-centric, developer-centric and symptomatic challenges. The user-centric challenge is described as a type of challenge that evolved because of cookies and caches interference or poor internet connection from the side of the volunteers. Process-centric refers to challenges that arise because of the process put forward by HR in conducting its operations. Developer related challenges evolved due to design enhancement while symptomatic challenges arise because of the pressure imposed on the systems. Having explained how each challenge evolved and highlighted approaches HR and its volunteers managed to use while overcoming some of these challenges, this section will provide a more extended discussion on some areas related to process-centric challenges. The discussion will centre around information management, media 'stickiness' syndrome, trust and privacy, as well as communication and culture challenges. Two considerations influenced the decision to focus on the process-centric challenges rather than covering all other areas. First, issues surrounding developer centred challenge and symptomatic challenges are problems that HR or its volunteers have no direct control or significant influence in providing an immediate solution to it. Related to the previous challenges, User-centred challenges appear to be a straightforward approach and therefore does not require further elaboration. Second, providing insights into the activities of volunteers is among the primary concern of this thesis. As such, providing an extended discussion on the process-centric challenge is therefore in fulfilment of the objective of this study.

7.3.2 Skype information management challenges

Previously, I highlighted the wisdom for creating event-specific windows in Chapter 4 subsection 4.6 and Chapter 5 subsection 5.3.2. According to HR President, one of the reasons is to manage information overload. Again, in Chapter 6 subsection 6.2.3 excerpts 6.11, I showed that the challenge continues to persist. Nonetheless, as vital as this strategic approach of creating an event-specific window, such an approach will, in the long run, create an information overload challenge. The question is how does creating event-specific windows contribute to information management challenges in HR?

In providing answers to the above question, there is a need to provide context for the problem. For example, the analysis of HR response activities from 2010 to 2016 has revealed that HR volunteers responded to 95 major events out of 910 response operations. By implication, this suggests the possibility of having 95 existing inactive windows. Also, by adding these windows to the four main Skype windows along with training, internal drills and committees' windows, users will be inundated with too many windows. Managing such windows along with other useful response chatter could, in the future become challenging for HR.

The growing number of HR Skype windows has made it difficult for individual volunteers to search and locate information quickly. It is sometimes confusing even to determine which window to search since a general search can reveal several inactive windows with potential answers. Not only that, the creation of event-specific windows has made my work as a researcher difficult to quickly access information. This has a long-term implication for future researchers that will undertake longitudinal research on the activities of digital volunteers utilising Skype as their core platforms.

A related challenge that may affect the smooth running of the social organisation of HR's response work is that during a major event, some volunteers find it difficult to stick to the rule of posting information into the right window. For example, information that is supposed to be sent to an event-specific window will find itself in the Urgent Event window or information that is meant to be posted to Work Diary window is sent to the Useful Links window. This type of posting brings confusion and loss of conversation flow. Likewise, the flow of conversation tended to be difficult to follow when it involves a large number of volunteers discussing different issues simultaneously. Such confusion will become more profound when some of these volunteers ignore the protocol of using '@' sign or Skype's 'reply to message' button when responding to specific chatter or referring to a specific request. By and large, the inability of some volunteers to maintain the culture of posting information to the right window or use '@' sign or Skype's 'reply to message' button when responding hampers, the smooth running of HR activities. The next section will discuss the challenge associated with the use of Skype as the only HR central command and control tool.

7.3.3 Media 'stickness' syndrome

As mentioned in the literature review section, 'media stickness' is the "tendency for a group of users to collectively stick to one type or style of media use and not switching to another "(Huysman et al. 2003: pg. 431). The author argues that steps taken in adopting tools by a virtual team in its early formation stage have tended to constrain later flexibility in adopting new tools. This type of tendency, as espoused by Huysman et al. (2003), is partly observed in HR. As demonstrated in Chapter 6 (subsection 6.2.3), HR does not have a backup plan to use when Skype service fails. As stated, during the field observation, Skype service was disrupted

five times. Despite such experience and having discussed the matter in one of the meetings that sought to find an alternative, HR has still not come up with an alternative.

From this, it is plausible to attribute such tendencies to 'media stickness' syndrome (Huysman *et al.*, 2003) to some certain extent. However, looking at the issue more deeply may provide an alternative explanation beyond 'media stickness' syndrome as espoused by Huysman et al.'s (2003). This is because there are some pieces of evidence to support the observation that HR has been adopting and adapting tools and platforms whenever it sees potential that they can improve their response process. For example, in Chapter 6, (subsection 6.2.1 excerpt 6.1) it was shown how the adoption of Google Docs improves the HR response process. Other instances include where HR adopted the use of Team Kinetic – a volunteer management portal and Ispring (presentation software) for managing volunteers and making presentations respectively. Therefore, a possible explanation might be that HR is hesitant to use alternative platforms because Skype is the preferred channel for most of the HR response partner organisations. As such, switching to other platforms such as Slack or Facebook Workplace might create a barrier with HR partners such as TWB, SWB, and SBTF among others when undertaking surge operations.

7.3.4 Trust and privacy challenges

Prior studies that have noted the importance of trust described it as a critical factor for the success of group activities (Panteli and Tucker, 2009). As noted in the literature review section, trust is the prerequisite for the existence of any group (Dunn, 1984). It is also trust that enables teams to achieve better accomplishment in task performance and the ability to cooperate with one another (Jones and Marsh, 1997). The findings of this study can reveal how the existence of trust helps in building and maintaining the cooperative work between HR and its volunteers. For example, in Chapter 6 (subsection 6.2.4 excerpts 6.6), a high-ranking member of HR revealed how she shared the Twitter password with a volunteer when GroupTweet failed. Likewise, it is a trust that made HR to grant access to some strategic resources such as Event Status Work to its volunteers. As commendable as this healthy relationship, one needs to ask a simple question about where the boundary of trust starts and ends. This question is pertinent more especially at this time when the new General Data Protection Regulation (GDPR) in Europe demands better data management for the organisations, businesses and bodies that handle personal information.

The reason for asking such a question arises because at some point there is a need to protect both parties. For example, shall trust alongside HR data protection policies and Non-disclosure Agreement (NDA) serve as enough safeguard for protecting HR intellectual property and other strategic documents? This in my view is critical bearing in mind that some people come to HR to learn about their work and then leave the organisation (as mentioned

by the HR President, Chapter 4.5). On the other hand, volunteers' privacy needs to be closely safeguarded. However, even though there are levels of access control, the present arrangement does not restrict volunteers to access other personally identifiable information of their fellow volunteers. As such, this presents a source of concern about volunteers' privacy. By and large, while trust must be reciprocal to allow for team building, both HR and its volunteers must devise a complementary mechanism in which an organisation's intellectual property and volunteers' privacy will be safeguarded.

Another interesting angle on understanding trust as an essential theme in this research relates to the strategic approach in which HR is negotiating its place within the realm of the international humanitarian system. It does so through engaging itself constructively with relevant and critical stakeholders within the humanitarian circle at both local, regional, state and global level. This strategy includes taking a leading role in attending international humanitarian summits, conferences, exercise and campaigns as well as authoring white papers and policy documents. Other activities include participating as members of an Information Management Working Group of the UN – OCHA, National Voluntary Organisations Active in Disasters, Home Land Security Social Media Working Group for Emergency Services and Disaster Management Subcommittee, FEMA Tech Sector and Weather-Ready Nation among others. Moreover, HR provides process improvement services to system designers and technology developers through tool testing. Against this, by taking part in the committee membership work, attending conferences as well as participating in international drill exercise, HR is indirectly building credibility and situating itself as a subject matter expert from emergency response stakeholders. This has the tendency to earning trust from all ranges of emergency stakeholders which, according to Tapia and Moore (2014) "in the sphere of emergency response, trust in people trumps trust in information (p. 508)".

In addition to the approach mentioned above, analysis of the field data suggests an implicit approach for safeguarding the reputation of HR work. For example, in excerpt 5.11 when a volunteer (HR Aline Carr) realised the information she shared was not from a credible source, she deleted it. This suggests an element of online reputation management to safeguard the credibility of HR. Related to this, is the implementation of cyber security audit of the devices of its social media listeners they used in logging into HR's Twitter, Facebook and Instagram accounts. The essence is to mitigate any malicious malware that can cause reputational damage to HR. For HR, a good reputation is a dimension closely linked to trust. It is against this; HR has a policy of sharing only stuff associated with preparedness, response and recovery that can help disaster victims to survive, sustain and reunite.

7.3.5 Communication challenges

Speed of access to information is a critical factor that affects the functioning of collaborative work in a global virtual team. The problem arises when some virtual team members have more access to information than their colleagues (Cramton, 1997). The speed of access challenge (as espoused by Cramton 1997 in his study of global virtual teams) remains relevant to understanding the dynamics of virtual teams. It can be counted as one of the factors that made HR volunteers from developing countries less active when compared to other nationalities. A possible explanation might be due to the lack of stable electricity in which access to information hinges. As someone who was born and bred in a developing nation, I can share my perspective from that vantage point. In developing countries, most households are not connected to the internet unlike in developed nations where internet connectivity is generally not an issue. In developed countries, most of the internet bills are paid monthly whereas in some developing countries the billing depends entirely on what someone can afford. As such, individuals must make personal arrangements to buy internet data. Because of the costly nature of the connectivity, many people switch their data off when they are not browsing to minimise unnecessary data 'wastage'. As such, this approach limits the input of volunteers in contributing to the overall response operation. This limitation might be due to the lack of electricity that powers the PC or the mobile phone of the volunteer. It might also occur because the volunteer has run out of the internet data since not everyone can afford an unlimited subscription. For some of these reasons, volunteers sometimes cannot stay longer online while contributing to the response operations or respond to requests as at the time their help is much needed. Based on this, it can be said that this study is consistent with Cramton (1997) finding that differences in speed of access to information can affect the overall functioning of a virtual team.

Related to the problem of the differences in speed of access to information is another challenge that is associated with the cultural and informational dimension of the social aspect of communication in HR. Over time, the virtual team tends to develop distinct communication patterns as noted by earlier studies (Huysman *et al.*, 2003). This manifestation has also been observed and documented in this study. Specifically, Chapter 4 (subsection 4.6) provides an overview of HR volunteers' social interactions and their distinct communication pattern. The section discussed the creation of Café in which volunteers "hang" out to relieve tension, throw jokes, and discuss social issues. On the positive side, the creation of Café could be described as a fulcrum that serves as a motivating factor for volunteers to remain active in the organisation. The pleasurable exchanges make the Café lively and appear to indirectly motivate people to want to hang out. On the flip side, much of the exchange in the Café is heavily skewed with a discourse based on western values and cultures. This is problematic for volunteers that have never been to the west or exposed to its culture, and such type of discourse

may sound uninteresting and not so funny at all. For example, to some volunteers discourse about 'sunshine', 'swimming', 'vacation', 'fruit and chocolate', 'national watermelon day', 'cat versus dog person', 'Starbucks coffee' may not possibly sound appealing. As such, this could make some of these volunteers from the other side of the world to withdraw or remain inactive. In any case, the domination of social exchange based on a one-sided cultural perspective may affect the social cohesion of a virtual team.

7.4 Implications

The previous sections (7.2 and 7.3) provide an interpretation and new understanding in the light of the findings from the two research questions. In the remaining section, I will attempt to discuss the implication of the findings concerning this study. However, before doing that, there is a need to put this study in context by asking some more questions about the relevance of its findings. Against this background, it is essential to ask why anyone should care about this study and how is this study different from previous ones.

To start with, it is essential to understand that during emergencies "people need information as much as water, food, medicine or shelter" (IFRC, 2005, p. 12). However, there is a growing misunderstanding and mistrust about the work of these volunteers who provide information as a form of aid. Regrettably, such misunderstanding and mistrusts are exacerbated by instances that cannot be dismissed easily as inconsequential. For example, the involvement of emergent volunteers in a virtual crime scene investigation that led to the misidentification of an innocent passer-by as a suspect (see Chapter 2 subsection 2.3.3) could be a reasonable justification for this mistrust to some people. Similarly, the 2018 Cambridge Analytica scandal has further worsened people's trust in user-generated information. On the flipside, the findings from this study have documented some positive aspects of these volunteers' work. For instance, through Chapter 5 this study has demonstrated instances where social media users referred people in need to HR for help as illustrated in Figure 5.3. Likewise, Figure 5.4 and 5.5. shows how HR reaches out to people in need by providing information as a form of aid. Therefore, by highlighting their work practices on processing crisis information, this work will contribute to the sociotechnical debate on the information quality and credibility of their information product.

Equally important, by bringing to light the work of HR, there is a potential for governments in developing nations to partner with such organisations on areas related to preparedness, response operations, resilience, process improvement and digital disaster readiness. This is because past studies have shown that 80 to 90 per cent of disasters that frequently occur at the global level takes place in developing countries that lag in most dimensions of modern life (Quarantelli, 1997). Additionally, bringing the findings of this study will shine light about the work of established communities to the global online public so that they will know the right

channel to look for help when the need arises. Previous studies have shown during disasters, people will employ every available means to find information from all manner of sources that will help them to satisfy their needs and inform their actions (Taylor *et al.*, 2005; Sorensen and Sorensen, 2007; Sutton, Palen and Shklovski, 2008). Against this background, the findings of this study along with others can serve as a basis for preparing on how to seriously synergise the activities of digital disaster organisations within the realm of the international humanitarian system. Having provided justifications for why this study is essential, the next paragraphs will argue about the distinctiveness of this work.

The distinctive nature of this work can be understood from two perspectives. First, unlike previous studies, this research work has taken a holistic approach to study different disaster types of various scales, across continents over a more extended period. Specifically, the study covers both natural disasters, non-community crisis as well as conflict type situations across thirteen countries of varying infrastructural densities and resilience. Equally important, the study utilised different data sources ranging from field notes, digital records of the case study organisation, Skype chat logs and interviews. Together, this allowed for generating a 'thick description' of volunteers' vetting mechanisms and practices. Therefore, this work differs from prior studies based on its methodological approaches and considerations. Second, this study differs from prior work in terms of scope of coverage. For instance, earlier studies tended to limit their work on the use of specific tools such as Flickr (Liu et al., 2008), and Facebook (Vieweg et al., 2008). Others have approached their work by examining the information content generated through the use and appropriation of specific tools such as Twitter (Heverin and Zach, 2010; Vieweg et al., 2010). In contrast, this study takes a holistic view in examining how these tools enable and hinder the activities of HR volunteers. Taking such an approach has nonetheless yielded an unexpected outcome for discovering 'language' as an essential factor in determining the success and smooth running of response operations. As demonstrated in Chapter 5 subsection 5.4.3 and Chapter 6 subsection 6.2.5. responding to disasters in places other than English speaking countries present a massive challenge to volunteers. This type of challenge exists despite the presence of a few multilingual volunteers as well as the availability of machine-generated translation tools. This surprising discovery could be attributed to: (a) the holistic approach in studying the broad-ranging tools used by volunteers (b) the decision to examine disasters across nations and (c) the extended period taken to study the work of volunteers. Overall, this justifies how this study differs from others by approaching this work from multiple angles to this depth using various data collection techniques over the period of seventeen months.

