

UNIVERSITY OF STRATHCLYDE

Department of Management Science

Explaining the Role of Twitter in the  
Amplification and Attenuation of Risk During  
Health Risk Events Through Causal Loop  
Diagrams: A Comparative Study of Nova Scotia  
and Scotland

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**Date:**

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## Abstract

The goal of the research is to support the development of an effective communication strategy within public health through social media. Drawing upon the Social Amplification of Risk Framework (SARF), developed by Kasperson *et al.* (1988) as the theoretical basis, this research explores and compares the use of Twitter by health organisations during health risk events. The research focuses on Twitter as an information channel and its role in the amplification and attenuation of risk events.

The empirical research employs a two case comparative case study approach in which data was collected from participants in health organisations in Nova Scotia and Scotland. The data collection method was semi-structured interviews. The interview data was analysed through a thematic analysis to identify the main themes emerging from the data. Lastly, a causal loop diagram was developed to model the interdependencies among factors during a risk event.

The research found that health organisations were using Twitter as a means of strengthening risk communication strategies. The use of Twitter had an increasingly important role within communication showing that it had a role in increasing credibility and trust in the organisation; a way of pushing and pulling information and a means of direct communication. However, the participatory, interactive nature of Twitter provided challenges for these organisations.

Theoretical contributions are made to the extant body of research relating to SARF, extending the application of the framework to Twitter. Also, more widely, to the field of risk communication identifying that Twitter is a medium through which information can both be pushed and pulled by organisations. Methodological contributions are made by applying causal loop diagramming to SARF. The use of causal loop diagrams enhances the SARF tool-kit providing a tool that models relationships between factors during a risk event. This methodology could be used by others and applied in other areas related to SARF.

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# Chapter 1

## Introduction

### 1.1 Introduction

This thesis explores the role of Twitter as a means of communication during a health risk event. The aim of this chapter is to provide context and understanding of the research area. This chapter provides an introduction to the research, including background and rationale for the research; defines the scope of the research; states the research goal and questions; introduces research methods and methods of analysis. Finally, to conclude this chapter, the structure of the thesis is provided.

### 1.2 Rationale for Research

This research is positioned in the interdisciplinary field of risk research. The field of risk research is a capacious one, attracting researchers from a diverse range of backgrounds. According to Rosa (1998) risk analysis comprises of four main stages: “(i) hazard or risk identification, (ii) risk estimation, (iii) risk evaluation, and (iv) risk management” (p.17). This research focuses on the fourth stage, risk management, and specifically within this stage research on risk communication and risk perception.

A number of key approaches are identified in the literature. These are: the psychometric paradigm, Cultural Theory and the Social Amplification of Risk Framework (SARF). Although the psychometric paradigm and Cultural Theory offer interesting insights, SARF is chosen as the theoretical basis of this study as it encapsulates aspects of both Cultural Theory and the psychometric paradigm while also adding more elements to provide a comprehensive framework.

Risk perception and risk communication literature remains fragmented, and to date there have been very few attempts “to provide an overarching theoretical framework through which to approach risk perception and communication issues systematically” (Pidgeon and Henwood, 2010, pp.53-54). The exception to this is SARF, which was developed by Kasperson *et al.* in 1988. Succinctly, the framework describes “the various *dynamic* social processes underlying risk perception and response” (Kasperson *et al.*, 2003, p.13), specifically focussing on the processes through which hazards and events can be amplified or attenuated by the public. A simplified version of the framework is shown in Figure 1.1.

The framework draws upon classical communications theory (Pidgeon and Henwood, 2010) both for the metaphor of amplification and the description of the way in which risk signals travel through various stations from transmitter to receiver. The metaphor refers to both amplification (intensification) and attenuation (weakening) of risk signals.

SARF contends that risk events, which may be actual or hypothesised, will have little impact unless communicated to the public more widely (Pidgeon and Henwood, 2010). Kasperson *et al.* (1988) propose that risk signals travel through a series of stations. Within the communication process, “risk events and their characteristics become portrayed through various signals (images, signs, and symbols) which in turn interact with a wide range of psychological, social, and institutional or cultural processes in ways that intensify or attenuate perceptions of risk” (Pidgeon and Henwood, 2010, pp.54-55).

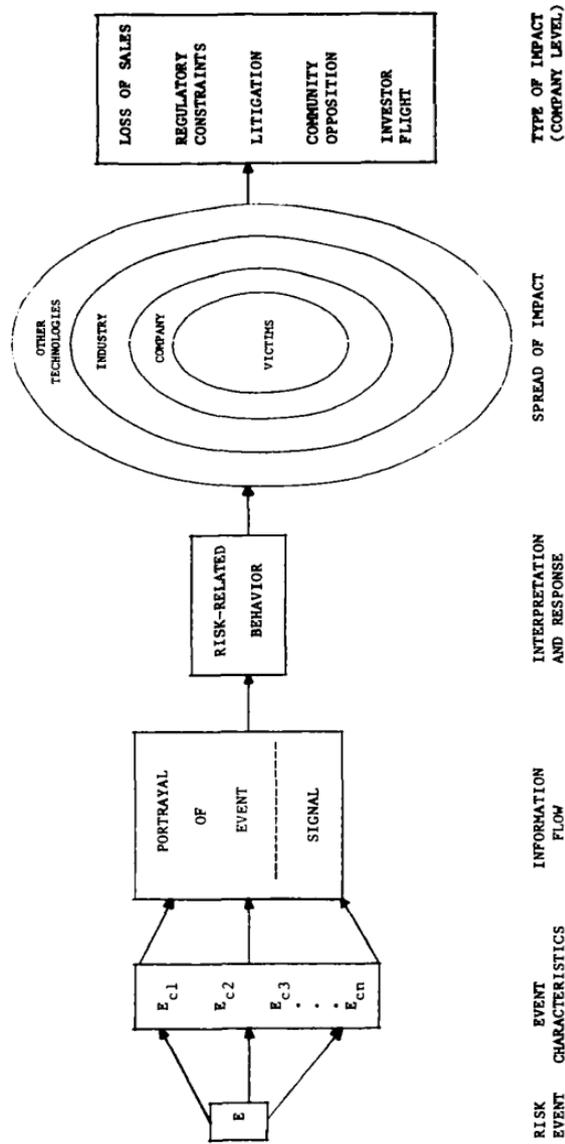


Figure 1.1: Simplified version of SARF (Source: Kasperson *et al.*, 1988, p.182).

Kasperson *et al.* (1988) postulate that risk signals travel between stations which can be both individual or social. As the signal reaches a station the message is decoded and then encoded as it is passed to the next station. As the signal passes between individual and social stations the signals are subject to what Kasperson *et al.* (1988) argue to be predictable transformations. Transformations can include “an increase or decrease in the volume of information about an event, selection to heighten the salience of certain aspects of a message, or reinterpretation and elaboration of the available symbols and images” (Pidgeon and Henwood, 2010, p.55). The framework recognises a dynamic aspect in the process, identifying that feedback occurs between the various social and individual stations.

Secondary effects, as described through the metaphor of dropping a stone into a pool of water, are also shown in the framework. As the stone falls in the pool it causes ripples which travel outwards. The rippling effect refer to wider impacts which can be caused in society. Effects can occur just to those affected, the victims, but far wider impacts can be caused in society as the ripples travel outwards due to amplification.

The key aspect of SARF which is not captured in the psychometric paradigm or Cultural Theory is the recognition of the dynamic element in the process of communication and its result on risk perceptions over the course of an event. Throughout a risk event new information becomes available and as it does so risk signals and risk perceptions undergo change. The way in which communication changes overtime, the feedback and the dynamic nature of the system requires consideration.

The comprehensive, interdisciplinary nature of the framework supports studies from a number of disciplines. SARF has provided the focus of a vast number of studies and this is discussed in more detail in Chapter 2. According to Pidgeon and Henwood (2010) “[t]here is considerable evidence now that risk attenuation

and intensification phenomena have occurred in America and Europe in recent years, raising the question of whether the SARF might inform our understanding of basic risk communication processes and lead to improved practice in health communication” (p.54).

In order to analyse SARF, this research proposes using system dynamics. System dynamics is an approach capable of dealing with complex systems containing aspects such as feedback loops and time delays. The systems in which we communicate are complex and the feedback loops are evident. It leads to the consideration of SARF and the application of a qualitative system dynamics technique, causal loop diagrams, to model the system. Previous studies have considered other system dynamics techniques, most notably stock and flow diagrams to SARF (Burns, 2009; Burns and Slovic, 2007; Busby and Onggo, 2013) but there have been no studies using causal loop diagrams.

A causal loop diagram is a qualitative diagramming tool used to capture the feedback structure in a system (Wolstenholme, 1990). Causal loop diagrams model the causal relationships within a system to create a visual representation showing the relationships between variables. These simple models can be used to better understand the system structure, particularly dynamic behaviour which can be difficult to understand.

Within the body of literature relating to SARF a number of channels for communication are identified. Previous research on SARF focuses on traditional channels such as newspapers and much empirical evidence is available. Research into SARF focuses on the role of the media as they are viewed as the main channel for transferring information between organisations and the public. However, with the advent of the internet, and importantly Web 2.0, a number of new platforms are available and are changing the news arena. This research focuses on the relatively new media, Twitter, during a health risk event. Although research relating to the use of Twitter during critical incidents is becoming increasingly

popular, few studies address the role of Twitter and SARF.

Twitter is a microblogging platform launched in 2006. Twitter users, which include both individuals and organisations, post updates known as tweets. These updates are limited to 140 characters. The short style of blogging means that users may update several times a day. Users can access the site from their mobile phones which allows for real-time updating. Users choose who to follow, i.e. whose tweets they see. Twitter has removed barriers between organisations and members of the public as organisations can directly interact with the public and vice versa. Aspects of Twitter mean that updates (tweets) can have a global reach as other users share (retweet) these messages with their own followers. Lastly, the site is searchable allowing users to find information on a given topic which is particularly important during a crisis event.

The structure of Twitter lends itself well to crisis and disaster events for a number of reasons. Firstly, the platform is searchable, meaning that users can find information easily. Secondly, it allows users to connect with other users. Research demonstrates the way in which Twitter can be used to organise volunteers through Twitter who are offering remote assistance. Thirdly, information has the potential of a global reach. Fourth, it is a wealth of information as people from the ground, the public, post information on Twitter as it is happens. Due to the short post style and ability to update through mobile phones Twitter becomes a source for up-to-date information.

Chew and Eysenbach (2010) note that with the increased use of the internet, and specifically Web 2.0 where there is more user-generated content, the public may have an increasingly important role in all stages of “knowledge translation, including information generation, filtering and amplification” (p.1). Therefore it is argued that for public health professionals it is critical to create a feedback loop through which public response and perceptions are monitored online during critical incidents (Chew and Eysenbach, 2010). To date, there is a lack of research

firstly investigating the use of Twitter by health organisations during health risk events and secondly, Twitter research out with the United States of America.

To summarise, the interdisciplinary nature of SARF provides a strong foundation for this research. In this research SARF is investigated using a type of modelling within the system dynamics approach, as this type of modelling is capable of dealing with complex systems such as that in communication and perception of risk. Traditionally, studies relating to SARF focus on the role of the media. However, this research focuses on the role of the new platform Twitter during health risk events. The research is interested in the way in which health organisations are using Twitter as part of their communications strategies. It investigates this by focusing on two areas: Nova Scotia and Scotland. Health organisations in these two areas are investigated to understand the use of Twitter as part of their communication strategies during health risk events. With the increasing popularity of social media and the potential benefits of its use during a crisis event, organisations need to consider their use of it and how it can contribute to successful management of health risk events. Social media, and in this case Twitter, allows organisations to directly communicate with the public. In addition to this, Twitter also allows organisations to gain insight into topics of conversation by the public. Monitoring Twitter can act as an early warning system for organisations. It also provides an insight into public perceptions and can update communications as needed.

## 1.3 Research Goal

As the rationale and context for the research is established, it is now an appropriate point to introduce the research goal which guides the study and the objectives of the research. The overarching goal of the research is:

*To support the development of an effective communication strategy within public health through social media.*

## 1.4 Research Questions

The research questions for this research are as follows:

1. What is the current role of Twitter in health organisations in Nova Scotia and Scotland?
2. What is the role of Twitter in the amplification and attenuation of risk signals by health organisations?
3. What are the differences and similarities of Twitter use between organisations?
4. To what extent can causal loop diagrams adequately represent interdependency among factors during a risk event?

## 1.5 Summary of Research Approach

The following details the research approach to answer the research questions posed in Section 1.4. It summarises the philosophical position, methods of data collection and methods of analysis.

The philosophical basis of the study is guided by the philosophical assumptions of SARF. Pidgeon and Henwood (2010) note that “[a]n advantage of SARF is that

it is clear in foregrounding an essential epistemological and ontological tension, often implicit within many risk studies, that, while hazards are real enough, our knowledge of them can only ever be socially constructed” (p.55). Rosa (2003) considers the philosophical basis of SARF in detail and sets out a philosophical approach of hierarchical epistemology and realist ontology (HERO) as able to satisfy the requirements of the framework. It is this philosophical stance which is adopted within this research.

To begin, the research first conducted a pilot study in which data was collected directly from Twitter during a disease outbreak in Edinburgh, Scotland. The research collected data from three official health organisations during the event. The analysis investigates the use of Twitter by official organisations during a disease outbreak. The purpose of this first aspect of the study was to identify whether Twitter was being used as a means of communication with the public. The analysis investigated the tweets of these organisations to identify whether they were also being used to amplify or attenuate the risk event.

The second stage of the research employed a comparative case study approach, with two cases selected for the collection of empirical interview data: Nova Scotia (Canada) and Scotland. The comparative case study used semi-structured interviews to collect empirical evidence from professionals within health organisations in both areas. Interview questions were developed based on a review of the literature and from the analysis of the Twitter data in the pilot study. The interview data was analysed through a thematic analysis where an inductive coding approach was used. The inductive approach allowed the data to guide the development of themes and the data naturally divided into a number of sections.