The next sections focus on the implication of these findings for system designers, organisations, and practitioners.

7.4.1 Implications for practice

The following section discusses how the findings from this study could be of relevance to the practitioners such as digital disaster response organisations, traditional and formal aid agencies as well as EMOs.

- Taking a cue from the findings of the first research question, digital disaster response organisations such as HR could create resource lists for disaster-prone countries before the sudden onset of disasters. The resource should contain information such as emergency numbers, websites, locations, maps, the social media handles of fire, ambulance, police, airports, transportation and emergency response organisations. By populating the list on a country by country basis, organisations such as HR could reduce the time taken at the listing phase while responding to disasters. Thus, the HR process workflow could be reduced to monitoring & activation, listening & verification, amplification as well as reporting. By doing that, the response process efficiency will improve, and HR will be more responsive in providing aid.
- HR and other partner organisations could consider the possibility of adopting an alternative platform such as Slack as a backup for coordinating their activities. This could work when there is synergy with regards to the type of platforms that partners will adopt. If different organisations choose different platforms, this will affect the inter-organisational coordination and cooperation required when partner organisation are looking for surge support. Adopting an alternative platform will allow for HR's continuous operation without waiting for Skype to restore its services to normal operation.
- HR and other digital disaster response organisations could consider the need for expanding their volunteer base to include non-English speaking volunteers. Through this approach, organisations could overcome the challenge associated with responding to disasters in non-English speaking countries to mitigate the limitations of machine-generated translation. Equally important, the approach would reduce the time taken to train and onboard translators while responding to disasters.
- The findings from the second research question have revealed that it is possible for organisations to blend and adopt the use of organisationally sanctioned tools and platforms with that of the individual volunteers. By blending the two, organisations could learn from the expertise that volunteers come with given the rapidity of change with technologies. This will enable organisations to manage volunteers' expectations.
- Insights derived from the findings can also assist volunteers, aid agencies and emergency responders to adapt and improve the way they use ICT tools in their daily

routine. Specifically, volunteers and organisations can devise means of mitigating and overcoming some of these challenges caused by various tools and platforms, and emergency management organisations from developing nations could take better advantage of the available tools and platforms and incorporate them into their operations.

- As trust is critical to the working of a virtual team, the current practice of HR and its volunteers do not take into cognisance where the boundary of trust and privacy starts and ends. Based on the findings from the empirical data, the current arrangement is to some extent cannot be said to have strong safeguard mechanism that can protect the organisation's intellectual property on the one hand, and privacy of the volunteers on the other side. Therefore, there is a need for the organisation to develop a workable approach that can allow volunteers to access information that does not contain personally identifiable information of fellow volunteers among others.

7.4.2 Implications for design

As noted previously in the first Chapter, one of the primary focus of this study is to provide insights into the volunteers' work practice on the use and appropriation of technological tools and platforms. In Chapter 6, this study demonstrated the use and appropriation of discrete tools and platforms by HR volunteers to fluidly coordinate and undertake cooperative work while responding to disasters. As demonstrated, volunteers leveraged Skype as its 'coordination and control centre' where the decision and series of cooperative work such as information verification takes place. From the same Skype window, volunteers can click a link that takes them to the SitRep (Google Docs) where crisis information harnessed through the internet and social media platforms are assembled before shared with those in need. Also, this study demonstrates that the use and appropriation of such tools' present both opportunities and challenges of the digital disaster response work. Against this background, an opportunity exists to provide implication for system design based on the identified bottlenecks that affect the coordination of cooperative work of responding to disasters.

As pointed out in Chapter one, it is not within the scope of this research work to design a prototype or develop an application. However, this study wishes to draw the attention of the CSCW research design community to consider the implications for system requirements of understanding the challenges associated with digital disaster response work. This is because some of the tools used by volunteers are designed to address the needs and preferences of general users. As a result, they lack specific features to address the needs of digital volunteers. As argued by Dourish (2003), past studies related to customisation in a collaborative system focused on approaches where features of the system's configuration can be made to suit the

different settings in which the system might be used or the preferences of different potential users. This study demonstrates that some of these tools and platform's lack system configuration features that can allow for adjustment in different settings by a different set of users.

Based on the preceding, system designers need to start for developing a system that will suit the collaborative and cooperative work of digital volunteer communities. Specifically, the proposed system should aim at assembling various components of system features that volunteers appropriate in coordinating their activities, for instance, by combining Skype features (coordination) with Google Docs (collaborative authoring) alongside that of monitoring and verification tools and platforms that are used for tracking disaster, data mining urgent needs and verifying information. In addition, this proposed system could have a mechanism for organising information in a well-structured form; the information management structure could be developed in such a way that it will allow for managing, classifying, archiving, downloading and searching for information in a systematic and structured way. Moreover, the proposed system could have features that can make interaction fluid and offers volunteers the ability to navigate seamlessly between various interface. Such features can include tags, pops up chatbots, disaster-specific emojis, links to folders, resource list and major search engines, as well as live feeds. The tag features would help volunteers to locate frequently used methods, procedures or vital information. Pops up chatbots could provide recommendations and answers to frequently typed words and asked questions. Also, the proposed system could have an API that integrates the OCHA 'humanitarian icons'[43] which could complement existing emojis. The links to various resources such as folders, resource list, data mining, search engines can help facilitate the work of volunteers. By developing such a system, some of the bottlenecks related to information overload, and communication (as discussed in Chapter 7) can be addressed. While the focus of this implication is general to the CSCW research community, the following relates to design team related to Skype and Twitter.

In chapter 6 subsection 6.2.3, the findings highlight potential organisational information overload challenges associated with the tradition of creating event-specific windows for every significant response operation. Although the practice was institutionalised to allow for HR to manage multiple response operations at the same time, the decision has its drawbacks. Therefore, to address such type of challenge Skype design team could create bookmark-like options that will allow for organising and archiving event-specific windows. Additionally, Skype could allow third-party developers to create add-ons that will cater to specific organisational needs since different organisations may have requirements that the basic Skype

[43] https://mw1.google.com/crisisresponse/icons/un-ocha/index.html

facilities do not provide. Presently, the available features cater to the general use Skype but not in specific and tailored circumstances.

The predominance of Twitter as a research tool and data source in crisis informatics has been discussed in chapter 2 subsection 2.3, and the findings from this study corroborated the earlier work and showed that Twitter is among HR's core tools. HR and its volunteers used it for sharing, amplification, reaching out to disaster-affected communities, curating information, data mining as well as translation. However, findings from this work revealed some challenges arising from its use when responding to disasters. These challenges revolved around refinement of icons, and surprising omission of search bar or sorting capability in the Twitter List. The redesign of the new icons as demonstrated in Excerpt 6.12 posed difficulties to people with disability, accessibility and functional need (DAFN) challenge. In like manner, the unanticipated omission of a search bar or sorting capability in the Twitter list tended to affect the response work by making volunteers to waste time in trying to track (find) information. As such, this finding can serve as an essential wake up call for interactive technology system designers on the need to design, support and develop systems that can suit different settings, applications and various uses and users' preferences. Specifically, Twitter could improve the usability of its 'list' by adding search option and sorting capability. It is highly likely the Twitter list design team projection has not envisaged how relevant the list could be in disaster scenario situation and how the exclusion of search bar can affect response work. Having discussed the implications of this research for the community of practice and system designers, the following section presents the summary of the chapter and highlights the contents of the final chapter.

7.5 Summary and conclusion

This chapter provides interpretations of the research findings arising from the analysis of the empirical data presented in chapter 5 and 6. The chapter is segmented into four parts. The first section presents the summary of the findings from the two research questions. This is followed by a discussion on the first research questions. Specifically, the section discusses the process workflow and its model. Following that, the section features a discussion on the professionalisation and awareness of humanitarian principles, data quality assurance measures and the social organisation of collaborative work. Next, the discussion centred on the second research question where the emphasis was on the use and appropriation of collaborative tools and platforms. The section also explores challenges arising from the use of various collaborative technologies. Specifically, it discusses challenges related to information management, media 'stickness' syndrome, trust and privacy as well as communication challenges. The chapter concludes by highlighting implications for practice and system

designers. The final Chapter presents a summary, the contributions of this study, challenges and limitations as well as direction for future research.

Chapter 8: Conclusion

8.1 Introduction

The purpose of this thesis is to understand the activities involved in processing crisis information with regards to how these volunteers acquire, organise, verify, and share actionable information as a form of aid. In order to do so, it has explored the workplace realities and practices of use and appropriation of collaborative technologies in digital disaster response. Its motivation was to provide insights into the verification process involved in determining the quality of the information product provided by these communities, and to shed light on the benefits and challenges associated with the use of collaborative tools and platforms in digital disaster response. Understanding such activities and the implication of the use and appropriation of collaborative technologies in emergency response is crucial in three ways. First, it deepens our knowledge and understanding of the challenges involved in responding to disasters and where to look for support during emergencies. Specifically, it contributes to our understanding of whether the quality of an information product is good enough for the use of humanitarian organisations and other stakeholders. This is especially crucial at this time when there is growing mistrust of social media following the recent Cambridge Analytica scandal. Second, it expands our knowledge of the salient but under-reported practical field challenges in the use of various collaborative technological tools and platforms within the realm of digital disaster response. By providing such insights, system designers and technology developers can utilise this information to improve collaborative work. Third, it serves as a feedback mechanism to the digital disaster response organisations on how to improve their response operations. The Chapter provides a summary of the key findings, discusses contributions and highlights the challenges and limitations of the study. Finally, the Chapter identifies the contributions drawn from the study, and offers suggestions for future research and concludes with an Endnote.

8.2 Summary of the key findings

This section provides an overview of key research findings in respects of the research questions presented in Chapter 1 subsection 1.3.

Research Question 1:

What are the activities involved in processing crisis information and how are these volunteers ensuring the quality of such information?

The findings from the empirical data suggest a series of steps involved in processing crisis information. These activities start with monitoring and activation and are connected to the listing activity in a constant iteration when the activation is at Yellow or Red level. Following this, the process workflow will continue from the listing phase to the listening and verification phase in a back and forth manner. At the listening and verification phase, the workflow connects to both the amplification and the reporting phase respectively. The activities will continue until the Disaster Desk Working Group asks volunteers to stand down. Monitoring and activation are activities that relate to tracking sudden onset or slow-moving disasters by active volunteers using electronic notification systems and making information available to the Urgent Event window for discussion and possible activation of the disaster desk. Listing refers to the series of activities that involve researching keywords, and hashtags, as well as finding addresses, and social media handles of crucial emergency response stakeholders. Listening refers to the use of manual and automated tools and platforms to data mine actionable information that is relevant to the response operations. Verification involves substantiating the veracity of information acquired while data mining information using tools and platforms to determine the credibility of such information. Amplification refers to activities that involve sharing verified official information and survival tips, routing urgent needs as well as encouraging responsible sharing of crisis information from the global online public. Reporting involves producing a written account of verified actionable information that will provide situational awareness information for decision making among emergency management stakeholders. This response workflow is consistent with every operation I participated or observed across all disaster types.

While the set of sequential activities provides a synopsis of activities involved in process crisis information, in what follows is an overview of how volunteers ensure the quality of the information product they provide after it has been monitored and acquired.

The first step volunteers take while determining the credibility of information is by identifying the source of information. This is done through understanding whether it emanates from official, unofficial, trusted, untrusted or an unknown source. If it is determined that it emanates from an official or trusted source, the information is assumed to be credible. Otherwise, volunteers will look at the content element – photos, videos, link, messaging – and compare it is against the day, date, time and location using tip sheets produced by HR. If the outcome demands additional validation, volunteers will invoke the 'verify X 2' procedure. 'Verify X 2' requires volunteers to look for two more independent sources conveying such type of information. If the information ties to two independent sources, volunteers then look for the location of the person sharing the information. Finding the location of the person sharing

information enable volunteers to identify whether the person sharing such information is in the area of the crisis or has a history or personal connection to that location. Volunteers also make use of tip sheets, maps, reverse image search and translation tools to corroborate information. In brief, processing crisis information involved a series of actions, sense-making and collaboration using tools to ensure information is good enough for sharing so that it will help people to sustain, survive and reunite.

Research Question 2:

What are the implications of deploying collaborative tools used by DVCs in disaster response and how do these tools work in practice?

Based on the findings from the empirical data, deploying collaborative technologies into digital disaster response present both benefits and challenges. On the one hand, these tools and platforms enabled volunteers to coordinate and communicate during response operations to provide information as a form of aid. By using collaborative platforms and tools such as Skype, Google Suite, GroupTweet, Twitter, and search engines and translation tools, volunteers provide support to emergency management organisations and formal and traditional aid agencies. For example, by appropriating such tools volunteers amplify verified official information to the disaster-affected communities and the global online public. Volunteers also leverage such tools to route urgent needs from disaster-affected communities to emergency management organisations as well as formal and traditional aid agencies and local groups. On the flipside, findings from the study revealed practical workplace challenges arising from the use and appropriation of such tools. These challenges are categorised into user-based challenges, system-based challenges, symptomatic challenges and process-centric challenges. User-based challenge refers to challenges that evolved because of cookies interference or low internet bandwidth which sometimes hampers the volunteers' ability to take part in briefing calls or result in unexpected drop calls. System-based challenges include issues arising mainly due to design enhancement of the product such as that of Twitter or server outages as experienced by Skype during the London Westminster attack. Symptomatic challenges are scalability and performance related problems that occur because of the pressure put on the system as seen in the use of Google Docs during response operations. The process-centric challenge arises because of the process put forward by the organisation in managing the activities of volunteers and response operations. For example, the policy of creating an event-specific window when responding to a major catastrophe, though helpful, but such action also succeeded in creating another challenge such as that of information overload.

The next segment discusses the contribution of this research work.

8.3 Contributions

This study contributes to the Computer Supported Cooperative Work (CSCW), Crisis Informatics, Information Systems for Crisis Response and Management (ISCRAM), and Disaster research communities in three ways as explained in detail in the following subsections:

8.3.1 Empirical contribution

The primary contributions of this thesis lie in providing insight into the social organisation of the sequence of interactions and collaborative activities of volunteers in a technologically supported, work environments. It does so by detailing the work practices of volunteers' organisational conduct and social interaction in which they undertake to communicate in a distributed mediating environment to perform the disparate collection of response tasks and activities. This study has also contributed to the socio-technical debates on information quality and integrity of the crowdsourced information harnessed through web 2.0. It does so by providing insight into the visible manifestation of professionalisation and knowledge of humanitarian principles through identifying, describing and analysing its participants' work practices. For example, the study identified (in Chapter 5) and analysed (in Chapter 7) the activities involved in verifying the credibility of crisis information harnessed through social media and the internet.

This study introduces a new perspective to the crisis informatics literature by adding to our understanding of the importance of *language* as another dimension that determines the effectiveness of volunteers' response operations. This is crucial since responding to disasters in non-English speaking countries can be problematic and subsequently slow down volunteers' efforts. Surprisingly, this dimension has received little attention in the existing literature. However, analysis of the disaster response in Peru, Ecuador and Japan humanitarian catastrophe has revealed the varying level of difficulties volunteers encountered, since most of the crisis information is crafted in local languages other than English. The translation tools that volunteers appropriately to make sense of the information are far from being perfect. As such, an additional effort must be devised to onboard and train native speakers who will then be assigned to work on the machine translated information. This process of onboarding and training native volunteers takes time and thereby slows the response of volunteers.

This research work has also gone some way towards enhancing our understanding of the digital volunteer communities' delineation and typology. It achieved this by building on the

Gorp's (2014) taxonomy of digital volunteer communities. The thesis identified another community – the Emergency Telecommunication Providers' Community – thereby increasing the number of communities into five. This new community has the potential of opening a new research landscape in digital volunteerism and humanitarian response system. The community also have trained members that can provide the initial assessment of disaster impact using unmanned aerial vehicles.

8.3.2 Theoretical contribution

This study has deepened the understanding and knowledge of organised response among established digital volunteer communities by building on the previous research work (Starbird and Palen, 2013). It achieved this by introducing an analytical framework that outlines the various stages involved in processing crisis information in the social media and data aggregation communities. This framework is comprehensive and flexible and can be applied in coordinating response operations across a wide variety of disasters with different scales by these communities in different countries and settings. While this framework is the first of its kind to represent the big picture, it provides insight into the activities involved in processing crisis information by the established digital volunteer communities. The framework has sketched out in details how the crisis information data is monitored, sourced, processed, managed, verified and reported.

8.3.3 Methodological contribution

An earlier review of the social media in disaster literature suggests that previous studies have tended to explore one disaster event and then suggest that the findings are generalisable to other studies (Fraustino et al., 2012). Furthermore, studies investigating digital volunteers' collective behaviour and organised response have tended to focus on examining a single communication tool or a social media platform using one single response within a case study (Starbird and Palen, 2011, 2013; Starbird, 2013). Recently, Olteanu, Vieweg, and Castillo (2015) took a step further by incorporating disaster types as an additional dimension in their methodological approach. While their approach provides a unique novelty in social media in the disaster research field, this study has expanded their method by incorporating an additional approach. Unlike their work that explores crisis information that was based on historical data generated from Twitter, this study has employed various data collection methods. These methods include Skype chatter, field notes, social media postings, and official documents from 8 disaster types in 13 countries, across 6 continents, covering both developing and developed nations for 17 months. To the author's knowledge, this methodological approach is the first of its kind in studying DVCs focusing on social media and data

aggregation. Additionally, this study is among the few that provides prescriptive operationalisation of AT by combining AODM and Martins-Daltrini framework. This approach provides a unique interpretive frame for analysing the composition of activities and understanding the social organisation of digital volunteers' use of collaborative computing applications. As a result, this work offers a distinctive contribution to the methodological advancement of disaster research within the CSCW, ISCRAM and crisis informatics fields. It has done so by providing a deeper understanding of volunteers' response process workflow and uncovers the unique challenges associated with response operations and under-reported practical field challenges of the use and appropriation of collaborative technologies.

8.4 Challenges and limitations

The work presented in this thesis has some limitations since it studied only one digital disaster response organisation within the social media and data aggregation communities. Therefore, the scope upon which this finding could be applied in other settings and context outside the social media and data aggregation communities may be limited. However, the general tenets of the research with regards to practices of use of collaborative tools and platforms can be generalised to a wide range of audience including communities of practice, emergency management organisations, as well as formal and traditional aid agencies. In other words, organisations and groups that appropriate collaborative tools and platforms (such as Google Docs, Skype, Twitter, GroupTweet among others) in their work can learn from the insights derived as a result of this study. Specifically, the identification of salient but under-reported practical field challenges and the approach for overcoming these challenges associated with the use of various technological tools and platforms can be of interest and beneficial to some of these organisations and groups.

A final limitation relates to the number of volunteers interviewed during this study even though the focus of the data collection and analysis was on first-hand observations. As documented in the methodology section, only a small number of volunteers were interviewed. Consideration of additional numbers by incorporating retired volunteers, former interns and researchers, as well as later entrants, could have given a more nuanced perspective. These limitations were because of the constraint of time, the inability or unwillingness of some volunteers to engage. Nonetheless, the reviews of past interviews of the early entrants (featured in HR blog called volunteers' spotlight that) and after-action reports of various response operations have provided insights into the early usage and appropriation of collaborative tools and disaster response activities.

8.5 Conclusion drawn from the study

Having outlined major findings and recapped the contributions, it is worth looking at the motivation and objectives upon which this work is premised to understand whether these objectives as stated in Chapter 1 (subsection 1.3) have been met. This work has been inspired by the socio-technical debates on the quality and credibility of the information products generated through crowdsourcing by internet-enabled volunteers during crisis situations. The central arguments of the debate assumed that crowdsourced information is bedevilled with information processing problems. As a result, they lacked an exacting standard, quality, credibility, and the trustworthiness required by the humanitarian response organisations. Based on this premise, a need arises for understanding the work of these internet-enabled volunteers and their activities, alongside their use and appropriation of the platforms that made it possible for them to assemble and produce contents. Our analysis shows that there is, to some extent, a misalignment of understanding between what the literature reports and what these volunteers are doing. Against this background, an opportunity exists to interrogate how these volunteers crowdsource and produced contents. To undertake such academic exercise, some objectives were put forward at the beginning as a roadmap for understanding this social and collaborative computing problem. These objectives were to:

a) Understand the activities involved in processing crisis information during humanitarian response operations.
b) Investigate data quality assurance mechanisms of the DVCs in determining the credibility of the crisis information shared during disasters.
c) Examine the implications of deploying such tools and offer insight into how these tools work in practice.
d) Identify the type of collaborative technologies used by volunteers in digital disaster response and how they are appropriated in practice.
e) To offer practical implications to research communities (Computer Supported Cooperative Work (CSCW), Information Systems for Crisis Response and Management (ISCRAM), Crisis Informatics, Disasters), practitioners (Emergency Management Organisations, Aid Agencies, Digital Humanitarian Networks), and System Designers/Developers.

This study has been able to provide answers to these objectives. For example, Chapter 5 subsection 5.3 sketched out activities involved in processing crises information, and this has been articulated further in Chapter 8 subsection 8.2. Likewise, Chapter 5 subsection 5.4 detailed data quality assurance measures. Chapter 6 subsection 6.2 and 6.3 sketched out the

implications for the appropriation and type of collaborative technologies used in digital disaster response. This has been discussed in detail in Chapter 7 subsection 7.3 and articulated further in Chapter 8 subsection 8.2. Moreover, the implication for design and practice has been provided in Chapter 7 subsection 7.4, while Chapter 8 subsection 8.3 offers theoretical and methodological contributions.

As a result, this study asserts that there is a lack of understanding between the work practice of spontaneous, unaffiliated and emergent volunteers on the one hand, and that of established professional group on the other hand. This lack of understanding contributes to the general perception that the information produced by digital volunteers are not good enough for the use of humanitarian organisations. However, findings from this study demonstrated that there are visible manifestations of quality standards in the activities of established groups in processing crisis information. By their standard and verification mechanisms, established groups such as HR provide 'good enough information' that humanitarian organisations can leverage for situational awareness information and decision making. This study also argues that most of the concerns related to standards, trustworthiness and credibility of the information product generated through crowdsourcing can be dismissed because of the work of some these spontaneous and unaffiliated groups.

8.6 Suggestions for future research

The findings and limitations of this research work, as highlighted in Chapter 5, 6 and 8 subsection 8.4, provide opportunities for future work. One area for a future extension could be in automating the process workflow for verifying unknown sources. As pointed out in Chapter 5 subsection 5.4.1, verifying unknown sources remains the most critical task for the volunteers. Fortunately, this study has sketched out the logic associated with volunteers' workflow in verifying unknown sources. Likewise, Chapter 7 subsection 7.2.3 discussed in detail how the volunteers' process workflow matches with dimensions set forward by earlier studies in which information quality and credibility of social media content could be assessed. Future studies could leverage this work and automate the process.

Based on the findings from this study, developing countries with low infrastructural densities appeared to lag in making information more accessible to the global online public even though making such information available does not require any additional resources. Against this, an opportunity exists for future work to look at the possibility of developing a minimum common benchmark for disaster readiness and resilience. This benchmark could be used as a baseline for evaluating the information infrastructure readiness of countries since developed countries suffer significantly more economic damage from disasters (OCHA, 2012). As pointed out in subsection 8.4, this work has studied only one digital disaster response organisation within

the social media and data aggregation communities. Therefore, further research can also explore two or more 'social media and data aggregation' communities to replicate the study. This will allow for the evaluation of the generalisability of the findings across the community.

8.7 Endnote

As a final note, I am convinced that the work of digital volunteers is a worthwhile venture because of its potentials in giving succour to those in need. This conclusion is drawn based on personal field experience. I learnt this through my experience during Sri Lanka massive flooding and landslide that occurred on 19th May 2016. While searching for urgent needs, I stumbled on a tweet which I shared it in the Urgent Event Window. A few minutes later, the SMIC re-shared my submission in the same window as follows:

As a newbie, I have no idea about the potential impact of what I have done until after two days. I came to this realisation when I have seen how HR volunteers worked tirelessly to link Yasir to the Sri Lankan Red Cross. Later, the Red Cross liaised with the Sri Lankan Military (Navy) to rescue the family in Sedawatta (two days later). Other experience relates to my findings during field observation. For example, through this study, I learnt how volunteers that could not have the strength to deploy physically during disasters are leveraging technology to provide situational awareness information. Some of these volunteers are in their mid-fifties and those that are housebound. Yet, despite their constraints, some of them have dedicated over 5000 hours in providing information as a form of aid. Not only that, these volunteers have succeeded in influencing the introduction of awareness programmes that seek to address the problems faced by people with Disability, Accessibility and Functional Needs (DAFN) and Animals affected during disasters. By their efforts, such volunteers became the pacesetters in setting standards for addressing the needs of the vulnerable groups and animals in disasters within the digital volunteer communities.

This study has shaped my understanding of the potentials and pitfalls associated with appropriating collaborative technologies. It inspired me to start thinking of how I as an individual can help in developing a community-based disaster information system that is tailored to the need and context of developing countries. I hope that this work will inspire people, communities, organisations and system designers to begin to understand the potentials of digital disaster work and some of its challenges.

References

Abedin, B., Babar, A. and Abbasi, A. (2014) 'Characterization of the Use of Social Media in Natural Disasters: A Systematic Review', in 2014 IEEE Fourth International Conference on Big Data and Cloud Computing. IEEE, pp. 449–454. doi: 10.1109/BDCloud.2014.17.

Acar, A. and Muraki, Y. (2011) 'Twitter for crisis communication: lessons learned from Japan's tsunami disaster', International Journal of Web Based Communities, 7(3), pp. 392–402. doi: 10.1504/IJWBC.2011.041206.

de Albuquerque, J. P., Herfort, B., Brenning, A. and Zipf, A. (2015) 'A geographic approach for combining social media and authoritative data towards identifying useful information for disaster management', International Journal of Geographical Information Science. Taylor & Francis, Inc., 29(4), pp. 667–689. doi: 10.1080/13658816.2014.996567.

Anderson, R. J., Hughes, J. A. and Sharrock, W. W. (1989) Working for profit: The social organisation of calculation in an entrepreneurial firm. Gower Publishing Company, Limited.

Bakhurst, D. (2009) 'Reflections on activity theory', Educational Review. Routledge, 61(2), pp. 197–210. doi: 10.1080/00131910902846916.

Bardram, J. and Doryab, A. (2011) 'Activity analysis: applying activity theory to analyze complex work in hospitals', in Proceedings of the ACM 2011 conference on Computer supported cooperative work, pp. 455–464. doi: 10.1145/1958824.1958895.

Bardram, J. and Jakob (1998) 'Designing for the dynamics of cooperative work activities', in. New York, New York, USA: ACM Press, pp. 89–98. doi: 10.1145/289444.289483.

Bedny, G. Z. and Harris, S. R. (2005) 'The Systemic-Structural Theory of Activity: Applications to the Study of Human Work', Mind, Culture, and Activity, 12(2), pp. 128–147. doi: 10.1207/s15327884mca1202_4.

Behrend, M. (2014) 'Engeström's activity theory as a tool to analyse online resources embedding academic literacies', Journal of Academic Language and Learning, 8(1), pp. A109–A120.

Benbasat, I., Goldstein, D. K. D. and Mead, M. (1987) 'The Case Research Strategy in Studies of Information Systems', MIS Quarterly. Minneapolis: The Society for Information Management and The Management Information Systems Research Center of the University of Minnesota, 11(3), pp. 369–386. doi: 10.2307/248684.

Bergtora Sandvik, K., Gabrielsen Jumbert, M., Karlsrud, J., Kaufmann, M., Harvard, S., Meier, P., Gilman, D., Burns, R., Wilson, C., Kleinman, M., Iaccuci, A. and Raymond, N. (2014) 'Humanitarian technology: a critical research agenda', International Review of the Red Cross, 96(893), pp. 219–242. doi: 10.1017/S1816383114000344.

Bertelsen, O. W. and Bødker, S. (2000) 'Introduction: Information Technology in Human Activity', Scandinavian Journal of Information Systems, 12(1). Available at: http://aisel.aisnet.org/sjis (Accessed: 21 October 2017).