Finally, from the interview data a causal loop diagram was created. The purpose of the causal loop diagram was to provide a visual representation of the interdependencies among factors during a risk event, with a specific focus on the use of Twitter by health organisations. The model was used as a way to map

the system structure and identify dynamic feedback within the system. Model verification was achieved through a second meeting with a number of participants where the model was presented and feedback on the model was gained.

## **1.6 Contributions to Knowledge**

To summarise this study makes a number of original theoretical, methodological and empirical contributions to knowledge. The theoretical contribution to knowledge is made by extending the application of SARF to the new medium Twitter. The findings of the research contribute to both research on SARF as well as the wider field of risk communication. A methodological contribution to knowledge is made through the application of causal loop diagrams to SARF and Twitter, extending the tool-kit of SARF and secondly, to the emerging field of crisis informatics through the use of causal loop diagrams to explore organisational use of Twitter. An empirical contribution is made through the empirical interviews with participants in Nova Scotia and Scotland. Finally, a practical contribution is made through the causal loop diagram which can be used by decision makers when considering the use of Twitter in health risk communication.

## **1.7 Thesis Structure**

To conclude this chapter the following provides an overview of the structure of the remainder of the thesis where a short summary of each chapter is detailed.

### **Chapter 2: Risk Literature Review**

This chapter focuses on previous research within the field of risk. The chapter initially highlights the diversity of risk research and provides a discussion of the definition of risk. The chapter focuses on risk perception and risk communication research. Three key approaches, the psychometric paradigm, Cultural Theory

and SARF, are identified and discussed in detail. Finally, the chapter develops an argument for the use of SARF as the theoretical basis for the study.

### **Chapter 3: Social Media Literature Review**

This second literature chapter focuses on crisis informatics research. In this review a detailed outline of Twitter and its role in changing communication is detailed. Research focussing on the use of Twitter during critical incidents is increasing and this chapter aims to reflect the developments. Two main bodies of research are discussed. Firstly, the research focussing upon the use of Twitter by official organisations is detailed. Secondly, a more popular area of research identifying the use of Twitter by the public during critical incidents is provided.

### **Chapter 4: Conceptual Framework**

The aim of this chapter is to bring together key aspects of Chapter 2 and Chapter 3 to develop the conceptual framework and research questions for the study.

### **Chapter 5: Methodology, Methods and Modelling**

This chapter explains the research methodology. The first aspect of the chapter presents the philosophical underpinnings of the study by considering both the ontological and epistemological aspects of the research. Secondly, the chapter presents the research design. Finally, the chapter introduces methods of empirical data collection, data analysis and modelling choice.

### **Chapter 6: Research Findings From Interviews**

Initially this chapter provides a detailed introduction to the two areas from which the interview participants were based: Nova Scotia and Scotland. Justification is made for the choice and suitability for comparison. Secondly, Twitter data was collected during an outbreak of Legionnaires' disease forming a pilot study and

this data is used to understand the use of Twitter by health organisations during a health risk event. Specifically, analysis is carried out on how health organisations were using Twitter during an event by reviewing their Twitter activity. Finally, the chapter presents the findings of the thematic analysis of the interview data.

### **Chapter 7: Causal Loop Diagram**

This second empirical chapter draws upon the interview data presented in Chapter 6. The purpose of this chapter is to develop a causal loop diagram which models the causal relationships among factors during a health risk event. Initially, a brief overview of causal loop diagramming is provided. Secondly, the causal loop diagram is then presented. Discussion is made around key feedback loops in the model. The chapter also details the verification of the causal loop diagram. Finally, drawing upon findings of both Chapter 6 and Chapter 7 applied recommendations of the use of Twitter by health organisations is presented.

### **Chapter 8: Discussion**

This is the penultimate chapter of the thesis and leads on from the empirical findings presented in Chapter 6 and Chapter 7. The aim of this chapter is to discuss the findings of the research with respect to the research questions posed in the study and secondly, considering these findings with respect to existing literature. Finally, the chapter returns to the conceptual framework to review the framework based on the findings of the study.

### **Chapter 9: Conclusions**

The final chapter of the thesis concludes by summarising the research approach and findings. In this chapter the original contributions to knowledge of this research, which include theoretical and methodological contributions, are outlined. The chapter also considers the practical implications of the research. Limita-

tions of the study are addressed and finally, the thesis concludes by considering potential areas for future research.

# Chapter 2

## Risk Literature Review

### 2.1 Introduction

This chapter reviews existing literature in the area of risk research, primarily in the fields of risk communication and risk perception. The aim of this chapter is to position SARF as the most suitable basis for the research. The chapter argues that certain aspects evident in SARF, including its comprehensive nature bringing together risk perception and risk communication literature; the ability of the framework to cope with the dynamic aspect of risk events and lastly, its ability to support understanding of feedback and iteration during a risk event contributing to the amplification and attenuation of risks make it a strong foundation for this study. It is noted that the role of newer channels of communication, such as Twitter, are becoming increasingly important during risk events. The review highlights that whilst the application of SARF has been diverse and extensive, its application with respect to Twitter is limited and provides a gap within the literature for further investigation.

The chapter is structured as follows. To begin, the review presents an overview of the diverse and growing body of research relating to risk, to provide background to the area of risk research. The chapter then takes a more specific focus by ex-

ploring issues relating to defining the term ‘risk’. Despite the vast amount of literature on the topic of risk, there is still little consensus on the definition of risk and, as such, it remains elusive. Part of the reason lies in the fact that researchers hail from a wide range of disciplines. As differing disciplines have competing viewpoints this results in a disparity between definitions. The remainder of the chapter is structured using Renn’s (2008) taxonomy of sociological approaches. The diagram classifies different sociological approaches to risk based on two axes: the individualist-structuralist axis and the realistic-constructivist axis. The diagram is first used to provide a broad overview of risk communication literature with a specific focus on the role of trust. It is then used to structure a discussion on three key approaches: the psychometric paradigm, Cultural Theory and SARF. The chapter concludes by positioning SARF as the most suitable basis for the research.

## **2.2 Background**

Members of the public face a number of hazards in their day-to-day lives. The way in which people perceive risks, their risk perception, affects the way in which they react to hazards and should be taken into consideration in risk management (Visschers and Siegrist, 2008). Prior incidents have demonstrated the importance of public risk perception within the management of events, such as the BSE crisis in the United Kingdom; if the risk perception of the public is not taken into account it may lead to “public outrage and distrust with regard to the responsible agencies” (Visschers and Siegrist, 2008, p.157).

A key text by Beck (1992) importantly notes a change in what he terms risk society; the seminal text asserts that we live in a society which is defined, by Beck, as reflexive modernity. It is noted that the type of risk a person is exposed to has undergone change with the advancement of technology. As a society,

there has been a change in focus of what society is concerned with. Risk is one such aspect with which the public is concerned, and the importance placed on risk, in today's society, can be seen through the substantial investment in the management of risks (Mohun, 2013). The study of risk is a rapidly developing field, gaining momentum since the 1970's. The term has grown in popularity, with increasing numbers of disciplines researching it through their own methods and approaching it from their own understanding and philosophical stance. According to Renn (2008) risks have the potential to shape our environment, therefore work in this area has great importance to society. "The investigation of risks is at once a scientific activity and an expression of culture" (Kasperson *et al.*, 2000, p.232) as the majority of "societies have become highly preoccupied with the notion of risk" (Renn, 1991, p.287). Within the literature there is a general consensus that there is increased focus on the concept of risk on a number of levels.

It is noted that the public now expect governments to eliminate risks or to reduce risks as much as is reasonably possible (Adams, 1995). Slovic (1993) notes that even though governments and organisations are now increasing safety and decreasing risk, paradoxically the public are more worried about risk. Governments have the power to make decisions which can impact upon millions if not billions of lives (Adams, 1995) and in democracies the law responds to the fear of the citizens in those nations (Sunstein, 2005). Sunstein (2005) argues that a well-functioning government will aim to become a deliberative democracy. A deliberative democracy will abstain from reacting to public fear if it is unsubstantiated and will put in place institutional safeguards which will allow public panics to be appropriately responded to (Sunstein, 2005). Government officials can be influenced by the public. However, the issue is that, often, people will focus, solely, on the short term instead of with a long term focus (Sunstein, 2005).

The historic study of risk is heavily dependent on what is known as the technical assessment of risk which is defined as probability multiplied by consequence.

The majority of risk assessments simply view the risk as expected fatalities. This measurement was challenged by academics in the social sciences who argued that this focus of expected fatalities was too narrow and instead other factors must be considered. Starr's (1969) seminal paper, in which he presents a methodology to answer the question: "How safe is safe enough?" through the quantitative examination of benefits versus costs provided a catalyst to further work in this area. The paper serves as an important starting point in risk research. Starr (1969) identifies key elements within the acceptability of risk, including distinguishing between whether risks are voluntary and involuntary, highlighting that people are less accepting of involuntary risks opposed to voluntary risk; benefits of risk (real or imagined) and, finally, statistical risk of death arising from risk. This paper highlights a number of qualitative aspects of risk which are important in the acceptability of the risk in society and it provides a foundation for psychological studies (Snary, 2004). Subsequently, in the 1980s, within the field of risk research, social and cultural perspectives gained importance (Rippl, 2002) and significant differences in risk perception is found when stratifying people into social and cultural groups (Renn, 2008). Interestingly cultures choose risks to focus their attention on and will ignore others (Weber, 2006). People form beliefs about a risk through various criteria. It is found that people are more frightened of a risk when they are aware that an event can occur at any time (Renn, 2008). A general agreement is that the world is not observed through "pristine eyes, but through perceptual lenses filtered by social and cultural meanings, transmitted via primary influences such as family, friends, subordinates and fellow workers" (Dietz *et al.*, *Forthcoming* cited in Renn, 1992, p.67). Within the psychological approach there is the argument that humans are rational choosers (more or less) when bounded by their personal aptitude of reasoning and learning (Taylor-Gooby and Zinn, 2006).

Within the social sciences, research into risk has developed into two areas.

Management scientists aim to look at developing methods which will be able to inform managers of the better actions for managers to take, alternatively behavioural scientists seek to describe how individuals and organisations view and react to risk (Burns *et al.*, 1993). The optimal approach to dealing with risk emerges, as suggested by Burns *et al.* (1993), as a result of the combination of these two areas of research. Bringing together the descriptive insights offered by behavioural scientists and the prescriptive measures developed by management scientists will help to formulate a comprehensive approach (Burns *et al.* 1993). Furthermore, studies from a wide-range of disciplines will allow consideration of more elements to help inform and contribute to the development of the prescriptive methods.

Scientists and industrialists often criticise the public's response to risk and put forth that their behaviour is due to irrationality or a lack of knowledge (Slovic, 1993). Early studies into public perception reveal that certain aspects such as "sensitivity to technical, social, and psychological qualities of hazards" (Slovic, 1993, p.675) failed to suitably be accounted for in risk assessments. Thus, it is argued the concerns of the public are not just the result of irrationality or ignorance (Slovic, 1993). Risk research shows that the public does not view risks in the same way as experts (Douglas, 1992), an expert's judgement of risk is found to be closely tied to the technical assessment of risk (Slovic, 1992).

To date, there is a diverse range of theoretical perspectives and methodological approaches which has influenced the direction of risk research (Taylor-Gooby and Zinn, 2006). Theories provide a spectrum of beliefs as to whether risks are to be viewed as an objective reality which exists external to those individuals or as subjective both culturally and socially created. Risk research has attracted studies from a wide range of disciplines and the multidisciplinary nature of risk has resulted in the disparity of definitions between disciplines (Renn, 2008) and, more fundamentally, the differing perspectives on defining risk. Rosa (2003) notes

that to date there is little consensus on the definition of risk. The arguments of whether risks are socially constructed or exist objectively and independently is discussed in the next section which investigates the differing definitions of risk, this will again be addressed in Chapter 5 which addresses the philosophical underpinnings of the study. Following on from the discussion of risk, three key approaches in risk research are presented: the psychometric paradigm, Cultural Theory and SARF.

## **2.3 Defining Risk**

Risk research is gaining popularity, and as it does the number of disciplines conducting research is also increasing. The result of this is a range of definitions for the term 'risk'. To date there is no universal agreement on the term risk (Rosa, 2003). Perspectives between disciplines vary greatly even on the issue of defining risk and this is in part due to the philosophical underpinnings of each discipline. These underpinnings lead to extremely different perspectives and the most notable and stark contrast can be seen between disciplines who intentionally do not define risk and disciplines in which there are substantial debates over the definition of risk (Rosa, 2003). Furthermore some argue that a single definition of risk is unlikely (Rayner, 1992) and thus these debates will not be resolved and instead it may be better to work towards multiple definitions (Snary, 2004). At this stage it is worth exploring some of these opposing perspectives of defining risk and definitions of the concept risk.

The term risk is possibly one of the more elusive words to attribute a definition to and this is in part due to the numerous disciplines in which risk is studied. As such, no universal definition of risk exists (Sjöberg, Moen and Rundmo, 2004). Despite this, research into 'risk' is extremely important as societies are becoming increasingly more obsessed with risk (Adams, 1995).

The traditional definition of risk (probability of event multiplied by magnitude of effects) dominated the literature, however, this definition has come under attack, with arguments that this definition is too narrow (Kasperson *et al.*, 1988). Slovic (2000c) discusses the multidimensionality of risk: “research has also shown that the public has a broad conception of risk, qualitative and complex, that incorporates considerations such as uncertainty, dread, catastrophic potential, controllability, equity, risk to future generations and so forth into the risk equation” (p.394). This is noted to be different to experts’ perception of risk which is aligned with expected deaths (Slovic, 2000c). It can be seen that there is a disparity between the two and this can cause issues on the handling of risks.

Before identifying a suitable definition of risk for this study it is necessary to provide an understanding of the spectrum of risk definitions and to do this it is worth, first, presenting two extreme positions. At one end of the spectrum is an approach that seeks to define risk “viewing it as an objective property of an event or activity and as measured as the probability of well-defined, adverse events (Kates and Kasperson, 1983)” (Rosa, 2003, p.55). Aligned with this view, the most commonly used and well-known definition of risk is a positivist definition: probability of an adverse event multiplied by the consequence of the adverse event (Rosa, 2003; Adams, 1995) as discussed earlier. In stark contrast to this position, at the other end of the spectrum, is the constructivist paradigm who oppose defining risk entirely (Rosa, 2003). Furthermore, some positions within the constructivist paradigm are completely opposed to objective risk altogether (Rosa, 2003).

An individual’s estimate of risk can be very different to an objective estimate of risk. Objective risk, is the risk that exists independent of an individual’s knowledge and worries of the source of the risk (Oltedal *et al.*, 2004, p.11). Renn (1992) argues that the definition of risk comprises of “three elements: undesirable outcomes, possibility of occurrence, and state of reality” (p.58). Rosa (2003)

considers some of the key aspects which are fundamental in a definition of risk. The first element which must be present in the definition of risk is that there must be an uncertainty of the outcome. Rosa (2003) states that if “the future is either predetermined or independent of present human activities, the term “risk” makes no sense whatsoever” (p.55). Therefore, events with impossible outcomes i.e.  $p = 0$ , and certain outcomes i.e.  $p = 1$  are not risks as there is no uncertainty regarding the outcome. Rosa (2003) argues that a key aspect of defining risk is the element of uncertainty, the “fact that these states are not predetermined means they are probabilistic and, therefore, embedded with some degree of uncertainty” (p.56). Uncertainty is argued to be a psychological construct and a reflection of imperfect knowledge; if humans have perfect knowledge uncertainty would be eliminated and the concept of risk would not exist (Sjöberg, Moen and Rundmo, 2004). Although Rosa (2003) sets out a realist foundation, it is noted that appearance of the objectivity of risk is dependant on the ability to “identify, measure and understand risk” (p.56), indeed as the ability to carry out these activities decrease it is suggested that risk will increasingly appear to be a social construction. The final element considered by Rosa (2003) in defining risk is that “risk exists only when...the uncertainty...impacts on human reality in some way” (p.56). Therefore, Rosa (2003) defines risk as “a situation or an event where something of human value (including humans themselves) is at stake and where the outcome is uncertain” (p.56).

The above addresses a definition of risk, but as noted some disciplines choose not to define risk at all such as that seen in Cultural Theory. Cultural Theory states that risk does not exist out there, but is instead a social construction in that cultures choose what to fear. Some argue that there is nothing ‘out there’ that can be called risk and sensed and thus it is impossible to perceive risk (Oltedal *et al.*, 2004).

To further complicate the issue, the terms hazard, danger, and risk are often

used interchangeably, however it is worth addressing each of these to better understand risk. According to Rosa (2003) the term danger “comprises elements of the world that threaten humans in some way” (p.64). “Risk is recognition of danger” (Rosa, 2003, p.64). Rosa addresses the definition of risk in terms of the ontological state of the world: “there is a liability of exposure to some untoward things out there: harm, injury, peril. There is no distinction between the “out there” things and our perceptions of them” (p.65) and therefore ontologically defines risk as real (Rosa, 2003).

This section provided a brief overview of the issues in relation to defining risk. It highlights the varying definitions of risk, identifying that different definitions are in part due to the differing disciplines and their respective underlying philosophical positions. The varying definitions of risk will be further examined when presenting the differing approaches to risk and considered with respect to their respective underlying philosophical positions. The decision on definition of risk is presented in Chapter 4, where the conceptual framework is developed and presented.

## **2.4 A Taxonomy of Risk Approaches**

The next part of this chapter explores risk communication and three key approaches in risk research. To structure a discussion on these topics and to compare the three approaches Renn’s (2008) taxonomy of sociological approaches to risk is used. The taxonomy organises the approaches based on two dimensions (Renn, 1992). The simple classification is able to position each of the relevant approaches with respect to the two dimensions and sufficiently distinguishes the approaches from one another without being over complicated. Thus, it serves as an appropriate means of structuring discussion and comparison of the three.

The taxonomy, with a number of the different approaches, is shown in Fig-

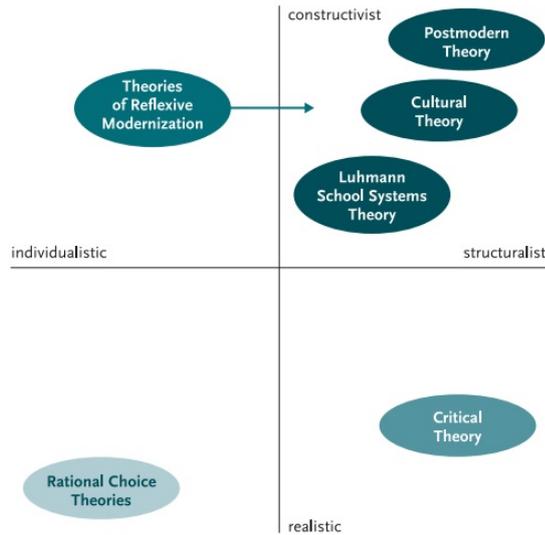


Figure 2.1: Renn’s taxonomy of sociological approaches (Source: Renn, 2008, p.57).

Figure 2.1. The two axes are the ‘individualistic-structuralist’ axis (x-axis) and the ‘realist-constructivist’ axis (y-axis). The x-axis, individualistic versus structuralist, positions the approaches according to the base unit of analysis; this ranges from individuals through to society (Renn, 1992). The y-axis, realist versus constructivist, addresses the nature of risk. This ranges from realist where risk is viewed as a real, objective conception that exists ‘out there’ to the constructivist concept where risk is viewed as a product of society (Renn, 1992).

Before introducing three of the key approaches, the psychometric paradigm, Cultural Theory and SARF, the next section introduces risk communication.

## 2.5 Risk Communication

Rosa (1998) provides the following description of risk analysis: “By risk analysis we refer to the four separate stages of: (i) hazard or risk identification, (ii) risk estimation, (iii) risk evaluation, and (iv) risk management” (p.17). It is the final stage, risk management, that is focused upon in this research. Risk management

is the “process of identifying, analyzing, assessing, and communicating risk and accepting, avoiding, transferring or controlling it to an acceptable level considering associated costs and benefits of any actions taken” (FEMA, 2010, p.30 cited in George, 2012, p.31). In this research, risk communication is a key aspect of interest within risk analysis and this is discussed in this section.

Risk communication can be defined as “an interactive process of exchange of information and opinion among individuals, groups and institutions. It involves multiple messages about the nature of risk and other messages, not strictly about risk, that express concerns, opinions, or reactions to risk messages or to legal and institutional arrangements for risk management” (US National Research Council, 1989, p.21 cited in Pidgeon and Henwood, 2010, p.57).

Risk communication research was originally intended to be a follow-up of risk perception research, however this area has far exceeded this intention and is an important area of research (Renn, 1991). The majority of risk communication/media research began in the field of psychology and social-psychology (Quigley, 2008). Krinsky and Golding (1992) note that with regard to risk communication although psychometric research was a key aspect of its development, contributions to risk communication have also come from other disciplines including sociologists and cultural theorists. In particular, sociologists and cultural theorists highlight the importance of considering social and cultural aspects (Krinsky and Golding, 1992).

Although extensive detailed lists exist for the objectives of risk communication it is suggested these can be categorised into “four items:

1. including changes in knowledge, opinions, or attitudes;
2. encouraging protective behavior by individuals and groups;

3. creating trust and confidence in risk management institutions; and
4. assisting conflict resolution and public involvement”

(Renn, 1991, p.292).

Risk communication can be sub-divided into three levels: micro, meso and macro. Micro level denotes communication between individuals. Meso level communication refers to communication between groups. Macro communication occurs on the social level (Renn, 1991). The communication within these levels and between these levels and their objectives is shown in a three-by-three matrix in Table 2.1.

The objective ‘*To inform and educate the public about risk issues*’ is noted to appear relatively easy to achieve, however it is identified that it is actually a difficult process and far harder to accomplish than would be imagined (Slovic, 1986). With the improvement and ease of technology the actual way of communicating to large audiences have become easier as technology such as television, radio, internet etc. become more widely used, accessible and accepted as part of daily life.

It is observed that campaigns which promote the public to adopt a new behaviour or even to replace an old behaviour are far more successful than campaigns which aim to cease an unhealthy behaviour (Prati, Pietrantonio and Zani, 2012). Slovic and colleagues argue that risk communication should be done using images, metaphors and narratives as this is how the experiential system codes reality (Prati, Pietrantonio and Zani, 2012).

Renn and Levine (1991) state that a foundation for successful information campaigns is two-way communication. However, they note that two-way communication is challenging to implement. This is due to the requirement of the communicating organisation to have the “flexibility and willingness to adapt to public concerns” (Renn and Levine, 1991, p.199).

From/To	MICRO-LEVEL Individual	MESO-LEVEL Groups	MACRO-LEVEL Society
Individual	Persuasion for risk reduction Risk acceptance Education	Influence on group decision Request for support Education	Change of risk policies Request for support Information
Group	Education Support  Persuasion for risk reduction Risk acceptance  Acceptance of risk management Trust in group's competence	Education Coalition  Conflict resolution Prestige  Acceptance of risk management Trust in group's competence	Information Influence on risk policies Acquisition of social resources Change in risk culture Compliance with risk standards Development of incentives for structural change
Society	Education  Risk reduction  Emergency response Acceptance of risk management  Trust in risk agencies Loyalty with respect to the risk handling capacity of society	Education  Risk reduction  Emergency response Acceptance of risk management  Legitimation of risk agencies Loyalty with respect to the risk handling capacity of society Mediating in conflict resolution	Strategies for risk management and regulation Agenda for risk agencies Institutional reform Development of new paradigms of risk Changes in risk culture Influence on international global risk policies International conflict resolution

Table 2.1: Risk communication levels and objectives (Source: Renn, 1991, p.293).

The importance of the media in conveying science and technology information to the general public is shown in many studies (Friedman and Egolf, 2011). Friedman and Egolf (2011) argue that media information has the potential to have a significant role in the communication and amplification of risk. Indeed, according to SARF media impacts on the way a risk is constructed, communicated and transformed (Friedman and Egolf, 2011).

Quite often, in the media, a single victim will be picked out and this victim can attract more attention than when there are hundreds of victims. Images are often able to strike a stronger and deeper reaction than numbers (Kasperson *et al.*, 1988); these images are also able to remain with a person for much longer than numbers can.

Pidgeon and Henwood (2010) note that risk communicators are key in the process of risk communication. They argue that their role in risk communication problems should not be overlooked as a consequence of the typical attribution of blame to an ‘unreceptive or irrational’ public or to an ‘ill-informed and sensationalist’ media.

In much of the previous literature many studies focus upon the role of newspapers in risk communication. However, social media is gaining importance in society and is beginning to be addressed in risk and crisis communication literature. According to George (2012) “[s]ocial media, an important arsenal in crisis communication, have become a vital part of some organization’s crisis management policy; yet, in a survey of companies with a social media crisis plan commissioned by German company Gartner Communications...only 29.7 percent of companies polled worldwide admit that they have a social media crisis plan, they have traditional crisis plan (Maul, 2010)” (George, 2012, p.33). Additionally, George (2012) recognises the speed at which bad news circulates in today’s social media era. The speed of information circulation is far quicker than previous methods, bad news can circulate just minutes after an event. This changes the

dynamic of risk communication greatly.

A key aspect within risk communication research is the role of trust. At this stage it is worth defining trust. It is noted that numerous definitions exist for the term 'trust' (Renn and Levine, 1991). Visschers and Siegrist (2008) highlight that, to date, no consensus has been reached among researchers on the "specific functions of trusts or the determinants of trust" (p.160). Renn and Levine (1991) suggest the following definition of trust in the context of communication: "Trust in communication refers to the generalized expectancy that a message received is true and reliable and that the communicator demonstrates competence and honesty by conveying accurate, objective, and complete information" (p.179). Renn and Levine (1991) state that trust relies on all of the following five components:

1. "Perceived competence (degree of technical expertise assigned to a message or a source);
2. Objectivity (lack of biases in information as perceived by others);
3. Fairness (acknowledgement and adequate representation of all relevant points of view);
4. Consistency (predictability of arguments and behavior based on past experience and previous communication efforts);
5. Faith (perception of "good will" in composing information)."

(pp.179-180).

One quality of trust is that it is fragile. Slovic (2000a) highlights that trust tends to be developed slowly, over time, but can be destroyed in an instant. Therefore, if trust is lost it can take a long time to be rebuilt and in some cases it can never be restored (Slovic, 2000a) this is known as the asymmetry principle.

Trust is shown to be a key aspect of the successful management of risk (Siegrist and Zingg, 2014). If risk managers are trusted then communication is relatively

easy, however if there is not trust with the risk manager then communication will not be successful (Slovic, 2000a). It is therefore recognised that trust is highly important. However, gaining trust is difficult and some of the issues are highlighted and explored in detail by Slovic (2000a, pp.320-323).

Slovic (1986) argues that for a risk communicator to be trusted and credible they must have enough knowledge to determine what is a valid criticism and if it should be acknowledged. Additionally they must also be able to decide if the risk estimates which are available have the potential to help the public gain perspective on the situation and decisions which must be made.

Addressing the issue of risk communication failure, a likely explanation for this relates to the trust in information providers (Cvetkovich and Lofstedt, 1999). Thus, the importance of the information source is critical with respect to risk communication. Credibility of information sources is also a key issue in risk communication, but it is noted that credibility is a rare and valuable attribute (Renn and Levine, 1991). “Credibility is a product of long-term evidence and commonly shared experience that a source is competent, fair, flexible to new demands, and consistent in its task performance and communication efforts” (Renn and Levine, 1991, p.180).