Bertelsen, O. W. and Bødker, S. (2003) 'Activity theory', in Caroll, J. M. (ed.) HCI models, theories, and frameworks: Toward a multidisciplinary science. San Francisco: Morgan Kaufmann, pp. 291–324.

Bishr, M. and Janowicz, K. (2010) 'Can we trust information?-the case of volunteered geographic information', in Towards digital earth search discover and share geospatial data workshop at future internet symposium.

Blomberg, J. and Burrell, M. (2007) 'An ethnographic approach to design', in Julie, A.J., Andrew, S. (ed.) The Human-Computer Interaction Handbook. L. Erlbaum Associates Inc, pp. 965–986.

Bloomfield, R. (2009) How online communities and flawed reasoning sound a death knell for qualitative methods, Terra Nova (blog).

Bob Travica (1997) 'The design of the virtual organization: A research model', in In Proceedings of the Americas Conference on Information Systems, pp. 15–17. Available at: http://home.cc.umanitoba.ca/~btravica/voais.html (Accessed: 1 June 2018).

Bodker, S. (1989) 'A human activity approach to user interfaces', Human-Computer Interaction. Taylor & Francis, 4(3), pp. 171–195.

Boehmer, E. (2010) 'Coordinating efforts by Volunteer and Technical Communities for disaster preparedness, response, and relief', Washington DC: Science and Technology Innovation Program, Woodrow Wilson International Center for Scholars.

Boellstorff, T. (2012) Ethnography and virtual worlds: A handbook of method. Princeton University Press.

Boellstorff, T., Nardi, B., Pearce, C. and Taylor, T. (2012) Ethnography and Virtual Worlds: A Handbook of Method. Princeton University Press.

Bowers, J., Button, G. and Sharrock, W. (1995) 'Workflow From Within and Without: Technology and Cooperative Work on the Print Industry Shopfloor', in Proceedings of the Fourth European Conference on Computer-Supported Cooperative Work ECSCW '95. Dordrecht: Springer Netherlands, pp. 51–66. doi: 10.1007/978-94-011-0349-7_4.

Bowler Jr, G. M. (2010) 'Netnography: A method specifically designed to study cultures and communities online', The Qualitative Report. The Qualitative Report, 15(5), p. 1270.

Boyatzis, R. E. (1998) Transforming qualitative information: Thematic analysis and code development. sage.

Braun, V., Clarke, V., Terry, G., Rohleder, P. and Lyons, A. (2014) 'Qualitative research in clinical and health psychology'.

Brewer, J. D. (1994) 'The Ethnographic Critique of Ethnography: Sectarianism in the RUC', Sociology. British Sociological Association Publications Limited, 28(1), pp. 231–244. doi: 10.1177/0038038594028001014.

Britton, N. R. (1988) 'Organised Behaviour in Disaster: A Review', International Journal of Mass Emergencies and Disasters, 6(3), pp. 363–395.

Britton, N. R. (1991) 'Permanent Disaster Volunteers: Where Do They Fit?', Nonprofit and Voluntary Sector Quarterly, 20(4), pp. 395–414. doi: 10.1177/089976409102000404.

Bui, T. and Tan, A. (2007) 'A template-based methodology for large-scale HA/DR involving ephemeral groups-A workflow perspective', in System Sciences, 2007. HICSS 2007. 40th Annual Hawaii International Conference on, p. 34.

Bui, T. X. and Sankaran, S. R. (2001) 'Design considerations for a virtual information center for humanitarian assistance/disaster relief using workflow modeling', Decision support systems. Elsevier, 31(2), pp. 165–179.

Burnap, P., Williams, M. L., Sloan, L., Rana, O., Housley, W., Edwards, A., Knight, V., Procter, R. and Voss, A. (2014) 'Tweeting the terror: modelling the social media reaction to the Woolwich terrorist attack', Social Network Analysis and Mining. Springer, 4(1), p. 206.

Busher, H. and James, N. (2007) 'Email communication as a technology of oppression: Attenuating identity in online research'.

Capelo, L., Chang, N. and Verity, A. (2013) Guidance for Collaborating with Volunteer & Technical Communities. Available at: http://digitalhumanitarians.com/content/guidance-collaborating-volunteer-technical-communities.

Castronova, E. (2001) 'Virtual worlds: A first-hand account of market and society on the cyberian frontier'. Available at: http://www.bepress.com/giwp. (Accessed: 12 November 2017).

Chaturvedi, A., Simha, A. and Wang, Z. (2015) 'ICT infrastructure and social media tools usage in disaster/crisis management'. Los Angeles: International Telecommunications Society.

Chiles, T. H. and McMackin, J. F. (1996) 'Integrating Variable Risk Preferences, Trust, and Transaction Cost Economics', Academy of Management Review, 21(1), pp. 73–99. doi: 10.5465/amr.1996.9602161566.

Christensen, L. R. (2016) 'On Intertext in Chemotherapy: an Ethnography of Text in Medical Practice', Computer Supported Cooperative Work (CSCW). Springer Netherlands, 25(1), pp. 1–38. doi: 10.1007/s10606-015-9238-1.

Cobb, C., McCarthy, T., Perkins, A., Bharadwaj, A., Comis, J., Do, B. and Starbird, K. (2014) 'Designing for the Deluge: Understanding & Supporting the Distributed, Collaborative Work of Crisis Volunteers', Proceedings of the Conference on Computer Supported Cooperative Work (CSCW), pp. 888–899. doi: 10.1145/2531602.2531712.

Coleman, D., Sabone, B. and Nkhwanana, N. J. (2010) 'Volunteering geographic information to authoritative databases: Linking contributor motivations to program characteristics', Geomatica, 64(1), pp. 27–40.

Collins, S. (2011) 'Conflict and Disaster Management in a Hyper-Connected World: Cooperative, Collaborative, Real Time', Journal of Urban and Regional, 25(2), pp. 227–52.

Cook, T. T. D., Campbell, D. T. D. and Day, A. (1979) Quasi-experimentation: Design & analysis issues for field settings. Houghton Mifflin Boston. Available at: http://dickyh.staff.ugm.ac.id/wp/wp-content/uploads/2009/ringkasan buku quasi-experimentakhir.pdf (Accessed: 3 December 2017).

Cramton, C. D. (1997) 'Information Problems in Dispersed Teams', Academy of Management Proceedings. Academy of Management Briarcliff Manor, NY 10510, 1997(1), pp. 298–302. doi: 10.5465/ambpp.1997.4983730.

Creswell, J. W. (2007) 'Qualitative inquiry and research design: Choosing among five approaches'. Sage Publications, Inc.

Crowley, J. and Chan, J. (2011) Disaster Relief 2.0: The future of information sharing in humanitarian emergencies. Available at: http://hhi.harvard.edu/publications/disaster-relief-20-future-information-sharing-humanitarian-emergencies (Accessed: 17 June 2017).

Dailey, D. and Starbird, K. (2014a) 'Journalists as Crowdsourcerers: Responding to Crisis by Reporting with a Crowd', Computer Supported Cooperative Work: CSCW: An International Journal, 23(4–6). doi: 10.1007/s10606-014-9208-z.

Dailey, D. and Starbird, K. (2014b) 'Visible skepticism: Community vetting after Hurricane Irene', in ISCRAM 2014 Proceedings - 11th International Conference on Information Systems for Crisis Response and Management, pp. 777–781.

Daymon, C. and Holloway, I. (2010) Qualitative research methods in public relations and marketing communications. Routledge.

St. Denis, L. A., Anderson, K. M. and Palen, L. (2014) 'Mastering Social Media : An Analysis of Jefferson County ' s Communications during the 2013 Colorado Floods', Iscram, (May), pp. 737–746.

St. Denis, L. A., Hughes, A. L. and Palen, L. (2012) 'Trial by Fire: The Deployment of Trusted Digital Volunteers in the 2011 Shadow Lake Fire', 9th International ISCRAM Conference, (April), pp. 1–10.

Department of Homeland Security, U., Directorate, T., Security Enterprise, H. and Responders Group, F. (2018) Countering False Information on Social Media in Disasters and Emergencies Social Media Working Group for Emergency Services and Disaster Management. Available at: https://www.dhs.gov/sites/default/files/publications/SMWG_Countering-False-Info-Social-Media-Disasters-Emergencies_Mar2018-508.pdf (Accessed: 31 March 2018).

DeSanctis, G. and Monge, P. (1999) 'Introduction to the Special Issue: Communication Processes for Virtual Organizations', Organization Science. INFORMS, 10(6), pp. 693–703. doi: 10.1287/orsc.10.6.693.

DiCicco-Bloom, B. and Crabtree, B. F. (2006) 'The qualitative research interview', Medical Education, 40(4), pp. 314–321. doi: 10.1111/j.1365-2929.2006.02418.x.

Dourish, P. (2014) 'Reading and Interpreting Ethnography', in Olson, J. S. and Kellogg, W. A. (eds) Ways of Knowing in HCI. New York, NY: Springer New York, pp. 1–23. doi: 10.1007/978-1-4939-0378-8_1.

Dourish, P. and Bellotti, V. (1992) 'Awareness and coordination in shared workspaces', in Proceedings of the 1992 ACM conference on Computer-supported cooperative work - CSCW '92. New York, New York, USA: ACM Press, pp. 107–114. doi: 10.1145/143457.143468.

Dourish, P. and Button, G. (1998) 'On "Technomethodology" Foundational Relationships Between Ethnomethodology and System Design', Human-Computer Interaction, 13(4), pp. 395–432. doi: 10.1207/s15327051hci1304_2.

Drury, J. L. (2009) 'Collaboration Research for Crisis Management Teams', Foundations and Trends® in Human–Computer Interaction, 3(3), pp. 139–212. doi: 10.1561/1100000020.

Ducheneaut, N., Moore, R. J. and Nickell, E. (2007) 'Virtual "'Third Places'": A Case Study of Sociability in Massively Multiplayer Games*', Computer Supported Cooperative Work, 16, pp. 129–166. doi: 10.1007/s10606-007-9041-8.

Dunn, J. (1984) 'The concept of trust in the politics of John Locke', in Philosophy in history: Essays on the historiography of philosophy. Cambridge University Press Cambridge, pp. 279–301.

Dynes, R. R. (1970) Organized Behavior in Disaster. Heath.

Eisenhardt, K. M. (1989) 'Building Theories from Case Study Research', The Academy of Management Review. Ada, Ohio, etc: Academy of Management, 14(4), pp. 532–550.

Eismann, K., Posegga, O. and Fischbach, K. (2016) 'Collective Behaviour, Social Media, And Disasters: A Systematic Literature Review', in Twenty-Fourth European Conference on Information Systems (ECIS), İstanbul,Turkey, 2016. doi: https://aisel.aisnet.org/ecis2016_rp/104.

Ellis, C. A., Gibbs, S. J. and Rein, G. (1991) 'Groupware: some issues and experiences', Communications of the ACM. ACM, 34(1), pp. 39–58. doi: 10.1145/99977.99987.

Estellés-Arolas, E. and González-Ladró n-de-Guevara, F. (2012) 'Towards an integrated crowdsourcing definition', Article Journal of Information Science, 38(2), pp. 189–200. doi: 10.1177/0165551512437638.

Evered, R. and Reis, M. (1981) 'Alternative Perspectives in the Organizational Sciences: "Inquiry from the Inside" and "Inquiry from the Outside"', Academy of Management Review. Academy of Management, 6(3), pp. 385–395. doi: 10.5465/AMR.1981.4285776.

Fairchild, A. M. (2004) 'Groups and Collaborative Technology', in Technological Aspects of Virtual Organizations. Dordrecht: Springer Netherlands, pp. 45–82. doi: 10.1007/978-94-017-3211-6_2.

Fereday, J., Muir-Cochrane, E., Fereday Rgn, J., Dip, G. and Ed, A. (2006) 'Demonstrating rigor using thematic analysis: A hybrid approach of inductive and deductive coding and theme development', International journal of qualitative methods. SAGE Publications Sage CA: Los Angeles, CA, 5(1), pp. 80–92. doi: 10.1063/1.2011295.

Foran, M. M. P., Greenough, P. G. P., Thow, A., Gilman, D., Schütz, A., Chandran, R. and Baiocchi, A. (2012) 'Identification of current priorities for research in humanitarian action: proceedings of the

First Annual UN OCHA Policy and Research Conference.', Prehospital and disaster medicine, 27(3), pp. 260–6. doi: 10.1017/S1049023X12000672.

Forsythe, D. E. (1999) '"It's Just a Matter of Common Sense": Ethnography as Invisible Work', Computer Supported Cooperative Work (CSCW). Kluwer Academic Publishers, 8(1–2), pp. 127–145. doi: 10.1023/A:1008692231284.

Fraustino, J. D., Liu, B. and Jin, Y. (2012) 'Social media use during disasters: a review of the knowledge base and gaps.' National Consortium for the Study of Terrorism and Responses to Terrorism [START].

Fritz, C. E. and Mathewson, J. H. (1957) Convergence behavior in disasters: A problem in social control: A special report prepared for the Committee on Disaster Studies. National Academy of Sciences National Research Council.

Garcia, A. C., Standlee, A. I., Bechkoff, J. and Yan Cui (2009) 'Ethnographic Approaches to the Internet and Computer-Mediated Communication', Journal of Contemporary Ethnography, 38(1), pp. 52–84. doi: 10.1177/0891241607310839.

Garfinkel, H. (1967) Studies in ethnomethodology. PRESS, POLITY.

Gatson, S. N. (2011) 'The methods, politics, and ethics of representation in online ethnography', Collecting and Interpreting Qualitative Materials. Sage Thousand Oaks, CA, 4, pp. 245–275.

Gaver, W. W., Boucher, A., Pennington, S. and Walker, B. (2004) 'Cultural probes and the value of uncertainty', interactions. ACM, 11(5), p. 53. doi: 10.1145/1015530.1015555.

Geertz, C. (1988) Works and lives: The anthropologist as author. Stanford University Press.

Gibson, C. B. and Manuel, J. A. (2003) Building trust: Effective multicultural communication processes in virtual teams, Virtual teams that work: Creating conditions for virtual team effectiveness.

Gilbert, N. (2008) Researching social life. Sage.

Golafshani, N. (2003) Understanding Reliability and Validity in Qualitative Research, The Qualitative Report. Available at: http://www.nova.edu/ssss/QR/QR8-4/golafshani.pdf (Accessed: 1 December 2018).