A serious result of risk communication failure or miscommunication is the potential of a crisis situation (George, 2012). Effective risk communication allows the public to respond to crisis events and also lowers the possibility of incorrect information (George, 2012).

The role of risk communication is clearly important in risk management and within this, the theme of trust emerges as a key aspect in the success of risk communication. Many studies involving risk communication investigate the media, but as highlighted by George (2012) social media is gaining importance. Building on from this section, the next three sections explore approaches which are key areas of research in the fields of risk communication and risk perception: the

psychometric paradigm, Cultural Theory and SARF, as well as present criticisms which have been highlighted in the literature. The psychometric paradigm was developed by psychologists, whereas Cultural Theory arises from a combination of sociology and anthropology. These two have largely been viewed as mutually exclusive and confined to their own discipline. However, suggestions have been made that the two can form a more integrative approach (Marris, Langford and O’Riordan, 1998). The third section presents SARF which is a comprehensive framework drawing upon aspects of these two approaches.

## 2.6 Psychometric Paradigm

The first area of research, the psychometric paradigm, aims to show factors which determine risk perception. It has been cited as the most influential model in the field of risk analysis receiving widespread credibility (Siegrist, Kellers and Kiers, 2005). The framework sits in the individualistic-constructivist quadrant of Renn’s taxonomy of approaches shown in Figure 2.2. Although the basis of this work had existed for decades, the ideas were formalised by Fischhoff, Slovic, Lichtenstein, Read and Combs in their 1978 paper. Since this paper there have been several further versions of the paradigm developed. Incorporated within the paradigm is a theoretical framework which assumes risk is subjectively defined by individuals (Slovic, 1992). It assumes that individuals can be influenced by a number of psychological, social and cultural factors (Sjöberg, Moen and Rundmo, 2004; Slovic, 1992).

An assumption of the psychometric paradigm is that risk is “inherently subjective” (Slovic, 1992, p.119). Indeed, the assumption is that risk does not exist independent to our minds, there is no ‘real’ or ‘objective’ risk (Slovic, 1992). Instead, it is argued that risk is a creation of humans, where the concept serves the purpose of assisting individuals understand and manage the dangers which they

face in their lives (Slovic, 1992).

The psychometric paradigm was developed using psychophysical scaling and multivariate analysis techniques to identify characteristics which impact upon a person's subjective feeling of being 'at risk' (Weber, 2006). Traditionally, participants involved in these types of studies are asked to rate a number of hazards (usually a heterogeneous group) using a number of different rating scales. Using factor analysis Fischhoff *et al.* (1978) find two factors to explain why some risks were perceived differently. The two factors are termed dread risk and unknown risk. Further studies have shown that "feelings of dread were the major determiner in public perception and acceptance of risk for a wide range of hazards" (Slovic *et al.*, 2004, p.314). The study has been repeated a number of times and it has been shown that the two factors are able to successfully account for perceived risk (Sjöberg, Moen and Rundmo, 2004), however there are debates on the way in which data is analysed and this is discussed in Section 2.6.1. Later, Slovic added a third factor which measures the number exposed (Hardman, 2009). The paradigm produces a cognitive map of the hazards using factor analysis (Siegrist, Keller and Kiers, 2005). Figure 2.2 shows a number of potential hazards which are positioned based on the two factors identified. Naturally, this area of research is predominantly quantitative in nature (Sjöberg, 1996).

Hazards are positioned in relation to two factors. Factor 1, labelled 'dread risk', is shown horizontally in Figure 2.2. Hazards which are shown to be high in 'dread risk' include nuclear weapons, nuclear reactor accidents and nerve gas. At the low end of the scale hazards include caffeine, aspirin and power mowers. Hazards which are high in dread risk are associated with situations which make us anxious and trigger our emotional early warning system (Weber, 2006). There is a perceived lack of control over exposure to these hazards and associated consequences are catastrophic. Factor 2, labelled 'unknown risk', is shown vertically in Figure 2.2. Hazards which are positioned at the high end (top) of the scale

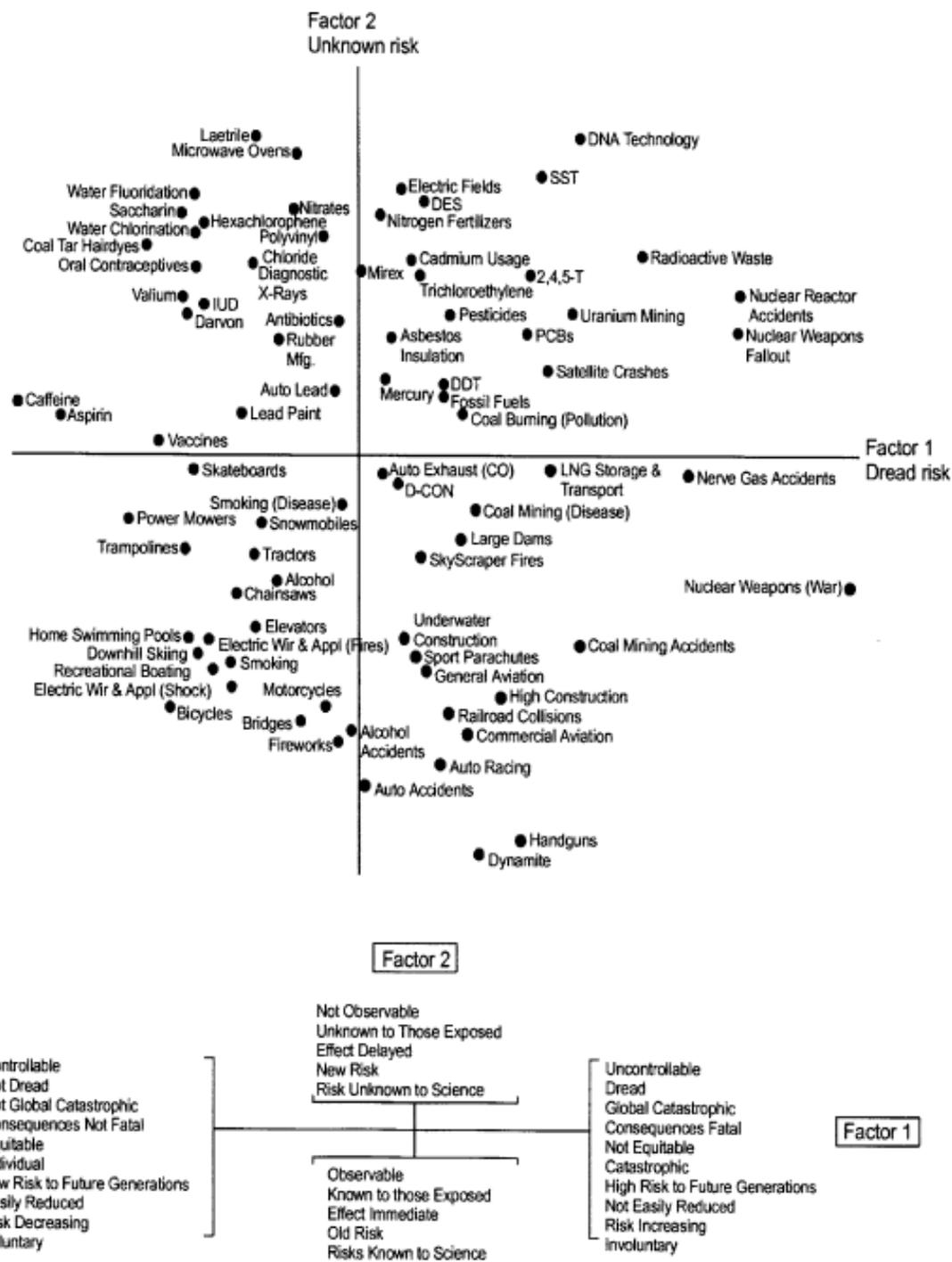


Figure 2.2: Psychometric paradigm factor space (Source: Weber, 2006, p.113).

are associated with newer hazards where there is relatively little knowledge, the effects of these are unobservable and the effects are not immediately realised. Hazards which rank high in terms of unknown include DNA technology, Laetrile and microwave ovens. Research on laypersons risk perception show risk perception of a hazard is related to its positioning within the factor space. Of the two factors, it is found that the horizontal factor, Factor 1 dread risk, is most important, the further right a hazard is positioned the greater the perceived risk of the event. Hazards which are positioned at the low end of the scale include dynamite, handguns and auto accidents. The most extreme position (at the right of this scale) is defined as “perceived lack of control, dread, catastrophic potential, fatal consequences, and the inequitable distribution of the results” (Slovic, 1987, p.283).

Typically, studies use aggregated data where the mean value of the responses is used, these show that the paradigm is able to explain 70% or more of the variance of perceived risk (Siegrist, Keller and Kiers, 2005). Few studies use non-aggregated data, therefore there is limited evidence available to show the difference. Results from studies where unaggregated data are used show a drastic reduction in the explanatory power of the model to, at most, 20-25% of the variance of perceived risk and risk tolerance (Sjöberg, Moen and Rundmo, 2004), this is discussed more in Section 2.6.1.

Originally, the research was conducted on participants in the United States, but has since been repeated internationally. The framework has also been applied internationally (see Teigen, Brun and Slovic, 1988; Keown, 1989; Rosa and Kleinhesselink, 1989; Goszczynska, Tyszka and Slovic 1991; Mechitov and Rebrik, 1990 cited in Slovic, 1992). These repeated studies in numerous countries reveal differences in the cognitive map, however the similarities have been found to be greater than the differences (Siegrist, Keller and Kiers, 2005).

The psychometric paradigm’s purpose is to explain factors determining risk

perception of laypersons, it does not explain experts' risk perception. It is claimed experts use different means of calculating risk which is closely tied to the number of expected fatalities i.e. the objective/technical assessment of risk. Therefore, the results of the psychometric paradigm have been used to explain differences between experts' opinions and those of a layperson. According to Sjöberg, Moen and Rundmo (2004) there are several suggestions as to why the paradigm has gained so much popularity. The first argument is that what it proposes appears to be logical, the ideas presented in the model are easily accepted and appear to be aligned with general common sense. Furthermore, the answers that the model provides are politically desirable, the model presents the public as emotional and ignorant which juxtaposes the objective 'correct' risk assessments of experts (Sjöberg, Moen and Rundmo, 2004), thus potentially providing a way to discount the views of the public. Finally, the model appears to be able to provide a definitive answer (Sjöberg, Moen and Rundmo, 2004). However, flaws of the paradigm are not explicitly acknowledged and this leads to criticisms which are discussed in Section 2.6.1.

To summarise, the paradigm has a number of benefits. Firstly, the study generates a high volume of quantitative data. A benefit of this is the ability to monitor perceptions of risk over time by repeating the study over time (Slovic, 1992). Secondly, as mentioned, the paradigm provides a visual representation of lay person's risk perception, thus it allows easy comparison of two or more risks. However, the assumption is that this is the final answer, yet it does not fully explain a layperson's risk perception.

### **2.6.1 Criticisms of the Psychometric Paradigm**

This subsection addresses the limitations and criticisms of the psychometric paradigm. The most notable critic of the paradigm is Lennart Sjöberg, his criticisms along with others are presented here.

Despite the large volume of research on the psychometric paradigm, there is still criticism on the empirical data and type of analysis and the reporting of explanatory power of the model (Sjöberg, Moen and Rundmo, 2004). One notable criticism relates to the use of aggregated versus raw data. Sjöberg (1996) highlights the results of the study are misleading as the paradigm claims that it can explain more than 70% of the variance in perceived risk. Studies claiming to explain 70% of the variance use aggregated data where the means of the samples are used. However, it is recognised, the means of aggregated data experience far less random errors than what is seen in the raw data and in general are smoother (Sjöberg, 2000). Therefore the variance in the unaggregated data is higher than that in the aggregated data. In the cases where means are used the explanatory power is high, but studies using raw data have far lower levels, 20-30%, of explanatory power (Sjöberg, 2000). Sjöberg (1996) highlights the explanatory power is due to the aggregation. This creates issues for users such as managers who are unaware of the concealed variance of the raw data and this is one of the major criticisms of the paradigm.

Secondly, the method of data collection is a survey, this causes issues in itself as participants are asked and expected to answer difficult questions such as “What is the risk of death in the United States from nuclear power?” (Slovic, 1992, p.119). Slovic (1992) states that the survey questions assess ‘cognitions not actual behavior’ (p.119) and this is clear. The fact that the survey is carried out in a laboratory setting is a major criticism. The survey method employed is also criticised as it is suggested that the results of the study are dependant on the specific hazards chosen for study; the questions asked pertaining to the selected hazards and, finally, the participants (Slovic, 1992).

In addition to this, the typical respondents are college students, however the paradigm has been tested on non-student populations as well (see Gould *et al.*, 1988; Morgan *et al.*, 1985; Slovic, Kraus, Lappe and Major, 1991; Kraus and

Slovic, 1988 cited in Renn, 1992). The use of student populations, alumni and members of other groups are convenience samples (Sjöberg, 1996) and this must be recognised.

In the original 1978 paper Fischhoff *et al.* ask participants to rate 30 activities and hazards on nine risk dimensions. It is noted that these nine risk dimensions are not selected based on a theory of risk perception and instead are nine factors identified as possibly important in research prior to the 1978 paper, therefore, the paradigm has no theory behind it (Sjöberg, 1996).

In terms of limitations of the paradigm, it explores the perception of risk as one point in time. The study requires a survey to be conducted in order to gain an understanding and this is a limitation of the paradigm. There is time and cost involved in surveys and despite knowing the risk perception of a number of hazards, during a crisis event the psychometric paradigm offers limited benefit to decision makers. Longitudinal studies would be interesting to understand the way in which perceptions change over time and this may reflect the way in which cultures are dealing with risks. Risk perception, of an individual during a risk event is something which is much more dynamic and the paradigm is only capable of measuring it at one point in time. The way in which a layperson gathers and filters knowledge is omitted. Although it could be used to make decisions and prediction as to what risks will be accepted in society, meaning it could have an important role in a political context. The paradigm, however, does not look at the way in which people gain information about a hazard and ignores the dynamic process in which perceptions are formed and present it as a static value, instead the perception of a risk changes over time as new information becomes available and the paradigm is not able to take this into account.