Gold, R. L. (1958) 'Roles in sociological field observations', Social forces. JSTOR, 36(3), pp. 217–223. doi: 10.2307/2573808.

Goodchild, M. F. and Glennon, J. A. (2010) 'Crowdsourcing geographic information for disaster response: a research frontier', International Journal of Digital Earth. Taylor & Francis, 3(3), pp. 231–241.

Gorp, A. F. Van (2014) 'Integration of Volunteer and Technical Communities into the Humanitarian Aid Sector: Barriers to Collaboration', Proceedings of the Information Systems for Crisis Response and Management (ISCRAM), (May), pp. 620–629.

Grabner-Kräuter, S. (2009) 'Web 2.0 Social Networks: The Role of Trust', Journal of Business Ethics, (90), pp. 505–522. doi: 10.1007/s10551-010-0603-1.

Gray, P. A. (2016) 'Memory, body, and the online researcher: Following Russian street demonstrations via social media', American Ethnologist, 43(3), pp. 500–510. doi: 10.1111/amet.12342.

Gross, T. (2013) 'Supporting Effortless Coordination: 25 Years of Awareness Research', Computer Supported Cooperative Work (CSCW). Springer Netherlands, 22(4–6), pp. 425–474. doi: 10.1007/s10606-013-9190-x.

Grudin, J. and Palen, L. (1995) 'Why groupware succeeds: Discretion or mandate?', in Proceedings of the Fourth European Conference on Computer-Supported Cooperative Work ECSCW'95, pp. 263–278.

Guest, G., MacQueen, K. M. and Namey, E. E. (2011) Applied thematic analysis. Sage.

Gupta, A., Kumaraguru, P., Castillo, C. and Meier, P. (2014) 'TweetCred: Real-time credibility assessment of content on Twitter', Lecture Notes in Computer Science (including subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics), 8851. doi: 10.1007/978-3-319-13734-6_16.

Gutwin, C. and Greenberg, S. (2002) 'A Descriptive Framework of Workspace Awareness for Real-Time Groupware', Computer Supported Cooperative Work (CSCW). Kluwer Academic Publishers, 11(3–4), pp. 411–446. doi: 10.1023/A:1021271517844.

Gutwin, C., Greenberg, S. and Roseman, M. (1996) 'Workspace Awareness in Real-Time Distributed Groupware: Framework, Widgets, and Evaluation', in People and Computers XI. London: Springer London, pp. 281–298. doi: 10.1007/978-1-4471-3588-3_18.

Halverson, C. A. (2002) 'Activity Theory and Distributed Cognition: Or What Does CSCW Need to DO with Theories?' Kluwer Academic Publishers, 11(1–2), pp. 243–267. doi: 10.1023/A:1015298005381.

Hammersley, M. (1990) 'What's wrong with ethnography? The myth of theoretical description', Sociology. British Sociological Association Publications Limited, 24(4), pp. 597–615. doi: 10.2307/42854731.

Handel, M. and Herbsleb, J. D. (2002) 'What is Chat Doing in the Workplace?', in Proceedings of the 2002 ACM Conference on Computer Supported Cooperative Work. New York, NY, USA: ACM (CSCW '02), pp. 1–10. doi: 10.1145/587078.587080.

Handy, C. (1995) Trust and the Virtual Organization, Harvard Business Review. Available at: https://hbr.org/1995/05/trust-and-the-virtual-organization (Accessed: 1 June 2018).

Harper, R. H. R. (2000) 'The Organisation in Ethnography A Discussion of Ethnographic Fieldwork Programs in CSCW', Computer Supported Cooperative Work, 9, pp. 239–264.

Harrald, J. R., Egan, D. M., Jefferson, T., Stok, E. and Žmavc, B. (2002) 'Web Enabled Disaster and Crisis Response: What Have We Learned from the September 11 th', Proceedings of the Bled eConference, pp. 69–83.

Harrison, S. and Dourish, P. (1996) 'Re-Place-ing Space: The Roles of Space and Place in Collaborative Environments', in Proc. ACM Conf. Computer-Supported Cooperative Work CSCW.

Hasan, H. and Kazlauskas, A. (2014) 'Activity Theory: who is doing what, why and how', in Being Practical with Theory: a Window into Business Research: Transforming Human Enterprise through Organisation Responsibility and Innovation. Hasan Hele, pp. 9–14.

Hayes, G. R. (2014) 'Knowing by doing: action research as an approach to HCI', in Ways of Knowing in HCI. Springer, pp. 49–68.

Hayes, P. J. and Reddy, D. R. (1983) 'Steps toward graceful interaction in spoken and written man-machine communication', International Journal of Man-Machine Studies. Academic Press, 19(3), pp. 231–284. doi: 10.1016/S0020-7373(83)80049-2.

Helsloot, I. and Groenendaal, J. (2013) 'Twitter: An underutilized potential during sudden crises?', Journal of Contingencies and Crisis Management. Wiley Online Library, 21(3), pp. 178–183.

Heverin, T. and Zach, L. (2010) 'Microblogging for Crisis Communication : Examination of Twitter Use in Response to a 2009 Violent Crisis in the Seattle-Tacoma , Washington Area', Proceedings of the 7th International ISCRAM Conference. ISCRAM, 2009(November), p. 5.

Heydebrand, W. V. (1989) 'New Organizational Forms', Work and Occupations. SAGE PUBLICATIONS, 16(3), pp. 323–357. doi: 10.1177/0730888489016003004.

Hiltz, S. R., Kushama, J. A. and Plotnick, L. (2014) 'Use of Social Media by U . S . Public Sector Emergency Managers : Barriers and Wish Lists', ISCRAM, (May), pp. 602–611.

Hindmarsh, J., Fraser, M., Heath, C., Benford, S. and Greenhalgh, C. (2000) 'Object-focused interaction in collaborative virtual environments', ACM Transactions on Computer-Human Interaction. ACM, 7(4), pp. 477–509. doi: 10.1145/365058.365088.

Hinds, P. J. (1999) Perspective Taking Among Distributed Workers: The Effect of Distance on Shared Mental Models of Work,.

Hine, C. (2000) Virtual ethnography. Sage.

Hine, C. (2005) Virtual methods. Berg Publishers.

Hine, C. (2008) 'Virtual ethnography: Modes, varieties, affordances', The SAGE handbook of online research methods. Sage, London, pp. 257–270.

Hine, C. (2012) The Internet. Oxford University Press.

Hine, C. (2015) Ethnography for the internet: Embedded, embodied and everyday. Bloomsbury Publishing.

Hjorth, L., Horst, H., Galloway, A. and Bell, G. (2017) The Routledge companion to digital ethnography. Taylor & Francis.

Homeland Security, Directorate, T., Security Enterprise, H. and Responders Group, F. (2013) Innovative Uses of Social Media in Emergency Management. United States. Department of Homeland Security.

Howe, J. (2006) 'The rise of crowdsourcing', Wired magazine. Available at: https://www.wired.com/2006/06/crowds/ (Accessed: 7 December 2015).

Hudson, S. E. and Mankoff, J. (2014) 'Concepts, Values, and Methods for Technical Human--Computer Interaction Research', in Ways of Knowing in HCI. Springer, pp. 69–93.

Hughes, A. L. and Palen, L. (2009) 'Twitter adoption and use in mass convergence and emergency events', International Journal of Emergency Management. Inderscience Publishers, 6(3–4), pp. 248–260.

Hughes, A. L., Palen, L., Sutton, J., Liu, S. B. and Vieweg, S. (2008) 'Sight-seeing in disaster: an examination of on-line social convergence', in Proceedings of the Information Systems for Crisis Response and Management Conference (ISCRAM 2008), pp. 44–54.

Hughes, A. L. and Tapia, A. H. (2015) 'Social Media in Crisis: When Professional Responders Meet Digital Volunteers', Journal of Homeland Security and Emergency Management, 12(3), pp. 679–706. doi: 10.1515/jhsem-2014-0080.

Hughes, J. A., O'Brien, J., Randall, D., Rouncefield, M. and Tolmie, P. (2001) 'Some "real" problems of "virtual" organisation', New Technology, Work and Employment. Wiley/Blackwell (10.1111), 16(1), pp. 49–64. doi: 10.1111/1468-005X.00076.

Huysman, M., Steinfield, C., Jang, C.-Y., David, K., Poot, J. and Mulder, I. (2003) 'Virtual Teams and the Appropriation of Communication Technology: Exploring the Concept of Media Stickiness', Computer Supported Cooperative Work (CSCW). Kluwer Academic Publishers, 12(4), pp. 411–436. doi: 10.1023/A:1026145017609.

Iacono, J., Brown, A. and Holtham, C. (2009) 'Research Methods--a Case Example of Participant Observation.', Electronic Journal of Business Research Methods, 7(1).

IFRC (2005) World Disaster Report, International Federation of Red Cross and Red Crescent Societies. doi: 10.1017/CBO9781107415324.004.

Igbaria, M. and Magid (1999) 'The driving forces in the virtual society', Communications of the ACM. ACM, 42(12), pp. 64–70. doi: 10.1145/322796.322812.

Imran, M., Castillo, C., Diaz, F. and Meier, P. (2013) 'Practical Extraction of Disaster-Relevant Information from Social Media', in Proceeding of International World Wide Web Conference Committee (IW3C2) WWW 2013 Companion, May 13–17, 2013, Rio de Janeiro, Brazil. ACM 978-1-4503-2038-2/13/05, pp. 1–4.

Irani, L. C., Hayes, G. R. and Dourish, P. (2008) 'Situated practices of looking', in Proceedings of the ACM 2008 conference on Computer supported cooperative work - CSCW '08. New York, New York, USA: ACM Press, p. 187. doi: 10.1145/1460563.1460592.

Jackson, E. L. (1999) 'Leisure and the Internet', Journal of Physical Education, Recreation & Dance. Taylor & Francis Group , 70(9), pp. 18–22. doi: 10.1080/07303084.1999.10605963.

James, C. (1990) Foundations of social theory, Cambridge, MA: Belknap.

Jarvenpaa, S. L. and Leidner, D. E. (1999) 'Communication and Trust in Global Virtual Teams', Organization Science. INFORMS , 10(6), pp. 791–815. doi: 10.1287/orsc.10.6.791.

Joffe, H. and Yardley, L. (2004) 'Content and thematic analysis', Research methods for clinical and health psychology, 56, p. 68.

Johns, T. and Gratton, L. (2013) 'The third wave of virtual work', Harvard Business Review, 9(1), pp. 66–73.

Jones, S. and Marsh, S. (1997) 'Human-computer-human interaction: trust in CSCW', SIGCHI Bulletin. ACM, 29(3), pp. 36–40.

Jordan, B. (1996) 'Ethnographic workplace studies and CSCW', Human Factors in Information Technology. Elsevier, 12, pp. 17–42.

Kaplan, A. M. and Haenlein, M. (2010) 'Users of the world, unite! The challenges and opportunities of Social Media', Business Horizons. Elsevier, 53(1), pp. 59–68. doi: 10.1016/J.BUSHOR.2009.09.003.

Kaplan, B. and Maxwell, J. (2005) 'Qualitative research methods for evaluating computer information systems', Evaluating the organizational impact of healthcare information systems. Springer, pp. 30–55.

Kaptelinin, V. (1996) 'Creating computer-based work environments: an empirical study of Macintosh users', in Proceedings of the 1996 ACM SIGCPR/SIGMIS conference on Computer personnel research, pp. 360–366.

Kaptelinin, V. (2005) 'The Encyclopedia of Human-Computer Interaction, 16. Activity Theory'.

Kaptelinin, V., Nardi, B. A. and Macaulay, C. (1999) 'Methods & tools: The activity checklist: a tool for representing the "space" of context', interactions. ACM, 6(4), pp. 27–39.

Karp, I. and Kendall, M. B. (1982) 'Reflexivity in field work', Explaining human behavior: Consciousness, human action, and structure, pp. 250–269.

Kasper-Fuehrera, E. C. and Ashkanasy, N. M. (2001) 'Communicating trustworthiness and building trust in interorganizational virtual organizations', Journal of Management, 27(3), pp. 235–254. doi: 10.1177/014920630102700302.

Kaufhold, M. A. and Reuter, C. (2016) 'The Self-Organization of Digital Volunteers across Social Media: The Case of the 2013 European Floods in Germany', Journal of Homeland Security and Emergency Management, 13(1), pp. 137–166. doi: 10.1515/jhsem-2015-0063.

Keith Ferrazi (2012) How to Build Trust in a Virtual Workplace, Harvard Business Review. Available at: https://hbr.org/2012/10/how-to-build-trust-in-virtual (Accessed: 1 June 2018).

Kirkman, B. L., Rosen, B., Gibson, C. B., Tesluk, P. E. and McPherson, S. O. (2002) 'Five challenges to virtual team success: Lessons from Sabre, Inc.', Academy of Management Perspectives. Academy of Management Briarcliff Manor, NY 10510, 16(3), pp. 67–79. doi: 10.5465/ame.2002.8540322.

Kock, N. (2005) 'Action Research', The Encyclopedia of Human-Computer Interaction. 2nd edn.

Kreps, G. . and Bosworth, S. L. (2007) 'Organizational adaptation to disaster. Handbook of disaster research', in Rodriguez, H., Quarantelli, E.L. and Dynes, R. eds. (ed.), p. 297–315.

Kuutti, K. (1991) 'The concept of activity as a basic unit of analysis for CSCW research', in Proceedings of the Second European Conference on Computer-Supported Cooperative Work ECSCW '91. Dordrecht: Springer Netherlands, pp. 249–264. doi: 10.1007/978-94-011-3506-1_19.

Latonero, M. and Shklovski, I. (2010) '"Respectfully Yours in Safety and Service": Emergency Management and Social Media Evangelism', in proceedings of Information Systems for Crisis Response and Management Conference (ISCRAM), Seattle WA, pp. 1–10.

Lave, J. and Wenger, E. (1991) Situated learning: Legitimate peripheral participation. Cambridge university press.

Lazar, J., Feng, J. H. and Hochheiser, H. (2010) Research Methods in Human-Computer Interaction. Wiley Publishing.

Leinonen, P., Järvelä, S. and Häkkinen, P. (2005) 'Conceptualizing the Awareness of Collaboration: A Qualitative Study of a Global Virtual Team', Computer Supported Cooperative Work (CSCW). Springer Netherlands, 14(4), pp. 301–322. doi: 10.1007/s10606-005-9002-z.

Lewis, E. T. (2000) 'Tech Support Engineers' Communication in a Chat Tool', in CHI '00 Extended Abstracts on Human Factors in Computing Systems (CHI EA '00). ACM, New York, NY, USA., pp. 103–104. doi: 10.1145/633292.633353.

Liamputtong, P. (2009) 'Qualitative data analysis: conceptual and practical considerations', Health Promotion Journal of Australia. CSIRO, 20(2), pp. 133–139.

Lipnack, J. and Stamps, J. (1999) 'Virtual teams: The new way to work', Strategy & Leadership. MCB UP Ltd, 27(1), pp. 14–19. doi: 10.1108/eb054625.

Liu, S. B. (2014) 'Crisis Crowdsourcing Framework: Designing Strategic Configurations of Crowdsourcing for the Emergency Management Domain', Computer Supported Cooperative Work (CSCW). Springer Netherlands, 23(4), pp. 389–443. doi: 10.1007/s10606-014-9204-3.

Liu, S. B. and Palen, L. (2010) 'The New Cartographers: Crisis Map Mashups and the Emergence of Neogeographic Practice', Cartography and Geographic Information Science, 37(1), pp. 69–90. doi: 10.1559/152304010790588098.

Liu, S. B., Palen, L., Sutton, J., Hughes, A. L. and Vieweg, S. (2008) 'In Search of the Bigger Picture : The Emergent Role of On-Line Photo Sharing in Times of Disaster', Proceedings of the 5th International ISCRAM Conference, 8(May), pp. 140–149. doi: -.

Loughran, J. (2000) 'Working together virtually: The care and feeding of global virtual teams', in Proceedings of 5th International Command and Control Research and Technology Symposium.

Ludwig, T., Reuter, C. and Pipek, V. (2015) 'Social Haystack: Dynamic Quality Assessment of Citizen-Generated Content during Emergencies', ACM Trans. Comput.-Hum. Interact. Article, 22(17). doi: 10.1145/2749461.

Ludwig, T., Reuter, C., Siebigteroth, T. and Pipek, V. (2015) 'CrowdMonitor: Mobile crowd sensing for assessing physical and digital activities of citizens during emergencies', in Proceedings of the 33rd Annual ACM Conference on Human Factors in Computing Systems, pp. 4083–4092. doi: 10.1145/2702123.2702265.

Ludwig, T., Siebigteroth, T. and Pipek, V. (2014) 'CrowdMonitor: Monitoring Physical and Digital Activities of Citizens During Emergencies', in Social Informatics, pp. 421–428.

Ludwig, T., Siebigteroth, T. and Pipek, V. (2015) 'Crowdmonitor: Monitoring physical and digital activities of citizens during emergencies', Lecture Notes in Computer Science (including subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics), 8852, pp. 421–428. doi: 10.1007/978-3-319-15168-7_51.

Madianou, M. (2015) 'Polymedia and Ethnography: Understanding the Social in Social Media', Social Media + Society, 1(1), p. 205630511557867. doi: 10.1177/2056305115578675.

Majchrzak, A., Jarvenpaa, S. L. and Hollingshead, A. B. (2007) 'Coordinating Expertise Among Emergent Groups Responding to Disasters', Organization Science, 18(1), pp. 147–161. doi: 10.1287/orsc.1060.0228.

Maloney-Krichmar, D. and Preece, J. (2005) 'A multilevel analysis of sociability, usability, and community dynamics in an online health community', ACM Transactions on Computer-Human Interaction (TOCHI). ACM, 12(2), pp. 201–232.

Map Maker, G., Blanchard, H., Commons Kate Chapman, C., Crowley, J., Eguchi, R. T., Ghesquiere, F., Lamy, F., Meier, P., Phillips, E. and Toro, J. (2012) Volunteer Technology Communities: Open Development. Available at: https://www.gfdrr.org/volunteer-technology-communities-open-development (Accessed: 29 April 2017).

Mark, G. J., Al-Ani, B. and Semaan, B. (2009) 'Resilience through technology adoption', in Proceedings of the 27th international conference on Human factors in computing systems - CHI 09. New York, New York, USA: ACM Press, p. 689. doi: 10.1145/1518701.1518808.

Mark, G. and Semaan, B. (2008) 'Resilience in Collaboration: Technology as a Resource for New Patterns of Action', in Proceedings of the ACM 2008 conference on Computer supported cooperative work - CSCW '08. New York, New York, USA: ACM Press, p. 137. doi: 10.1145/1460563.1460585.

Markham, A. N. (2005) 'The methods, politics, and ethics of representation in online ethnography', in The Sage Handbook of Qualitative Research, SAGE, Thousand Oaks, CA.

Markman, K. M. (2009) '"So What Shall We Talk About" Openings and Closings in Chat-Based Virtual Meetings', The Journal of Business Communication (1973). SAGE Publications Sage CA: Los Angeles, CA, 46(1), pp. 150–170.

Martins, L. E. G. and Daltrini, B. M. (1999) 'An approach to software requirements elicitation using precepts from activity theory', in Automated Software Engineering, 1999. 14th IEEE International Conference on., pp. 15–23.

Mayer, R. C., Davis, J. H. and Schoorman, F. D. (1995) 'an Integrative Model of Organizational Trust.', Academy of Management Review, 20(3), pp. 709–734. doi: 10.5465/AMR.1995.9508080335.

Mays, N. and Pope, C. (2007) 'Quality in qualitative health research', Qualitative Research in Health Care, Third Edition. Wiley Online Library, pp. 82–101.

McAndrew, F. and Jeong, H. (2012) 'Who does what on Facebook? Age, sex, and relationship status as predictors of Facebook use', Computers in Human Elsevier.

Mcevily, B., Perrone, V. and Zaheer, A. (2003) 'Introduction to the Special Issue on Trust in an Organizational Context', 14(1), pp. 1–4. doi: 10.1287/orsc.14.1.1.12812.

McKernan, J. (2013) Curriculum action research: A handbook of methods and resources for the reflective practitioner. Routledge.

Meier, P. (2011) 'New information technologies and their impact on the humanitarian sector', International Review of the Red Cross, 93(884), pp. 1239–1263. doi: 10.1017/S1816383112000318.

Mendoza, M., Poblete, B. and Castillo, C. (2010) 'Twitter under crisis: can we trust what we rt?', in In Proceedings of the First Workshop on Social Media Analytics SOMA'10, pp. 71–79.

Milner, M. . and Verity, A. (2013) Collaborative Innovation in Humanitarian Affairs: Organization and Governance in the Era of Digital Humanitarianism. Available at: http://blog.veritythink.com/post/64759220120/collaborative-innovation-in-humanitarian-affairs (Accessed: 15 March 2017).

Moore, R. J., Ducheneaut, N. and Nickell, E. (2007) 'Doing Virtually Nothing: Awareness and Accountability in Massively Multiplayer Online Worlds', Computer Supported Cooperative Work (CSCW). Kluwer Academic Publishers, 16(3), pp. 265–305. doi: 10.1007/s10606-006-9021-4.

Morrow, N., Mock, N., Papendieck, A. and N., K. (2011) Independent Evaluation of the Ushahidi Haiti Project. Available at: http://www.alnap.org/resource/6000 (Accessed: 23 April 2017).

Myers, M. D. (1999) 'Investigating information systems with ethnographic research', Communications of the AIS. Association for Information Systems, 2(4es), p. 1.

Nagy, A. and Stamberger, J. (2012) 'Crowd sentiment detection during disasters and crises', in Proceedings of the 9th International ISCRAM Conference, pp. 1–9.

Nakamura, L. (2013) '"Words with Friends": Socially Networked Reading on Goodreads', PMLA. Modern Language Association of America 26 Broadway, 3rd floor New York, NY 10004-1789 USA, 128(1), pp. 238–243. doi: 10.1632/pmla.2013.128.1.238.

Nardi, B. A. (1996) 'Studying context: A comparison of activity theory, situated action models, and distributed cognition', in Context and consciousness: Activity theory and human-computer interaction, pp. 69–102.

Nardi, B. A. (1998) 'Activity Theory and Its Use Within Human-Computer Interaction', The Journal of the Learning Sciences, 7(2), pp. 257–261.

Nhan, J., Huey, L. and Broll, R. (2017) 'Digilantism: An analysis of crowdsourcing and the Boston marathon bombings', The British Journal of Criminology. Oxford University Press, 57(2), pp. 341–361. doi: 10.1093/bjc/azv118.

O'Neill, J. and Martin, D. (2003) 'Text chat in action', in Proceedings of the 2003 international ACM SIGGROUP conference on Supporting group work - GROUP '03. New York, New York, USA: ACM Press, p. 40. doi: 10.1145/958160.958167.

OCHA, U. N. (2012) 'World Humanitarian Data and Trends, 2013'. Geneva.

Olteanu, A., Vieweg, S. and Castillo, C. (2015) 'What to Expect When the Unexpected Happens: Social Media Communications Across Crises', Proceedings of the 18th ACM Conference on Computer Supported Cooperative Work & Social Computing - CSCW '15. doi: 10.1145/2675133.2675242.

Orlikowski, W. J. (1995) 'Evolving with Notes: Organizational change around groupware technology'. Sloan School of Management, Massachusetts Institute of Technology.

Orlikowski, W. J. (1995) 'Learning From Notes: Organizational Issues in Groupware Implementation', Readings in Human–Computer Interaction. Morgan Kaufmann, pp. 197–204. doi: 10.1016/B978-0-08-051574-8.50023-6.

Ortner, S. B. (2006) Anthropology and social theory: Culture, power, and the acting subject. Duke University Press.

Ostermann, F. O. and Spinsanti, L. (2011) 'A conceptual workflow for automatically assessing the quality of volunteered geographic information for crisis management', in Proceedings of AGILE, pp. 1–6.

Palen, L., Hiltz, S. R. and Liu, S. B. (2007) 'Citizen communications in crisis: anticipating a future of ICT-supported public participation', in CHI '07 Proceedings of the SIGCHI conference on Human factors in computing systems. San Jose, CA, USA: ACM New York, NY, USA, p. 10. Available at: http://dx.doi.org/10.1145/1240624.1240736.

Palen, L., Soden, R., Anderson, T. J. and Barrenechea, M. (2015) 'Success & Scale in a Data-Producing Organization: The Socio-Technical Evolution of OpenStreetMap in Response to Humanitarian Events', Proceedings of the ACM CHI'15 Conference on Human Factors in Computing Systems, 1, pp. 4113–4122. doi: 10.1145/2702123.2702294.

Palen, L., Vieweg, S., Liu, S. B. and Hughes, A. L. (2009) 'Crisis in a Networked World', in Social Science Computer Review, pp. 467–480. doi: 10.1177/0894439309332302.

Panteli, N. and Tucker, R. (2009) 'Power and trust in global virtual teams', Communications of the ACM. ACM, 52(12), p. 113. doi: 10.1145/1610252.1610282.

Parks, M. R. and Floyd, K. (2006) 'Making Friends in Cyberspace', Journal of Computer-Mediated Communication. Oxford University Press, 1(4), pp. 0–0. doi: 10.1111/j.1083-6101.1996.tb00176.x.

Peshkin, A. (1988) 'In search of subjectivity - one's own', Educational researcher. Sage Publications Sage CA: Thousand Oaks, CA, 17(7), pp. 17–21.

Pink, S., Horst, H., Postill, J., Hjorth, L., Lewis, T. and Tacchi, J. (2015) Digital Ethnography: Principles and Practice. SAGE.

Porter, C. E. (2006) 'A Typology of Virtual Communities: A Multi-Disciplinary Foundation for Future Research', Journal of Computer-Mediated Communication, 10(1), pp. 00–00. doi: 10.1111/j.1083-6101.2004.tb00228.x.

Postill, J. (2017) 'Remote Ethnography: Studying Culture from Afar', in The Routledge Companion to Digital Ethnography. Taylor & Francis, pp. 87–95.

Preist, C., Massung, E. and Coyle, D. (2014) 'Competing or aiming to be average?', Proceedings of the 17th ACM conference on Computer supported cooperative work & social computing - CSCW '14, pp. 1222–1233. doi: 10.1145/2531602.2531615.

Quarantelli, E. L. (1988) 'Disaster crisis management: A summary of research findings', Journal of management studies. Wiley Online Library, 25(4), pp. 373–385. doi: 10.1111/j.1467-6486.1988.tb00043.x.

Quarantelli, E. L. (1997) 'Problematical aspects of the information/ communication revolution for disaster planning and research: ten non-technical issues and questions', Disaster Prevention and Management: An International Journal. MCB UP Ltd, 6(2), pp. 94–106. doi: 10.1108/09653569710164053.

Quarantelli, E. L. and Dynes, R. R. (1977) 'Response to Social Crisis and Disaster', Annual Review of Sociology, 3(1), pp. 23–49. doi: 10.1146/annurev.so.03.080177.000323.

Quek, A. and Shah, H. (2004) 'A Comparative Survey of Activity-Based Methods for Information Systems Development.', in ICEIS (5), pp. 221–232.

Rama, J. and Bishop, J. (2006) 'A survey and comparison of CSCW groupware applications', in Proceedings of the 2006 annual research conference of the South African institute of computer scientists and information technologists on IT research in developing couuntries - SAICSIT '06. New York, New York, USA: ACM Press, pp. 198–205. doi: 10.1145/1216262.1216284.

Randall, D., Harper, R. and Rouncefield, M. (2007) Fieldwork for design: theory and practice. Springer Science & Business Media.

Randall, D. and Rouncefield, M. (2012) '31. Ethnography', The Encyclopedia of Human-Computer Interaction. 2nd edn. The Interaction Design Foundation. Available at: https://www.interaction-design.org/literature/book/the-encyclopedia-of-human-computer-interaction-2nd-ed/ethnography.

Randall, D., Rouncefield, M. and Hughes, J. A. (1995) 'Chalk and cheese: BPR and ethnomethodologically informed ethnography in CSCW', in Proceedings of the fourth conference on European Conference on Computer-Supported Cooperative Work, pp. 325–340.

Raymond, N., Howarth, C. and Hutson, J. (2012) Crisis Mapping Needs an Ethical Compass : Global Brief, Global Brief - World Affairs in 21st Century.

Redmiles, D. (2002) 'Introduction to the Special Issue on Activity Theory and the Practice of Design', Computer Supported Cooperative Work (CSCW). Kluwer Academic Publishers, 11(1–2), pp. 1–11. doi: 10.1023/A:1015215726353.