As is shown, there are a number of criticisms and limitations of the psychometric paradigm, despite this it still has many attractions for it to be used as a basis of research. One of the main reasons for its acceptance within research is

its simplicity and its automatic plausibility.

## 2.7 Cultural Theory

As identified, three key approaches are explored in detail in this chapter: the psychometric paradigm, Cultural Theory and SARF. This section considers the second of these, Cultural Theory, in detail. Renn (2008) positions Cultural Theory in the top-right of the constructivist-structuralist quadrant, with a tendency toward structuralism (see Figure 2.1). Cultural theorists of risk view risks as social constructs in a similar way to post-modern thinkers (Renn, 2008). Cultural Theory draws upon both anthropology and sociology (Hirsch and Baxter, 2011) and an ethnographic approach has been taken in many studies relating to this theory. The work of Douglas and Wildavsky, to date, is the most notable within this field. Douglas' seminal book published in 1966 first highlighted these ideas and important further work on Cultural Theory was published by Douglas (1978) and Douglas and Wildavsky (1982). The seminal work has triggered much subsequent work and debate. Cultural Theory proposes that the way in which risk is constructed by an individual will be dependent on the cultural group to which they belong. Douglas (1992) argues that Cultural Theory "brings us somewhat nearer to understanding risk perception of lay persons by providing a systematic view of the widest range of goals that the person is seeking to achieve" (p.51).

Douglas developed a conceptual framework that argues the way in which risk is constructed is dependent on the cultural group (also known as prototype) to which the individual belongs. The theory proposes that there are a distinct number of prototypes. The number and definitions of groups depends on the researcher. Some work on Cultural Theory defines four groups as seen in Hood (1998) and Thompson, Ellis and Wildavsky (1990) whereas some define five groups as seen in Dake (1991) and Renn (2008). The theory proposes that people can be categorised

into one of these prototypes/groups. Each prototype has certain elements in common which is said to distinguish between how each group constructs and selects risks to worry about.

“According to cultural theory, the perceptions of risks is culturally constructed, from general orientations or world views, hence national boundaries and distinct world views will not coincide. People have different perceptions of risk, not primarily because they belong to particular nationalities but because they have separate world views” (Boholm, 1998, p.151). Cultural Theory argues that participants from each quadrant argue rationally from different grounds (Adams, 1995).

Much research has been carried out to distinguish cultural prototypes, where the prototypes are distinguished based on a combination of worldviews, conviction as well as values (Renn, 2008). Each prototype represents a group within society and each group has a certain position on risk. Additionally it is claimed that the groups also have defined coping mechanisms and attitudes. It is argued that the prototypes can be used to predict individual responses (Renn, 1992). There are a number of different versions of types. The number and types of groups is not consistent in the literature (Renn, 1992). Quite often there are four defined types see Hood (1998) and Thompson *et al.* (1990), the four are fatalist, hierarchist, individualist and egalitarian. The prototypes are not used to describe individuals, but instead social groups (Renn, 1992).

An important aspect of the work is the way in which the groups are stratified using the ‘grid’ and ‘group’ (see Figure 2.3). These characteristics are an important aspect within Cultural Theory research and is a fundamental means of stratifying the different groups. Grid refers to the degree to which someone will accept and respect hierarchy and formal sets of rules (Quigley, 2008). The degree of group quantifies the degree of group cohesiveness i.e. the extent to which one will identify with a given social group Renn (2008).

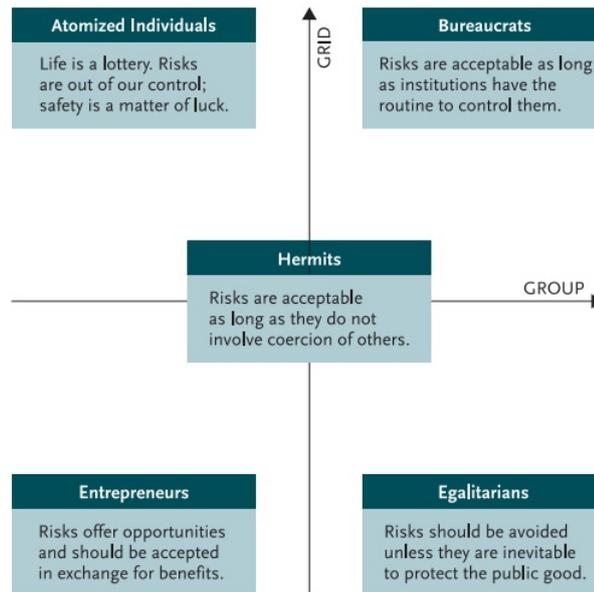


Figure 2.3: Diagram of the cultural prototypes placed with respect to ‘grid’ and ‘group’ (Source: Renn, 2008, p.62).

In one version of the theory, five prototypes are defined: entrepreneurial, egalitarian, bureaucrats, atomized individuals and hermits. As shown in Figure 2.3, Renn (2008) stratifies five prototypes in relation to the two characteristics ‘grid’ and ‘group’. The five prototypes are defined as follows. Firstly, the entrepreneurial prototype view risk-taking as an “opportunity to succeed in a competitive market and to pursue their own goals” (Renn, 1992, p.73). Those belonging to this prototype prefer less regulations by the government. In contrast to this, the next prototype, egalitarians with a higher degree of ‘group’ through cooperation and equality focus on long term effects. They are more “likely to abandon an activity (even if they perceive it as beneficial to them) than to take chances” (Renn, 1992, p.73). In the third prototype, bureaucrats, rules and regulations are relied upon to handle uncertainty. Bureaucrats believe that if risks “are managed by capable institutions and coping strategies have been provided for all eventualities, there is no need to worry about risks” (Renn, 1992, pp.73-74). The fourth prototype is the atomized individuals, they have a high degree

of grid and low degree of group. They believe in hierarchy but do not associate themselves with the hierarchy that they belong with (Renn, 1992). In this group the members trust only themselves, although they are willing to take high risks they object to risks which are opposed on them by others. They also believe that safety is a matter of luck. Finally, the fifth group sitting in the middle is the hermit, also known as autonomous individuals. Autonomous individuals are described as “self-centred hermits and short-term risk evaluators” (Renn, 1992, p.74).

In terms of communication, Cultural Theory offers a number of insights. Relating to rumours Douglas (1992) states that the control of rumours is crucial to risk perception. Furthermore, in cases of rumour the first thing to identify is whether the source is credible highlighting the importance of credibility in risk communication. Douglas (1992) proposes that Cultural Theory “can say a lot that is useful about the control of knowledge, the emergence of consensus and the development of expectations” (p.19). “News that is going to be accepted as true information has to be wearing a badge of loyalty to the particular political regime which the person supports; the rest is suspect, deliberately censored or unconsciously ignored” (Douglas, 1992, p.19). Based on this perspective Douglas (1992) suggests studying risk starting with the study of institutional design. A final aspect which is touched upon by Douglas (1992) is that of blame. According to Douglas (1992), the act of blaming is viewed as “a way of manning the gates and at the same time manning the guard” (p.19).

A significant piece of work within this area of study is the development of a questionnaire by Dake (1990; 1991). In 1990, Dake presented a “measurement instrument that is used broadly in quantitative studies on cultural theory and risk” (Rippl, 2002, p.147). Dake (1991) developed a questionnaire to categorise people into one of the prototypes. However, in later studies using the questionnaire it was found that classifying individuals into a distinct number of groups is

difficult and this is discussed more in more detail in Section 2.7.1.

Finally, cultural theorists have two opposing hypotheses of the grid-group typology - the stability hypothesis and the mobility hypothesis. The stability hypothesis claims that individuals prefer to be in the same type of environment. For example an individual from a hierarchical family will prefer a hierarchical job. Mobility theory alternatively allows for individuals to change their 'type' in different contexts. This disparity leaves some uncertainty about what Cultural Theory is (Tansey and O'Riordan, 1999) and leaves it open to criticism.

### **2.7.1 Criticisms of Cultural Theory**

Cultural Theory has received a number of criticisms which are outlined in this section. These criticisms include the oversimplification of groups within society; lack of empirical support for the theory and low explanatory power of the theory. These are discussed in further detail below.

A number of empirical studies have been carried out on Cultural Theory and to date little empirical support has been shown to support it (Boholm, 1996; Renn 1992; Oltedal *et al.*, 2004). Specifically, the findings of Dake (1990) and Dake and Wildavsky (1990) have not been replicated in further studies leading to questions around the explanatory power of the theory (Oltedal *et al.*, 2004).

Marris, Langford and O'Riordan's (1998) study aimed to determine whether the questionnaire proposed by Dake (1990) can be used to measure cultural bias. To categorise a person as one of four cultural prototypes using the questionnaire, they propose that an individual's score must meet the following criteria: the score of the individual must have one score above the mean for the sample and for the other three scores, they must score below the sample mean. They find that only 32% of the participants (41 of 129) could be assigned to one of the prototypes, eight respondents had no cultural bias and 80 respondents were of mixed cultural bias according to the questionnaire. Another study using Dake's questionnaire

by Brenot, Bonnefous and Marris (1998) in which the study is carried a French context, with a large sample of 1022 participants, also find that it has limited value in measuring cultural bias.

Oltedal *et al.* (2004) discusses two possibilities as to why the findings have not been replicated. The first possibility, which they argue to be the most serious of the two, is that the theory is wrong and that the cultural group to which an individual belongs is not important in the explanation of how people understand and perceive risks. The second possibility, is that the operationalisation of the theory has been carried out incorrectly and therefore the predictions of the theory have not been tested appropriately by the previous research studies.

It is suggested by Oltedal *et al.* (2004) that despite the, apparently, relatively low explanatory power of the theory its popularity may be in part due to the fact that it is relatively easy to understand as well as it appears reasonable and the combination of these contribute to its acceptance. Oltedal *et al.* (2004) also argue that Cultural Theory is unlikely to be able to make predictions about risk perceptions for specific events.

Tansey and O’Riordan (1998) note the limited applications of theory. They also note that many of the research methods are claimed to be likened to ones in other disciplines and ontologically these are not suitable for use with the theory. Specifically, these positivistic methodologies (such as the questionnaire developed by Dake (1990; 1991)) which have been applied to research of Cultural Theory are inappropriate. Tansey and O’Riordan (1999) argue that instead to further this theory, research should be based on detailed case studies and that research methods should be chosen which are more appropriate and aligned with the anthropological roots of the theory.

Lastly, Renn (1992) argues that the selection of a finite number of prototypes (usually four or five) requires more evidence. It is suggested that by reducing culture to four or five groups based on the two scales of grid and group is too

simplistic (Renn, 1992).

Although it has had many criticisms, Cultural Theory remains an important framework used to understand how groups in society formulate relationships which trust or distrust in institutions which have the power to create as well as regulate risk. Additionally, it also serves as a way of understanding how these groups understand hazards (Tansey and O’Riordan, 1999). The next approach, is SARF which draws upon aspects of both Cultural Theory and the psychometric paradigm.

## **2.8 The Social Amplification of Risk Framework**

The final area of research is SARF. This framework sits in the middle of Renn’s (2008) classification. SARF was proposed by researchers at Clark University and Decision Research in June of 1988 for the analysis of risk (Kasperson, 1992). The theoretical foundations of SARF is developed in five key papers (Kasperson *et al.*, 1988; Renn, 1991; Kasperson, 1992; Burns *et al.* 1993; Kasperson and Kasperson, 1996). In this section, the framework is introduced in detail, criticisms and limitations will also be identified and addressed where possible. The section then goes on to explore the existing body of empirical research relating to SARF.

In their seminal paper Kasperson and colleagues begin by stating:

“One of the most perplexing problems in risk analysis is why some relatively minor risks or risk events, as assessed by the technical experts, often elicit strong public concerns and result in substantial impacts upon society and economy”

(Kasperson *et al.*, 1988, p.177).

In essence the authors note that some events generate a disproportionate reaction; essentially some relatively minor events evoke strong public reaction

and alternatively some more serious risks are attenuated or ignored. The issue faced by Kasperson and colleagues in 1988 was that risk analysis was required to design public policies, but the concepts, at the time, were unable to predict the public's response to risk.

SARF “originated in the psychometric tradition, but also draws on a range of other literatures in its attempts to resolve issues that have been identified as problematic” (Taylor-Gooby, 2004/3, p.3). Leading on from Section 2.6 and Section 2.7, SARF encompasses ideas from both areas of research to put forth a conceptual framework that seeks to “link systematically the technical assessment of risk with psychological, social, institutional, and cultural processes in ways that may amplify or attenuate public responses to the risk or risk event” (Kasperson *et al.*, 1988, p.177). By drawing upon aspects of the psychometric paradigm and Cultural Theory SARF is one of the most influential frameworks which have been developed in the field and provides an integrated approach to risk analysis. Unlike previous approaches, the framework aims to link the “technical assessment of risk with psychological and cultural perspectives on risk-related behaviour” (Burns *et al.* 1993, p.612).

One of the main issues which Kasperson *et al.* (1988) raise in the paper is the narrow concept of risk. It is noted that the traditional definition of risk, where ‘risk’ is typically viewed as the ‘probability of events’ multiplied by ‘magnitude of the consequences of the event’ (Kasperson, 1992) is too narrow. It is argued that the public should be indifferent to high consequence/low probability risk events and low-consequence/high probability events (Kasperson *et al.*, 1988), however studies have shown that this is not the case (see Slovic, 1987).