Resor, E. (2016) 'The Neo-Humanitarians: Assessing the Credibility of Organized Volunteer Crisis Mappers', Policy and Internet, 8(1), pp. 34–54. doi: 10.1002/poi3.112.

Reuter, C. (2015) Crisis 2.0: Towards a Systematization of Social Software Use (IJISCRAM), Emergent Collaboration Infrastructures. Springer Gabler, Wiesbaden.

Reuter, C., Heger, O. and Pipek, V. (2013) Combining Real and Virtual Volunteers through Social Media. doi: 10.1126/science.1060143.

Reuter, C., Hughes, A. L. and Kaufhold, M.-A. (2018) 'Social Media in Crisis Management: An Evaluation and Analysis of Crisis Informatics Research', International Journal of Human–Computer Interaction. Taylor & Francis, pp. 1–15. doi: 10.1080/10447318.2018.1427832.

Reuter, C. and Kaufhold, M.-A. (2018) 'Fifteen years of social media in emergencies: a retrospective review and future directions for crisis informatics', Journal of Contingencies and Crisis Management. Wiley Online Library, 26(1), pp. 41–57. doi: 10.1111/1468-5973.12196.

Reuter, C., Ludwig, T., Kaufhold, M.-A. and Pipek, V. (2015) 'XHELP: Design of a Cross-Platform Social-Media Application to Support Volunteer Moderators in Disasters', in Proceedings of the 33rd Annual ACM Conference on Human Factors in Computing Systems (CHI '15). ACM. New York, NY, USA, pp. 4093–4102. doi: 10.1145/2702123.2702171.

Reuter, C. and Scholl, S. (2014) 'Technical Limitations for Designing Applications for Social Media.', in Mensch & Computer Workshopband, pp. 131–139.

Rice, D. J., Davidson, B. D., Dannenhoffer, J. F. and Gay, G. K. (2007) 'Improving the Effectiveness of Virtual Teams by Adapting Team Processes', Computer Supported Cooperative Work (CSCW). Springer Netherlands, 16(6), pp. 567–594. doi: 10.1007/s10606-007-9070-3.

Ridings, C. M. and Gefen, D. (2006) 'Virtual Community Attraction: Why People Hang Out Online', Journal of Computer-Mediated Communication. Oxford University Press, 10(1), pp. 00–00. doi: 10.1111/j.1083-6101.2004.tb00229.x.

Robson, E. S. (2012) Responding to Liability: Evaluating and Reducing Tort Liability for Digital Volunteers, Woodrow Wilson International Center for Scholars. Washington, DC.

Rode, J. A. (2011) 'Reflexivity in Digital Anthropology', in Proceedings of the SIGCHI Conference on Human Factors in Computing Systems. New York, NY, USA: ACM (CHI '11), pp. 123–132. doi: 10.1145/1978942.1978961.

Rousseau, D. M., Sitkin, S. B., Burt, R. S. and Camerer, C. (1998) 'Not So Different After All: A Cross-Discipline View Of Trust', Academy of Management Review, 23(3), pp. 393–404. doi: 10.5465/amr.1998.926617.

Rozakis, M. (2007) 'The cultural context of emergencies: Seeking for a(n) holistic approach on disaster management', Disaster Prevention and Management: An International Journal,. PT, 16(2), pp. 201–209. doi: 10.1108/09653560710739522.

Sabou, J. and Videlov, S. (2016) 'An Analysis on the Role of Trust in Digital Humanitarian Actor Networks', in ISCRAM.

Sagar, V. C. (2016) As the water recedes: Sri Lanka rebuilds, (RSIS Commentaries, No. 141). RSIS Commentaries. Singapore: Nanyang Technological University. Available at: https://dr.ntu.edu.sg/handle/10220/40750.

Sandvik, K. B., Gabrielsen Jumbert, M., Karlsrud, J. and Kaufmann, M. (2014) 'Humanitarian technology: a critical research agenda', International Review of the Red Cross, 96(893), pp. 219–242. doi: 10.1017/S1816383114000344.

Sandvik, K. B. and Lohne, K. (2014) 'The Rise of the Humanitarian Drone: Giving Content to an Emerging Concept', Millennium, 43(1), pp. 145–164. doi: 10.1177/0305829814529470.

Schade, S., Luraschi, G., De Longueville, B., Cox, S. and Díaz, L. (2010) 'Citizens as sensors for crisis events: Sensor web enablement for volunteered geographic information'. Citeseer.

Schlichter, J., Koch, M. and Xu, C. (1998) 'Awareness - The Common Link Between Groupware and Community Support Systems', in. Springer, Berlin, Heidelberg, pp. 77–93. doi: 10.1007/3-540-49247-X_6.

Seale, C. (1999) Quality in Qualitative Research, Qualitative Inquiry. Available at: https://journals.sagepub.com/doi/pdf/10.1177/107780049900500402?casa_token=rvKUYUOgWJ4AAAAA%3AzXT76tBIEdaL_uJDtd1SmwCcPK3_yt1EP8mSfCzgqbyAj3n-oqlhhtAKLPrX_cDik_5hALoK-88-OA (Accessed: 1 December 2018).

Sebastian, I. M. and Bui, T. X. (2009a) 'Emergent groups for emergency response-theoretical foundations and information design implications', AMCIS 2009 Proceedings, p. 638.

Sebastian, I. M. and Bui, T. X. (2009b) 'Emergent Groups for Emergency Response – Theoretical Foundations and Information Design Implications', in AMCIS 2009 Proceedings, p. 638.

Sell, C. and Braun, I. (2009) 'Using a workflow management system to manage emergency plans', in Proceedings of the 6th International ISCRAM Conference, p. 43.

Shanley, L., Burns, R., Bastian, Z. and Robson, E. (2013) Tweeting up a Storm. The Promise and Perils of Crisis Mapping. doi: http://dx.doi.org/10.2139/ssrn.2464599.

Shao, Y. P., Liao, S. Y. and Wang, H. Q. (1998) 'A model of virtual organisations', Journal of Information Science, 24(5), pp. 305–312. doi: 10.1177/016555159802400504.

Shapiro, D. and Dan (1994) 'The limits of ethnography', in Proceedings of the 1994 ACM conference on Computer supported cooperative work - CSCW '94. New York, New York, USA: ACM Press, pp. 417–428. doi: 10.1145/192844.193064.

Shklovski, I., Palen, L. and Sutton, J. (2008) 'Finding community through information and communication technology in disaster response', in Proceedings of the ACM 2008 conference on Computer supported cooperative work - CSCW '08. New York, New York, USA: ACM Press, p. 127. doi: 10.1145/1460563.1460584.

Sieber, P. and Griese, J. (1998) 'Organizational virtualness', in Verlag, S. (ed.) Proceedings of the VoNet - Workshop, April 27-28, 1998.

Smith, M. A., Farnham, S. D. and Drucker, S. M. (2000) 'The Social Life of Small Graphical Chat Spaces', in Proceedings of the SIGCHI Conference on Human Factors in Computing Systems. New York, NY, USA: ACM (CHI '00), pp. 462–469. doi: 10.1145/332040.332477.

Sorensen, J. and Sorensen, B. (2007) 'Community processes: Warning and evacuation', in Handbook of disaster research. New York, NY.: Springer, pp. 183–199.

Stahl, B. C. (2014) 'Interpretive accounts and fairy tales: a critical polemic against the empiricist bias in interpretive IS research', European Journal of Information Systems. Palgrave Macmillan UK, 23(1), pp. 1–11. doi: 10.1057/ejis.2012.58.

Stallings, R. A. and Quarantelli, E. L. (1985) 'Emergent citizen groups and emergency management', Public Administration Review. JSTOR, 45, pp. 93–100.

Standby Task Force (2011) Why We Need a Disaster 2.1 Report. Available at: http://www.standbytaskforce.org/2011/04/06/why-we-need-a-disaster-2-1-report/ (Accessed: 19 April 2017).

Starbird, K. (2011) 'Digital volunteerism during disaster: Crowdsourcing information processing', in Conference on human factors in computing systems, pp. 7–12.

Starbird, K. (2013) 'Delivering Patients to Sacré Coeur : Collective Intelligence in Digital Volunteer Communities', Proceedings of the Conference on Human Factors in Computing Systems (CHI), pp. 801–810. doi: 10.1145/2470654.2470769.

Starbird, K., Muzny, G. and Palen, L. (2012) 'Learning from the Crowd: Collaborative Filtering Techniques for Identifying On-the-Ground Twitterers during Mass Disruptions', Proceedings of 9th International Conference on Information Systems for Crisis Response and Management, ISCRAM, 2011(April), pp. 1–10.

Starbird, K. and Palen, L. (2011) '"Voluntweeters": Self-Organizing by Digital Volunteers in Times of Crisis', in Proceedings of the SIGCHI conference on human factors in computing systemsCHI 2011, May 7–12, 2011, Vancouver, BC, Canada., pp. 1071–1080.

Starbird, K. and Palen, L. (2012) 'Digital volunteerism: Examining connected crowd work during mass disruption events', Proc. CSCW 2012 Workshop on Collaboration and, 116–123.

Starbird, K. and Palen, L. (2013) 'Working and sustaining the virtual "Disaster Desk"', in Proceedings of the 2013 conference on Computer supported cooperative work - CSCW '13. New York, New York, USA: ACM Press, pp. 491–502. doi: 10.1145/2441776.2441832.

Starbird, K., Palen, L., Hughes, A. L. and Vieweg, S. (2010) 'Chatter on The Red: What Hazards Threat Reveals about the Social Life of Microblogged Information', in Proceedings of the 2010 ACM conference on Computer supported cooperative work (CSCW '10). ACM,. New York, NY, USA, p. 241–250. doi: https://doi.org/10.1145/1718918.1718965.

Su, N. M. and Mark, G. (2008) 'Communication Chains and Multitasking', in Proceedings of the SIGCHI Conference on Human Factors in Computing Systems. New York, NY, USA: ACM (CHI '08), pp. 83–92. doi: 10.1145/1357054.1357069.

Suchman, L. A. (1987) Plans and situated actions: The problem of human-machine communication. Cambridge University Press.

Sutton, J. N., Palen, L. and Shklovski, I. (2008) Backchannels on the front lines: Emergency uses of social media in the 2007 Southern California Wildfires, Proceedings of the 5 th International ISCRAM Conference . University of Colorado.

Tapia, A. H. and LaLone, N. J. (2014) 'Crowdsourcing Investigations':, International Journal of Information Systems for Crisis Response and Management, 6(4), pp. 60–75. doi: 10.4018/IJISCRAM.2014100105.

Tapia, A. H., LaLone, N. J. and Kim, H.-W. (2014) 'Run amok: Group crowd participation in identifying the bomb and bomber from the Boston marathon bombing', in ISCRAM, pp. 265–274. doi: 10.4018/IJISCRAM.2014100105.

Tapia, A. H. and Moore, K. (2014) 'Good Enough is Good Enough: Overcoming Disaster Response Organizations' Slow Social Media Data Adoption', Computer Supported Cooperative Work: CSCW: An International Journal, 23(4–6), pp. 483–512. doi: 10.1007/s10606-014-9206-1.

Taylor, J. G., Gillette, S. C., Hodgson, R. W. and Downing, J. L. (2005) Communicating with wildland interface communities during wildfire. doi: 10.3133/ofr20051061.

Thuan, N. H., Antunes, P. and Johnstone, D. (2016) 'Factors influencing the decision to crowdsource: A systematic literature review', Information Systems Frontiers, 18(1), pp. 47–68. doi: 10.1007/s10796-015-9578-x.

Trainor, J., Subbio, T., Hughes, A. L., Palen, L. and Peterson, S. (2014) Critical issues in disaster science and management: A dialogue between researchers and practitioners. FEMA Higher Education Project.

Vaismoradi, M., Turunen, H. and Bondas, T. (2013) 'Content analysis and thematic analysis: Implications for conducting a qualitative descriptive study', Nursing & health sciences. Wiley Online Library, 15(3), pp. 398–405.

Vieweg, S., Hughes, A. L., Starbird, K. and Palen, L. (2010) 'Microblogging during two natural hazards events: what twitter may contribute to situational awareness', in Proceedings of the 28th international conference on human factors in computing systems. ACM, pp. 1079–1088. doi: 10.1145/1753326.1753486.

Vieweg, S., Palen, L., Liu, S. B., Hughes, A. L. and Sutton, J. (2008) Collective Intelligence in Disaster: Examination of the Phenomenon in the Aftermath of the 2007 Virginia Tech Shooting. Boulder, CO: University of Colorado.

Wageman, R. (1995) 'Interdependence and group effectiveness', Administrative science quarterly, pp. 145–80.

Waldman, S. and Kaminska, K. (2015) 'Connecting emergency management organizations with digitally enabled emergent volunteering'. Available at: http://cradpdf.drdc-rddc.gc.ca/PDFS/unc214/p803152_A1b.pdf (Accessed: 24 April 2017).

Walker, P., Hein, K., Russ, C., Bertleff, G. and Caspersz, D. (2010) 'A Blueprint For Professionalizing Humanitarian Assistance', Health Affairs, 29(12), pp. 2223–2230. doi: 10.1377/hlthaff.2010.1023.

Walsham, G. (1995) 'The emergence of interpretivism in IS research', Information systems research. INFORMS, 6(4), pp. 376–394.

Wang, R. Y. and Strong, D. M. (1996) 'Beyond accuracy: What data quality means to data consumers', Journal of management information systems. Taylor & Francis, 12(4), pp. 5–33. doi: https://doi.org/10.1080/07421222.1996.11518099.

Wang, Y., Huang, Y. and Louis, C. (2013) 'Towards a Framework for Privacy-Aware Mobile Crowdsourcing', in 2013 International Conference on Social Computing. IEEE, pp. 454–459. doi: 10.1109/SocialCom.2013.71.

Ward, K. J. (1999) 'Cyber-ethnography and the emergence of the virtually new community', Journal of Information technology. Taylor & Francis, 14(1), pp. 95–105.

Webb, G. R., Marinelli, L., McCloskey, J. and McMichael, M. (1999) Individual and Organizational Response to Natural Disasters and Other Crisis Events: The Continuing Value of the DRC Typology. PRELIMINARY PAPER #277.

Weinandy, T. (2016) Volunteer and Technical Communities in Humanitarian Response: Lessons in Digital Humanitarianism from Typhoon Haiyan, UN Chronicle. Available at: http://www.oecd-ilibrary.org/content/article/f22a27d6-en (Accessed: 15 March 2017).

Wellman, B. (1996) 'For a social network analysis of computer networks: a sociological perspective on collaborative work and virtual community', in Proceedings of the 1996 ACM SIGCPR/SIGMIS conference on Computer personnel research. New York, New York, USA: ACM Press, pp. 1–11. doi: 10.1145/238857.238860.

Wilensky, H. (2014) 'Twitter as a navigator for stranded commuters during the great east Japan earthquake', in Proceedings of the 11th International ISCRAM Conference – University Park, Pennsylvania, USA, pp. 697–706.

Yang, S., Chung, H., Lin, X., Lee, S., Chen, L., Wood, A., Kavanaugh, A. L., Sheetz, S. D., Shoemaker, D. J. and Fox, E. A. (2013) 'PhaseVis: What, when, where, and who in visualizing the four phases of emergency management through the lens of social media', in Proceedings of the 10th International ISCRAM Conference – Baden-Baden, Germany, pp. 912–917.

Yates, D. and Paquette, S. (2011) 'Emergency knowledge management and social media technologies: a case study of the 2010 Haitian earthquake', International Journal of Information Management. American Society for Information Science, 31(1), p. 42.

Yates, J., Orlikowski, W. J. and Okamura, K. (1999) 'Explicit and Implicit Structuring of Genres in Electronic Communication: Reinforcement and Change of Social Interaction', Organization Science. INFORMS, 10(1), pp. 83–103. doi: 10.1287/orsc.10.1.83.

Yin, R. K. (2003) 'Case study research: Design and methods . Thousands Oaks', Sage. Young, LC and Wilkinson, IR (1989). The role of trust and co-operation in marketing channels: a preliminary study. European Journal of Marketing. Los Angeles: SAGE, 23(2), pp. 109–122.

Zettl, V., Ludwig, T., Kotthaus, C. and Skudelny, S. (2017) 'Embedding unaffiliated volunteers in crisis management systems: Deploying and supporting the concept of intermediary organizations.', in Proceedings of the 14th ISCRAM Conference – Albi, France, pp. 421–31.

Appendix I A: Ethical Approval Letter

College of Engineering, Design and Physical Sciences Research Ethics Committee
Brunel University London
Kingston Lane
Uxbridge
UB8 3PH
United Kingdom

www.brunel.ac.uk

25 May 2016

LETTER OF APPROVAL

Applicant: Mr Najeeb Gambo Abdulhamid

Project Title: Coordinating Volunteer Responses in Disaster Situations

Reference: 3082-LR-May/2016- 3071-2

Dear Mr Najeeb Gambo Abdulhamid

The Research Ethics Committee has considered the above application recently submitted by you.

The Chair, acting under delegated authority has agreed that there is no objection on ethical grounds to the proposed study. Approval is given on the understanding that the conditions of approval set out below are followed:

- The agreed protocol must be followed. Any changes to the protocol will require prior approval from the Committee by way of an application for an amendment.

Please note that:

- Research Participant Information Sheets and (where relevant) flyers, posters, and consent forms should include a clear statement that research ethics approval has been obtained from the relevant Research Ethics Committee.
- The Research Participant Information Sheets should include a clear statement that queries should be directed, in the first instance, to the Supervisor (where relevant), or the researcher. Complaints, on the other hand, should be directed, in the first instance, to the Chair of the relevant Research Ethics Committee.
- Approval to proceed with the study is granted subject to receipt by the Committee of satisfactory responses to any conditions that may appear above, in addition to any subsequent changes to the protocol.
- The Research Ethics Committee reserves the right to sample and review documentation, including raw data, relevant to the study.
- You may not undertake any research activity if you are not a registered student of Brunel University or if you cease to become registered, including abeyance or temporary withdrawal. As a deregistered student you would not be insured to undertake research activity. Research activity includes the recruitment of participants, undertaking consent procedures and collection of data. Breach of this requirement constitutes research misconduct and is a disciplinary offence.

Professor Hua Zhao

Chair

College of Engineering, Design and Physical Sciences Research Ethics Committee
Brunel University London

Appendix I B: HR's Approval

HUMANITYROAD℠

June 22, 2016

Najeeb Abdulhamid Gambo
Via: Najeeb.Abdulhamid@Brunel.ac.uk
Computer Science Department
College of Engineering Design and Physical Sciences

Re: **Permission to Conduct Case Study Research**

Dear Mr. Gambo

Thank you for your interest in studying the role of digital volunteers in humanitarian emergencies. I am writing to inform you that your research request was approved.

Thank you for signing our code of conduct upon registering as a volunteer. As we discussed, please insert the word "Researcher" in front of your skype name so that other volunteers are aware of the nature of your presence in our skype rooms. I have included a copy of our Data Protection and Research Guidelines which we reviewed on the interview call yesterday.

Included in this package is the nondisclosure agreement that we discussed. Please review print, sign, scan and return prior to starting your research.

Thank you for selecting digital disaster response as your field of study. I will be your point of contact liaison for your project. Please reach out to me if you have any other questions.

Thank you,

Cat Graham

Cat Graham
Vice President, COO Humanity Road, Inc
230 Washington Street
Boydton, VA 23917
Cat@humanityroad.org

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Appendix II: Explanation of interview coding system

In this study, a typical interview code is written as **P7#0004T78** where:

- P7 represents participants number 7
- #0002 represents interview subtheme number 2 (information workflow)
- T7 represents transcript number 7
- 8 represent the page number in which the quote was excerpted

Participants information

S/N	Participant (Code)	Transcript Label	Gender	Experience (Tier)	Interview Date
1	P1	T1	F	Early entrant (2012)	10/10/2017
2	P2	T2	F	Later entrant (2013 – 2015)	11/10/2017
3	P3	T3	M	2015 - upward	12/10/2017
4	P4	T4	M	2015 - upward	16/10/2017
5	P5	T5	M	Later entrant (2013 – 2015)	24/10/2017
6	P6	T6	F	Founding volunteer	15/11/2017
7	P7	T7	F	Founding volunteer	22/11/2017

Interview Subthemes

Sub Theme	Code
Ice breakers	#0001
Information workflow – Disaster response	#0002
Verification and data quality assurance measures	#0003
ICT tools and usage	#0004
Organisational matter – HR	#0005
Exit questions	#0006
Closing	#0007

Appendix III: Participant observation

Breakdown of committees and activities I participated, observed or combined participation with observations.

S/N	ACTIVITY	FREQUENCY
1.	Standing Committees	3
2.	Special Project	10
3.	Daily Activities	6
4.	Extraordinary meetings	2
5.	Traditional training	5
6.	Internal Drills	13

Below is the complete list of the committees and activities

Standing Committees

1. HR Internal Drill Team
2. HR Disaster Desk Working Group
3. HR Team and Project Leads

Special Project

1. Burundi Hospital Wrk Group 7-15/3/16
2. EarthEX 2017
3. Fiji Response Work Group
4. Haiti Orphanage Solutions Group
5. Hill AFB Airshow 24-26/8/16 Utah US Special project Workbook
6. Hurricane Matthew - CAFEDO Orphanage Activation 5/5/17 to 19/6/17
7. McHenry Floods 17-22/7/17 McHenry County, Illinois - Activation for McHenry County emergency management – special report

8. Operation Swimming Bear, California, US - Special Project, Sacramento OES 8-11/1/17 special report
9. Pacific Endeavour exercise 2017 http://bit.ly/2qrOQJR
10. Simex Exercise

Daily Activities - Windows

1. HR Work Diary
2. HR Useful Links
3. HR Urgent Events - Event Status & Info
4. HR Scanigo
5. HR Cafe - Volunteer Portal
6. HR AID team

Extraordinary meeting

1. HR Public Safety Response Discussion, 1/26/2017
2. Humanity Road Briefing Room

Traditional training

1. HR New Volunteer Orientation
2. HR Forms & Reports
3. HR Media Monitoring & Disaster Desk Training
4. HR Toolbar Training
5. HR Social Media Listener/Ambassador Training

Internal Drills

1. Operation Apollo (Internal Drill) simulating refugees 2/4/16 sitrep and workbook
2. Operation Atlantis – Workbook
3. Operation Bloodhound - Feb 25, 2016
4. Operation Dark Knight / Instructions26-27/4/17
5. Operation Dive for Data main window

6. Operation Magellan Drill, Instructions
7. Operation Soggy Brew - Dec 3, 2016
8. Operation Swimming Bear
9. Operation Wet Sheep (Disaster Drill) 30/8/16 NZ
10. Operation Bright Kiwi (Earthquake, New Zealand) 13-15/11/16 Canterbury Region New Zealand sitrep
11. Summer 2017 Scavenger Hunt / Instructions23/6/17 to 7/1/2017 -
12. HR Team 3: Nile Samurai
    - HR Team 2: Lunatic Elves
    - HR Team 1: Endzone Imperials
13. Training Operation Magellan

Appendix IV: Consent Form

Participant Information Sheet for A Research on Coordinating Volunteer Responses in Disaster Situations: The Role of Digital Humanitarians

You are being asked to be interviewed in a research study about Coordinating Volunteer Responses in Disaster Situations. This research is part of a PhD Thesis at Brunel University London. The information derived from this research will be used to make recommendations for best practice in coordinating humanitarian response among actors and will offer insights into the role of volunteer and technical communities within the multipolar international humanitarian system.

The purpose of the study is to understand the nature of organization during disaster response and how are volunteer and technical communities and the coordination of humanitarian response shaped each other. You have been asked because you are among the veterans in this field with extensive experiences in response coordination, volunteer recruitment and training.

There are no known risks or disadvantages if you agree to take part in it and you will be asked to participate in an interview which will take approximately 60 minutes via Skype. With your permission, I will audio record the interviews in order to accurately capture what is said. Furthermore, anyone who takes part in the research will be identified only by a code or hypothetical name and the record will be protected from intrusion and it will also be destroyed at the end of the study.

Your participation is completely voluntary, and you may withdraw from the interview at any time without giving a reason. You may also skip any question during the interview, but continue to participate in the rest of the study.

If you have any concerns or complaints regarding the ethical elements of this study, please contact siscm.srec@brunel.ac.uk or Mr Malcolm Clarke (Chair of Departmental Ethics Committee) at Brunel University London.

Thank you for taking the time to read this Information Sheet,

Yours Sincerely,

Najeeb Abdulhamid Gambo

NajeebGambo.Abdulhamid2@Brunel.ac.uk

M +44 (0)7423240207

Computer Science Department

College of Engineering Design and Physical Sciences

Consent Form to Participate in research concerning Coordinating Volunteer Responses in Disaster Situations: The Role of Digital Humanitarians

The participant should complete the whole of this sheet him/herself	*YES*	*NO*
Have you read the Research Participant Information Sheet?	☐	☐
Have you had an opportunity to ask questions and discuss this study?	☐	☐
Have you received satisfactory answers to all your questions?	☐	☐
Who have you spoken to?		
Do you understand that you will not be referred to by name in any report concerning the study?	☐	☐
Do you understand that you are free to withdraw from the study:		
• at any time	☐	☐
• without having to give a reason for withdrawing?	☐	☐
I agree to my interview being recorded.	☐	☐
I agree to the use of non-attributable direct quotes when the study is written up or published.	☐	☐
Do you agree to take part in this study?	☐	☐

Signature of Research Participant:	
Name in capitals:	Date:
Witness statement	
I am satisfied that the above-named has given informed consent.	
Witnessed by:	
Name in capitals:	Date:

Appendix V: Interview Guide

Introduction

- Opening remarks
- Discussion of the purpose of the research
- Explanation of the confidentiality and consent
- Request for permission to audio tape the interview

Ice breakers

- How did you come across to HR?
- Can you tell me what motivates you to join HR as a volunteer?
- What is it like to work with people that you have probably never met physically?

Activities and information workflow

- How would you describe a typical workflow of volunteers when responding to Disasters?

Verification and Data Quality Assurance

- As a volunteer that works remotely, how do you determine the credibility of urgent needs?
- How do you verify information posted on social media as an individual?
- How do you verify that information while working as a group?

ICT tools

- Can you tell me more about the type of tools and platforms you are using as a volunteer?
- What makes you chose those tools not others?
- Are there instances that you had problems when working with those tools?
- Tell me how you managed to overcome such issues

Organisational

- How would you describe the impact of HR work?

Exit

- Could you tell me the impact of your participation as a volunteer has had on your life?
- Is there anything else you would like to tell me?

Closing:

- Thank you for your patience and all that valuable information. I hope you would be happy to be contacted for a follow up in case I need some clarification.

Appendix VI: Chat Logs Windows

1. Urgent Event Window to analyse data on the following response operations
    - Belgium (Brussel) explosion [Green event]
    - Turkey (Istanbul) explosion [Green event]
    - Manchester (UK) explosion [Green event]
    - Westminster (UK) terrorist attack [Green event]
    - Sri Lanka flooding/landslide [Green event]
    - Fiji tropical cyclone [Green event]
    - Oklahoma wildfire (USA) [Green event]
    - Chile Wildfire [Green event]
2. Oroville Dam Spillway Breach, California, US 10-14/2/17 sitrep
3. M7.0 Kumamoto Earthquake, Japan 14-18/4/16 sitrep and workbook
4. M7.8 Earthquake, Ecuador 16-25/4/16 sitrep and workbook
5. M6.2 Italy Earthquake 23-29/8/16 Marche, Lazio, and Umbria Italy sitrep
6. Flooding, Peru, 17-27/3/17 sitrep and workbook
7. Burundi Hospital Work Group 7-15/3/16
8. Hurricane Irma, Florida) Situation Report 1 – (September 10-11, 2017) sitrep I and II
9. Fort McMurray Wildfire (#YMMFire), Alberta, Canada 3-9/5/16 Resource list only

Appendix VII: Collaborative Tools and Platforms

Tools and Platforms classification

Collaborative platforms

- Mobile phone
- Skype
- Trello
- Ispring
- Airtable
- Google Form
- Google Docs
- Google Sheet
- Google Slide Deck

Live feeds and notification systems

- Amateur Radio
- GDAC
- NHC
- NWS chat
- PDC
- Reddit
- USGS

Verification platforms

- Bing
- Google
- HR Firefox Adds on
- TinEye
- Virus total
- Media bias fact check
- Google maps
- Telephone

Social Media, Management Platforms and Aggregation Dashboards

- Facebook
- Google +
- Group tweet
- Hootsuite
- Instagram
- Scanigo
- Social Mentions
- Tweet Tracker
- TweetDeck
- TweetReach
- Twitter
- Twitter fall
- Twuffer
- YouTube