The authors developed the framework in an attempt to resolve the ‘fragmented’ nature of risk communication and risk perception research (Kasperson *et al.*, 2003; Pidgeon and Henwood, 2010). Accordingly on review of the previous research in the area Kasperson *et al.* (1988) posit that a “comprehensive

theory is needed that is capable of integrating the technical analysis of risk and cultural, social, and individual response structures that shape the public experience of risk” (p.178). Renn (1991) draws upon an existing definition of risk communication by Covello, von Winterfeldt and Slovic: “Risk communication is defined as any purposeful exchange of information about health or environmental risks between interested parties. More specifically, risk communication is the act of conveying or transmitting information between parties about (a) levels of health or environmental risks; (b) the significance or meaning of health or environmental risks; or (c) decisions, actions, or policies aimed at managing or controlling health or environmental risks. Interested parties include government agencies, corporations and industry groups, unions, the media scientists, professional organizations, public interest groups, and individual citizens” (Covello, von Winterfeldt and Slovic 1986, p.172 cited in Renn, 1991, p.177).

The framework claims that conventional risk analysis is not always able to predict the social impacts on seemingly minor events (Kasperson *et al.*, 1988). They claim that to effectively design public policies for risk it is necessary to be able to anticipate or explain public response (Kasperson *et al.*, 1988).

Kasperson (1992) addresses the fundamentals of SARF by first presenting their definition of risk. “Risk, in our view, is in part an objective threat of harm to people and in part a product of culture and social experience. Hence, hazardous events are “real”: they involve transformations of the physical environment or human health as a result of continuous or sudden (accidental) releases of energy, matter, or information or involve perturbations in social and value structures” (Kasperson, 1992, p.154). Risk “as treated in the social amplification framework, is in part the threat of direct harm that happens to people and their environments regardless of their social constructs, and in part the threat associated with the social conceptions and structures that shape the nature of other harms (to people, corporations, social institutions, communities, and values)” (Kasperson, 1992,

p.161). A 'risk event' is defined by Kasperson *et al.* (1988) as "occurrences that are manifestations of the risk and that initiate signals pertaining to the risk" (p.178).

The framework draws upon traditional communications theory and this foundation of the framework is introduced here. Communications theory states that information sources send out messages, these messages are made up of a group of signals. The message will either be sent directly to the receiver or to a transmitter (Kasperson *et al.*, 1988). The signals are 'decoded' when they are received so that they can be understood. If the message is received by a transmitter, the transmitter will change the message "by intensifying or attenuating incoming signals, adding or deleting others, and sending a new cluster of signals on to the next transmitter or final receiver" (Kasperson *et al.*, 1988, p.180). The metaphor of amplification used in the name of the framework also has its roots in communications theory, meaning the process of intensifying or attenuating signals as it travels between the information source to the receiver and through intermediate transmitters. It must be stressed that in communications theory the term 'amplification' includes both intensification or attenuation of signals. The framework proposes that messages travel through a series of transmitters and receivers; there are various stations through which the message passes through before reaching the final person, at each station the message is received and then again transmitted to the next station. As a station decodes and encodes a message, the message will be attenuated or amplified. Previous studies have highlighted the importance of symbols in amplification and attenuation of the messages, specifically adding or removing a symbol from a message may have the greatest effect on the process. It is argued that amplification and attenuation of risks should receive the same attention (Renn, 1991). A simplified version of the framework is shown in Figure 2.4.

To summarise, "the main thesis of the social amplification of risk concept is

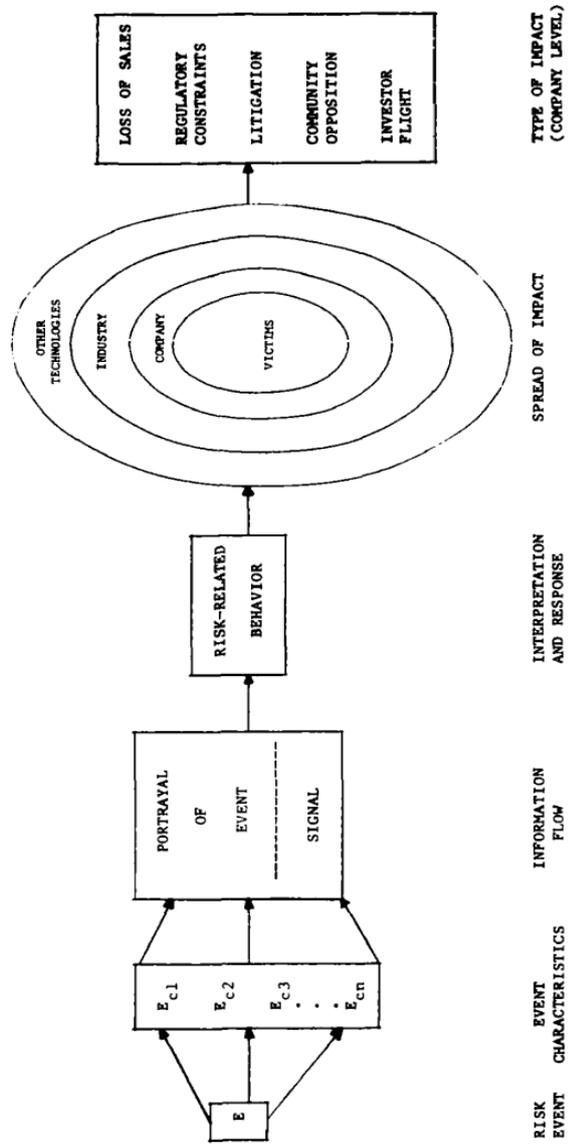


Figure 2.4: Highly simplified SARF (Source: Kasperson *et al.*, 1988, p.182).

that event pertaining to hazards interact with psychological, social, institutional, and cultural processes in ways that can heighten or attenuate public perceptions of risk and shape behavior. Behavioral patterns, in turn, generate secondary social or economic consequences. These consequences extend far beyond direct harms” (Renn, 1991, p.287). The detailed amplification of risk process is shown in Figure 2.5, as can be seen the process begins with a risk event, the risk event can be actual or hypothesised and the signals pass through a number of stations resulting in wider indirect effects. Taylor-Gooby (2004/3) describe the framework as an “ambitious attempt to integrate a range of existing approaches within an overall framework for understanding risk perception and communication” (p.3).

At this stage, when discussing amplification and attenuation it is important to note the definition of risk again. Kasperson *et al.* (1988) state that for this framework risk “has meaning only to the extent that it treats how people think about the world and its relationships. Thus there is no such thing as “true” (absolute) and “distorted” (socially determined) risk. Rather the information system and characteristics of public response that compose social amplification are essential elements in determining the nature and magnitude of risk” (p.181). Of course, there are potential hazards and there are also hazardous events that occur and these hazardous events are real (Renn, 1991).

Amplification stations include both individual and social stations. Examples of stations are scientists, news media, public agencies and personal networks (Kasperson *et al.*, 1988). The social amplification stations both produce and transmit information through communication channels. These communication channels include media, telephone and direct conversation. Kasperson *et al.* (1988) hypothesise seven key steps for amplification. These are:

- “Filtering of signal (e.g. only a fraction of all incoming information is actually processed);
- Decoding of the signal;

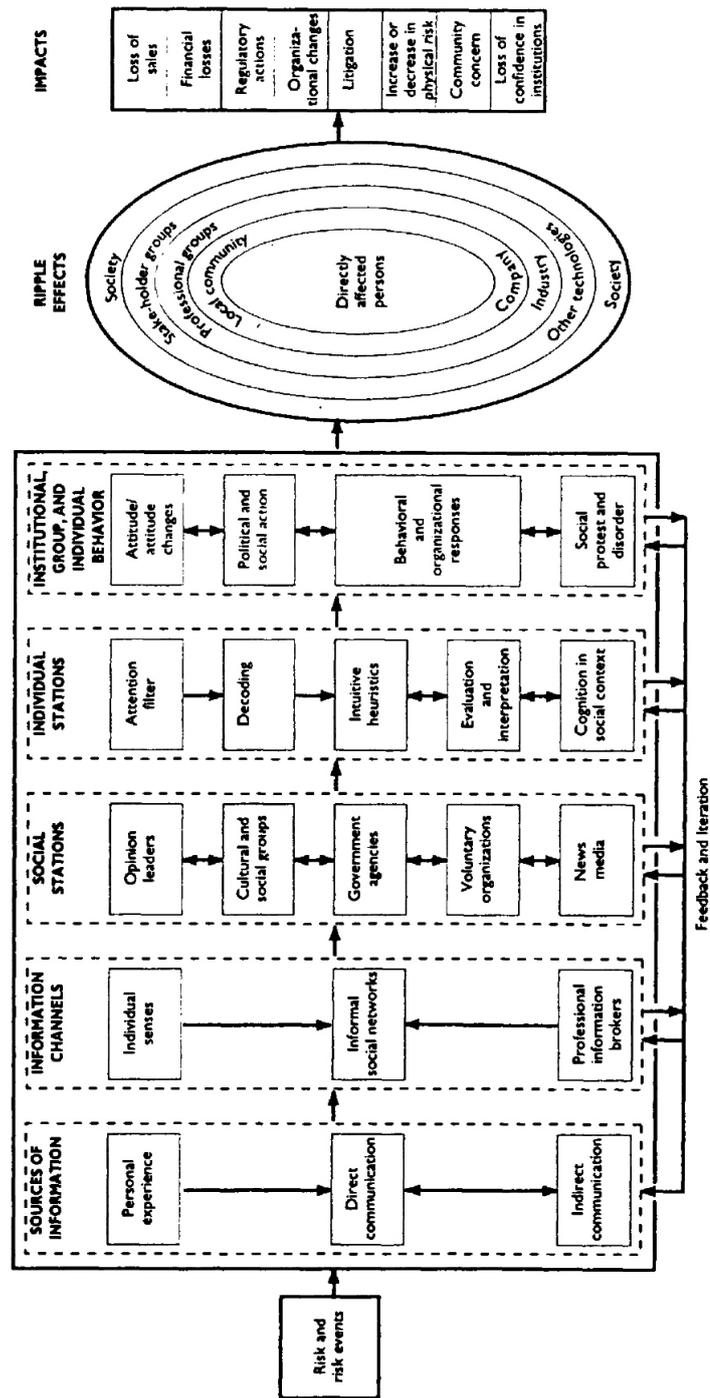


Figure 2.5: The Social Amplification of Risk Framework (Source: Kasperson and Kasperson, 1996, p.97)

- Processing of risk information (e.g. the use of cognitive heuristics for drawing inferences);
- Attaching social values to the information in order to draw implications for management and policy;
- Interacting with one's cultural and peer groups to interpret and validate signals;
- Formulating behavioral intentions to tolerate the risk or to take actions against the risk or risk manager;
- Engaging in group or individual actions to accept, ignore, tolerate, or change the risk"

(Kasperson *et al.*, 1988, p.181).

SARF was developed to aid understanding of the change of attention to risk issues over time (Breakwell and Barnett, 2001). Indeed, the "question of how risk communications are likely to be interpreted across the lifetime of a hazard is a vital one for those concerned with the communication of public health risks" (Barnett and Breakwell, 2003, p.302).

It is noted that the public learn about risks and risk events through information systems opposed to direct experience, therefore "risk communicators, and especially the mass media, are major agents, or what we term social stations, of risk amplification and attenuation" (Kasperson and Kasperson, 1996, p.18). Kasperson and Kasperson (1996) argue that important factors in "shaping group and individual views of risk are the extent of media coverage; the volume of information provided; the ways in which the risk is framed; interpretations of messages concerning the risk; and the symbols and metaphors, and discourse enlisted in depicting and characterizing the risk" (p.97).

As noted above, the way in which events interact with social, psychological, institutional and cultural processes can shape risk behaviour; these behaviours then in turn cause secondary effects, shown on the right of Figure 2.5. The framework highlights that secondary effects can be generated that extend far beyond those directly affected. The analogy of dropping a stone into a pool of water is used to illustrate the way in which the secondary effects occur. As the stone is dropped in the water it initially affects those directly affected, however as the ripples travel outwards highlighting the extent to which the risk event impacts. According to Kasperson (1992) secondary impacts include “such effect as

- enduring mental perceptions, images, and attitudes (e.g., antitechnology attitudes, alienation from physical environment, social apathy, or distrust of risk management institutions);
- impacts on the local or regional economy (e.g., reduced business sales, declines in residential property values, and drops in tourism);
- political and social pressure (e.g., political demands, changes in political climate and culture);
- social disorder (e.g., protesting, rioting, sabotage, terrorism);
- changes in risk monitoring and regulation;
- increased liability and insurance costs;
- repercussions on other technologies (e.g., lower levels of public acceptance) and on social institutions (e.g., erosion of public trust)”

(Kasperson, 1992, p.160).

As these secondary impacts occur, they are witnessed by social groups and individuals, thus allowing additional stages of amplification to occur. The effects

of the original event can therefore cause effects to a number of parties, over great geographical distances as well as to future generations (Kasperson, 1992). Thus, as shown above, the social amplification of risk involves two main stages. Firstly, the passing of information about the risk or risk event and secondly the societal response mechanisms (Kasperson *et al.*, 1988).

Direct experience of risk can serve as reassuring or an alarming experience and these experiences feedback on the hazard in question. However, risks are typically not directly experienced and this means that information and its flow to the public is key in the public response to risks and amplification (Kasperson *et al.*, 1988). Indeed, it is noted that if risks are not communicated they will have little or no impact further than to those directly affected (Kasperson *et al.*, 2003; Pidgeon and Henwood, 2010).

It is recognised that debates among credible sources will heighten the public's uncertainty about the event and is likely to increase concern (Kasperson *et al.* 1988). Alternatively, a "factual statement repeated several times, especially if by different sources, tends to elicit greater belief in the accuracy of the information" (Kasperson *et al.*, 1988, p.180).

As information flow is posited as the most important factor in shaping the social amplification of risk it is considered in more depth. Information flows through a number of channels. Two main channels of information flow is identified by Kasperson *et al.* (1988) namely the news media (television and newsprint) and informal personal networks. It is noted that the majority of research focuses on the role of news media and actually little is known about informal communications. Kasperson and Kasperson (1996) add another channel termed specialised media, representing professions and interests, recognising the increasing role of the internet for this information flow.

Kasperson and Kasperson (1996) highlight that media coverage is an important aspect in the social amplification of risk. Specifically, volume of cover-

age; framing of the risk event; how the risk is depicted (including symbols and metaphors) and the message interpretations. In relation to the volume of media coverage it is seen as a possible amplifier. It is found that the media typically provide more coverage on rare events. This increase in coverage has role in recall bias as noted by Kahneman and Tversky. Secondly, event dramatization within the media coverage also serves as a source for amplification.

Amplification of risks is a dynamic term as the risks are interpreted and responded to. The response of the risks is the final aspect of the model to consider. As shown in Figure 2.5 there is feedback in the first stage of the model between the different processes (Taylor-Gooby, 2004/3). The feedback highlights that “communication is almost always a process of two-way exchange or dialogue between parties” (Pidgeon and Henwood, 2010, p.55). The model also acknowledges some of the heuristics and biases found by Kahneman and Tversky (1974).

Kasperson *et al.* (1988) recognise in their seminal paper, which introduces this framework, is an initial step and conclude their paper by stating: “The conceptualisation needs scrutiny, elaboration, and competing views. Empirical studies, now beginning, should provide important tests and insights for the next stage of theory construction” (Kasperson *et al.*, 1988, p.187). The following subsection details the limitations and criticisms of the framework.

### **2.8.1 Criticisms and Limitations of SARF**

In Kasperson *et al.* (1988) the authors put forth a ‘fledgling’ conceptual framework. Since its publication in 1988 significant amounts of research have been carried out. This section identifies and discusses some of the criticisms of SARF and addresses concerns where possible.

Firstly, the metaphor of amplification has been criticised (see Rayner, 1988). It is argued that the metaphor ‘amplification’ suggests an underlying ‘true’ or ‘objective’ risk and a ‘subjective’ or ‘distorted’ view of risk (Kasperson, 1992).

However, despite the concerns raised, referring back to the original paper by Kasperson *et al.* (1988) it is clear that the authors do not suggest this. Instead, the authors' views are "risk is a composite of physically and socially induced effects" (Kasperson, 1992, p.163). As discussed earlier in Section 2.8 the authors clearly state otherwise. Despite this it has been misinterpreted by numerous researchers. Additionally, in the second stage of the model, depicted by the ripples travelling outwards is criticised by Taylor-Gooby (2004/3) who rejects the notion that this is a one-way process as shown.

The next criticism is whether the framework is testable and can generate hypotheses (Kasperson, 1992). The comprehensive nature of the framework means that empirical analysis cannot test the validity of the framework (Kasperson, 1992). This criticism is not specific to SARF, and as highlighted previously Cultural Theory also has the same criticism. Later Rosa (2003) however notes that it has been shown that SARF is capable of generating testable hypotheses and this has been demonstrated through empirical studies.

A further criticism of SARF is that it is trying to do too much, as the theory takes into consideration many complex cultural and social factors. As noted earlier, Taylor-Gooby (2004/3) describes the framework as an "ambitious attempt to integrate a range of existing approaches within an overall framework for understanding risk perception and communication" (p.3). Additionally the complexity of the framework makes it difficult to test.

Finally, as expected a large amount of work has been carried out and the next part of this section focuses on the applied research which has emerged from the framework and this allows the exploration of developments.

## **2.8.2 A Review of Empirical Research on SARF**

Now that the framework has been provided as well as highlighting and addressing some of the criticisms it is now important to introduce and summarise previous

research associated with SARF. SARF has been applied to a wide range of fields including health (Barnett and Breakwell, 2003), climate change (Renn, 2011), the role of the media (Susarla, 2003; Murdock, Petts and Horlick-Jones, 2003; Frewer, Miles and Marsh, 2002; Bakir, 2005) and trust (Frewer, 2003). On review of the literature Barnett and Breakwell (2003) state SARF “itself has not found wide currency among those looking to optimise the impact of a hazard notification, although the dilemmas that it addresses are very familiar to those concerned with improving health behaviour as it attempts to explain the discrepancy often seen between expert opinion about the magnitude and potential consequences of a hazard and public reactions to it” (pp.302-303).

### **SARF and the Media**

Bakir (2005) demonstrates how the framework can be successfully used as a way of analysing the role of the media in communicating risk signals.

Frewer, Miles and Marsh (2002) investigate the effect of an increase in media coverage of risks relating to genetically modified food on public attitude of technology. They find that participants who perceived the media stories to be negative were associated with a higher perceived risk than those who had not judged the reports as negative. Therefore Frewer, Miles and Marsh (2002) find that the volume and content of media reporting can potentially result in a change in perception consistent with SARF. They also find that the public’s trust in regulators was not affected by the media coverage.

Murdock, Petts and Horlick-Jones (2003) address the role of the media as a station for transmitting information to the public and therefore the result on the public’s perception of a risk. Murdock, Petts and Horlick-Jones (2003) argue that while the framework has sparked research it cannot be used to fully account for risk communication and responses. The study conducts a quantitative content analysis of risk reporting on a number of key newspaper and television channels,

and additionally group discussions were used to identify concerns and finally a number of interviews were conducted. In their study, they find that there are differences between tabloid newspapers and broadsheet newspapers reporting styles and news attention.

Murdock, Petts and Horlick-Jones (2003) argue that SARF can only provide a “highly simplistic understanding of the role and influence of the media in the amplification and attenuation of risk” (p.177). On reflection of this, Murdock, Petts and Horlick-Jones (2003) suggest that the most important goal is to “move towards a design-based and user-centred approach to communication; that is communication that is based on an understanding of existing lay knowledge and beliefs prompted by asking the question “do we know what lay publics know and want to know rather than what we want to tell them?” This requires detailed analysis of how different lay publics talk about and respond to risk issues and their media preferences and how these change with time” (p.177). It is argued that the relationship between media, government and official organisations need to be more proactive, one that is responsive to preferences including “narrative forms, visuals, and lay language” (Murdock, Petts and Horlick-Jones, 2003, p.178). Finally, Murdock, Petts and Horlick-Jones (2003) note that although newspaper coverage has been used in previous empirical investigations, televised news coverage has received little attention within risk communication research.

### **SARF and Trust**

The second key area of research relates to trust. Kasperson *et al.* (2003) notes that “[h]igh or growing social distrust of responsible institutions and their managers” (p.331) is a mechanism within the second stage of amplification in the framework. Amplification of risk can lead to secondary effects including loss of trust in institutions (Pidgeon and Barnett, 2013). To maintain trust in institutions requires openness and honesty in the communication of risks, particularly

regarding uncertainties (Pidgeon and Barnett, 2013).

Within SARF, the role of trust is increasingly being viewed as a means of moderating amplification (Breakwell and Barnett, 2001). Distrust in organisations responsible for managing a risk is, however, seen as a way for secondary, ripple effects to occur (Breakwell and Barnett, 2001). “Mistrust engenders a vicious descending spiral. The more mistrust by the public, the less effective government becomes at delivering what people want and need; the more government bureaucrats in turn respond with enmity towards the citizens they serve, the more ineffective government becomes, the more people mistrust it, and so on, down and down.” (Ruckelshaus, 1996, p.2 cited in Kasperson *et al.* 2003, p.332).

Frewer (2003) notes that an important aspect of the amplification process “is the role of public trust in different institutions...in mediating public responses to potential hazards, and any resulting risk amplification or attenuation effects” (p.123). Frewer (2003) examines the role of trust, or distrust in “mediating risk amplification or attenuation” (p.123). Frewer (2003) postulates that trust in public sector organisations may be important as the public sector is viewed by the public as both a generator of risks as well as a regulator of risks. Additionally these organisations are expected to communicate, regulate and maintain these risks (Frewer, 2003). “Risk information from a trusted source is internalized by the receiver of the information, and contributes to the way that individual perceives and responds to a particular risk. Risk information from a distrusted source may be disregarded as unreliable or self-serving, or even result in influencing risk attitudes in an opposite way to that intended by the information content itself” (p.124). When looking at trust in relation to SARF, increases in amplification may result from messaging released by trust sources about an increase in danger from a given hazard, and alternatively attenuation may occur if the trusted source releases a message which states a lack of danger from the particular hazard (Frewer, 2003).

Finally, social trust is posited as a key aspect within the process of social amplification (Kasperson *et al.*, 2003). There are many types of trust, but the way in which trust is created and destroyed remains relatively unknown, therefore Kasperson *et al.* (2003) suggest that this is a key area of research for future within the social amplification of risk research.

### **SARF and System Dynamics**

The final aspect of SARF related research is a methodological development with systems thinking. Burns (2009) and Burns and Slovic (2007) are complementary papers. Both papers use SARF as a conceptual framework for research alongside systems thinking. The papers bring together SARF and systems thinking and this is a new and interesting methodological step in the development of SARF research and will be discussed here.

The question arises of why bring together SARF and systems thinking and modelling. Systems thinking provides modelling tools that are useful for understanding dynamic complexity, which is likely to be found during crisis events (Burns, 2009). From a policy perspective, Burns (2009) notes that understanding how changes in one area can impact on the entire system is very useful. Specific aspects of systems thinking tools such as feedback loops (positive and negative), delays in systems, lend themselves well to modelling how amplification and attenuation occurs and therefore contributing to wider impacts. Burns and Slovic (2007) state that positive loops will typically amplify behaviours whereas negative loops, which have ‘goals’ will work against change to reach a certain value. A further aspect causing issues in making predictions in relation to future behaviours are delays between an event and its consequences. Burns (2009) notes that previous studies have made significant progress in understanding the public’s perception of risk, however, there is still little knowledge on how amplification or attenuation occurs and the link with secondary impacts.

Burns and Slovic (2007) recognise that there has been a substantial increase in knowledge on the public perception of risk, but much less is known about “the contexts under which amplification or attenuation occurs or how such amplification of risk perceptions are linked to other community impacts” (pp.299-300). In Burns and Slovic (2007), they use system dynamics modelling to “forecast community response...that examines how a community is likely to respond to a terrorist attack along several dimensions” (p.298). Their research, however, specifically seeks to demonstrate how system dynamics modelling could provide understanding of how risk signals may ripple through a community (Burns and Slovic, 2007). Their research takes a focus on characteristics of hazards and their contribution to the diffusion of fear among the community. The research utilises survey data. The aim of the second part of the study by Burns (2009) is to examine differences in the public response to terrorism events by systematically varying scenarios based on “non-terrorism vs. terrorism, explosions vs. infectious diseases, terrorists’ motive as demands to release prisoners vs. solely to instill fear, non-terrorists; motives as non-intentional vs. intentional (criminal), terrorist acts as non-suicidal vs. suicidal, non-terrorist incident as involving no negligence vs. negligence, victims as government officials vs. tourists, and a number of casualties (0, 15, 495)” (p.3). In the second paper, Burns (2009) develops a system dynamics model to forecast community response of the various hazards which incorporates survey findings. The type of modelling used by Burns (2009) is a stock and flow diagram. Similar to the first paper, the conceptual basis for the study is guided by SARF and it is also grounded in systems thinking and modelling. Burns (2009) uses SARF as a guide on what should be modelled. The system dynamics model is used to model the diffusion of fear of a variety of events to simulate the immediate and mid-term diffusion of fear. The study draws upon a survey which uses university students as participants. The survey questions address different aspects such as risk perception and trust, attention to

media, contact and conversations with friends and family, behaviour during and following the event. The questions were answered based on Likert-type scale.

In summary, Burns and Slovic (2007) effectively show in this paper how systems modelling could provide a way to demonstrate how risk signals propagate through society. The authors, however, note that further variables can and may need to be incorporated into the model as the model only captures some of the dynamics of community responses to a number of event (Burns and Slovic, 2007).

A further piece of research in which SARF and system dynamics ideas are used together is Busby and Onggo (2013). The research is a case study of zoonotic disease outbreaks, where system dynamics modelling is used as a medium. The researchers construct a system dynamics simulation in order to understand the outcomes that would occur in a system of social actors “who attributed amplification to other actors” (p.639). It is noted that “[r]isk responses first and foremost reflect the way in which people think about risks and think about the responses of other people to those risks. Second, the explicit and intuitive representation of feedback loops was important to show the reflective nature of social behaviour: how actors see the impact of their risk responses on other actors plays an important part in this” (Busby and Onggo, 2013, p.641). Again, it is shown that system dynamics modelling lends itself well to modelling SARF.

Despite the wide-ranging applications of system dynamics modelling in a variety of domains, the application of system dynamics modelling to risk perception and SARF is limited (Busby and Onggo, 2013). The ideas presented above to bring together SARF and systems modelling appears to be a sensible and helpful way to consider SARF. Previous research highlights that SARF is a large framework, and systems modelling is able to handle the large number of interactions, capturing feedback and delays in the process. Using systems modelling techniques will help capture an understanding of feedback in the system which can be difficult for people to understand.

## 2.9 Justification for Adopting SARF

This section presents a summary of the three approaches detailed in this chapter and justifies the adoption of SARF in this study. The psychometric paradigm examines an individual's perception of risks. The paradigm claims to have a high explanatory power, with results cited as 70%. However, criticisms of the paradigm argue that the use of aggregated data are misleading. Instead, results using raw data mean the paradigm is able to only explain 20-30% of the variance in the data (Sjöberg, 2000). The paradigm positions hazards with respect to two factors: unknown risk and dread risk. Although this allows for an easy way to compare two or more risks it only provides one estimate of risk perception and does not account for how risk perceptions change over an event. In comparison to Cultural Theory, the psychometric paradigm has been 'reasonably' successful in explaining and predicting perceived risk (Sjöberg, Moen and Rundmo, 2004).

Secondly, Cultural Theory, which typically looks at groups within society, postulates that people are predisposed to fear certain hazards due to social and cultural factors. In this research a number of prototypes are identified and it is argued that the prototype/group to which an individual belongs determines what that individual will fear. It also offers insights into the way in which the different prototypes will perceive organisations and also the way they want risks to be managed. Although the theory offers interesting insights into risk perception the limited empirical evidence in support of the theory is a major drawback.

The third approach, SARF, is argued to be "the most comprehensive tool available for the study of risk" (Rosa, 2003, p.47). The framework is developed in five key publications: Kasperson *et al.* (1988); Renn (1991); Kasperson (1992); Burns *et al.* (1993) and Kasperson and Kasperson (1996). Firstly, Kasperson *et al.* (1988) set out the initial ideas for the framework. Renn (1991) then identifies risk communication as the major aspect of risk amplification and provides a thorough examination of risk communication in light of SARF. Kasperson (1992)

addresses the criticisms of SARF from other researchers, clarifying some of the definitions. Burns *et al.* (1993) indicates the importance of the role of the media and public response in the response to an event. Finally, Kasperson and Kasperson (1996) present a number of case studies of amplification and attenuation of risks.

To summarise, Kasperson and colleagues recognised the need for an integrative framework (Rosa, 2003) and this motivated the development of SARF. SARF is a comprehensive framework, it “provides an analytical framework capable of integrating the competing perspectives of individualistic (risk perception), structuralist (cultural theory of risk, and some sociological and Marxist approaches), and constructivist (social construct theory) concepts. It represents a flexible and logical framework for the analysis of the relationships among individuals, social, and political responses to risks” (Renn, 1991, pp.289-290). SARF is cited as “the most promising effort to date for integrating cognitive and sociological approaches to risk...by setting up a framework that structures interdependencies in a risk event...[SARF] has been able to integrate media analysis into a theory of risk. While the media’s role is universally recognized, the particular function of the media has not been satisfactorily incorporated into a theoretical framework, which gives the social amplification framework an advantage over other theoretical approaches” (Krimsky and Golding, 1992, p.359). Therefore, it is clear that SARF takes into consideration aspects of both the psychometric approach and Cultural Theory detailed in this section.

Pidgeon and Henwood (2010) note that there is an extensive body of research relating to SARF, however much of this is predominantly focused on North America, they state that there needs to be further studies to identify the transferability of findings, but also to investigate “the way in which different cultural contexts uniquely shape risk communication and amplification effects” (p.62). Thus, there is an asymmetry between the development of studies within the United States

and out with this area.

Furthermore, an objective in European and North American health policy is to have the public participating in the decision-making process within the context of risk management issues (Pidgeon and Henwood, 2010). “As a consequence, deliberative and participatory mechanisms have become increasingly important in the risk communication arena, and look set to be so for the foreseeable future, particularly with the application of new and emerging technologies to health...Participation can be seen as a vehicle for for appropriate two-way risk communication between policy-makers and public, as a discursive device that empowers communities, as a means of incorporating public values in ethical decisions or sometimes as a combination of all of these” (Pidgeon and Henwood, 2010, p.63). SARF is treated as an analytical framework opposed to a theory as suggested by Pidgeon and Henwood (2010). “Putting trust and multidirectional communication at the heart of public health risk communication strategies may be fostered through the innovative use of narrative to complement the epidemiological, statistical evidence that has traditionally informed public health policy and communication” (Casiday, 2010, p.142). There has been a significant amount of research studies focussing on the role of the media within the amplification and attenuation of events. However, it is recognised that social media are beginning to emerge and the role of social media in the amplification and attenuation of events is of interest. As identified by Casiday (2010) a multidirectional communication tool could be likened to social media in which the communication is much more interactive and no longer is the communication assumed to be one-way.

A final point to note is that a common feature of all the approaches is the importance of trust with respect to risk communication and understanding (Taylor-Gooby, 2004/3). Visschers and Siegrist (2008) highlight that no consensus has been reached among researchers on the “specific functions of trust or the determinants of trust” (p.160) and naturally trust is put forth as a key area for future

research by a various researchers. On review of the research on risk communication, George (2012) notes that it is found that effective communication requires trust between the organisations communicating risk information and those receiving the information.

## **2.10 Summary**

To conclude, this chapter recognises that a wide variety of theories and approaches exist in the field of risk research. Three key approaches have been identified within risk analysis and explored in detail: the psychometric paradigm which considers risk perception at an individual level; Cultural Theory, a theory which identifies groups within society and argues that these groups choose which hazards to fear and, finally, SARF which puts forth a comprehensive framework which seeks to identify the way in which risk and risk events become amplified and attenuated in society. There are substantial bodies of research on each of the three approaches and all three are well established within the field of risk analysis. However, none are without criticism and each have limitations.

Although both the psychometric paradigm and Cultural Theory offer interesting and valuable insights, as well as raising aspects for consideration, this chapter argues that SARF positions itself as the most appropriate framework to underpin this research for a number of reasons. Although SARF has several drawbacks and criticisms, which are noted earlier, its multidisciplinary nature and comprehensive approach, position it as the most suitable framework to support this study. The detail within the framework supports the exploration of the way in which Twitter is used as a means of risk communication by health organisations. The framework has an important dynamic element which allows the study of the perception and response to a risk event over time. The framework identifies the feedback and iteration between the processes in the framework and this is an important aspect

within risk events. These aspects position SARF as the most suitable choice of framework for the research.

The following chapter, Chapter 3, provides a detailed investigation of literature relating to social media, in particular Twitter during crisis events. Chapter 4 then develops the conceptual framework and research questions for this research by drawing upon aspects of the two literature chapters.

# Chapter 3

## Social Media Literature Review

### 3.1 Introduction

The literature review in Chapter 2 highlights a number of broad areas in risk analysis research namely risk communication and risk perception. It presents three key approaches, the psychometric paradigm, Cultural Theory and SARF, which are explored in detail. Of the three approaches SARF is identified as the most appropriate basis for the research and is proposed as the theoretical lens for the study. SARF postulates that risk signals travel through individual and social stations causing the amplification and attenuation of risk events. Previous research focuses on the role of the media as a station in information communication. However, social media is gaining importance in society and is growing in popularity. As highlighted in Chapter 1, this research takes a specific focus on the use of social media as this area has not been explored in detail unlike traditional media such as newspapers. One social media is chosen as the platform for investigation: Twitter. Research relating to the use of Twitter during risk events is an increasingly popular area.

This chapter provides a review of the literature in this area to highlight current directions in social media related research. It also highlights, more broadly, the

type of analyses that are being applied to Twitter data. The literature review is structured as follows. Firstly, the literature review provides an understanding of Twitter and social media. Secondly, the chapter presents research which focuses on organisational use of Twitter during risk events. Thirdly, the chapter presents research focussing on the use of Twitter by the public during risk events. Finally, a large body of quantitative analysis has been carried out developing techniques to analyse Twitter data and this will be covered briefly. The research covered in this chapter is predominantly be related to Twitter, but it must be noted that some studies focus on platforms other than Twitter.

## **3.2 Twitter**

When referring to media there is often a distinction made between ‘traditional’ media and ‘new’ media, regardless of the time that new media has existed for. New media emerged as part of the Web 2.0 development and it is predominantly linked with communication associated with digital technologies such as the internet, thus including social media. Traditional media remains a one-way channel of communication and this includes radio, television and newspapers whereas social media “provides the potential for interactive, participatory, synchronic, two-way communication” (Latonero and Shklovski, 2011, p.6). It is the difference between one-way and the other ways listed above that is the main differentiator between traditional and new media.

Different stages in the development of the internet have recently been identified as Web 1.0 and Web 2.0 and the distinction between these is a recent one (Hsu and Park, 2011). The term Web 2.0 has varied definitions, but some distinctions between Web 1.0 and Web 2.0 are clear. Social media and social networking are part of this participatory Web 2.0. Falling under the Web 2.0 development are social media and social networking sites. There is still a lack of consensus

surrounding the definitions of these terms and are often used interchangeably. Murthy (2012) proposes that social networks include Facebook and LinkedIn and unlike these social media, such as Twitter, users tend not to interact with users offline.

This research specifically focuses on Twitter, the following outlines Twitter and develops an argument for this decision. Twitter is most commonly defined as a microblogging site (Sakaki, Okazaki and Matsuo, 2010). The site was launched in 2006, and gained popularity after winning the South by Southwest (SXSW) conference award in 2007 (Java *et al.*, 2007) and has since become the most popular microblogging site (Pak and Paroubek, 2010). There are 271 million monthly active users and each day 500 million tweets are sent (Twitter, 2014a). Twitter, as well as other microblogging applications are experiencing a rapid increase in the number of users (Starbird and Palen, 2010). Millions, worldwide use Twitter, connecting to others using the site through mobile phones and other internet enabled devices (Sakaki, Okazaki and Matsuo, 2010). An important aspect of microblogging is the real-time nature; unlike traditional, longer style, blogs Twitter users update more frequently and in some cases several times a day (Sakaki, Okazaki and Matsuo, 2010). The importance of Twitter data is recognised by the American Library of Congress who archive every tweet sent giving permanence to Twitter data (Murthy, 2012). Additionally, Twitter is also becoming a formal aspect of communications in both corporate and government organisations (Starbird and Palen, 2010).

Twitter users post short status updates known as ‘tweets’. A tweet “is an expression of a moment or idea. It can contain text, photos, and videos. Millions of Tweets are shared in real time, every day” (Twitter, 2014b). Tweets are limited to 140 characters, meaning users can only post short updates, hence the term microblogging. “Twitter’s character-count limits and real-time updates render it a place for ongoing and immediate interaction” (Smith, 2010, p.320).

Upon logging in to Twitter a user is greeted with a homepage. The main aspect of the homepage is the newsfeed. Twitter users choose who to follow. In most cases, a Twitter user will follow more users than the number who follow them. Followings are not necessarily reciprocal meaning that Twitter is a directed network. The newsfeed shows tweets of the other Twitter users which the user has chosen to follow. It is displayed in chronological order, with the newest tweets being shown at the top. As a user scrolls down, tweets become older. The choice of who to follow acts as a filter for the information a user will see as this limits the tweets visible on the newsfeed to these users' tweets (including ones that they have retweeted). Kwak *et al.* (2010) state that the popularity of a Twitter user is shown through the number of followers. Kwak *et al.* (2010) studied the Twittersphere finding that the top 20 Twitter users, based on their number of followers are either celebrities or news media.

A tweet will also display a number of icons and these are used by other users in response to a tweet. The three icons are 'reply', 'retweet' and 'favourite'. To comment on a tweet the reply icon is used and this allows a user to do so (Twitter, 2014b). The second icon is to retweet the tweet, this allows users to share the tweet with their followers (Twitter, 2014b). Due to the retweeting aspect of Twitter, people often gain information from those they are not directly following via retweets (Kwak *et al.*, 2010, p.598). Finally, users can 'favourite' tweets and this is done to show the author of the tweet that it is liked (Twitter, 2014b).

A further aspect of Twitter is a 'hashtag', this is used to classify a tweet where the symbol '#' is placed before a word that summarises the tweet, or what the tweet relates to. An example of a hashtag is #H1N1. Words prefixed with the hash symbol, hashtags, are also hyperlinks. When a user clicks on a hashtag it displays all the tweets containing that hashtag. It allows users to see the discussion on a particular topic by any Twitter user (not just those a user is following). Again, like the newsfeed, this is shown in chronological order. Twitter

monitors the use of hashtags and the most popular ones will be shown as trending.

Twitter can be accessed by both registered users who have Twitter accounts and by those who do not have Twitter accounts. The search function on Twitter can be accessed at [www.twitter.com/search](http://www.twitter.com/search) and this allows any internet user to search the site. The Twitter site can be searched through words or using hashtags. Searches will show all tweets containing the searched words or tweets containing the hashtag. There are limitations on what can be seen by users who are not signed in, this relates to details about users, who they are following and who follows them. Though public timelines, including all tweets by the user can be seen as long as the privacy setting is set as 'public'. Some studies have shown that 10% of Twitter users are not publicly available (Takhteyev, Gruzd and Wellman, 2012). Some users do change their privacy settings to private meaning that only users who are following their account can see their tweets. However, the default setting on Twitter is 'public' and most accounts have this setting.

Although there are a number of platforms which could provide the focus for the study, Twitter is chosen. Other platforms, such as Facebook could also provide an interesting platform for investigation. At this point it is worth noting what makes Twitter a more suitable medium to study rather than Facebook as by user numbers Facebook is the most used platform worldwide. The key differences between Twitter and Facebook, which position Twitter as a more appropriate area of study are as follows. Firstly, Twitter is designed to facilitate regular updating due to the short nature of the posts. Secondly, the chronological ordering of posts on Twitter, with the most recent being displayed at the top of the feed lends itself well to risk events where the latest information is displayed at the top of the Twitter feed. Facebook also has a newsfeed, however the posts are not displayed in chronological order, but instead depends on other factors. Twitter for the main part is public, this is a stark contrast to Facebook where many profiles are private.

### 3.2.1 Role of Twitter

Murthy (2012) compares the introduction of Twitter to the introduction of the telegraph and notes the striking similarities of the two. Murthy (2012) draws upon an 18th-century play titled ‘The Telegraph, or, A New Way of Knowing Things’ by John Dent (1795) to illustrate the main aspects of the introduction of the technology. In the play the main character is intent on getting a telegraph installed so that he can spy on his family when he is away from the household. The immediacy through which the telegraph can provide information and over great distances is a great attraction to the character. Consequences for the staff in the household means that they can no longer expect their discrepancies to go unnoticed as the main character will find out everything through the telegraph. Murthy (2012) highlights the similarities of the introduction of Twitter to the introduction of the telegraph. Murthy (2012) firstly highlights that both are used to send short messages. In the case of Twitter users are limited to 140 characters per tweet. Both Twitter and the telegraph share similarities relating to the wider impacts of the introduction of it. In the case of the telegraph, on its introduction it was thought that it would be the end of letter writing. Similar concerns are raised with the introduction of Twitter in that it is feared to replace longer styles of blogs and other longer length electronic media (Murthy, 2012). Although on different scales, Dent’s play also highlights the use of these technologies as a means of surveillance. Twitter is different from the telegraph as users choose what to post knowing that their posts are available to the public and they are searchable. However, Twitter allows organisations and individuals to collect information about a given topic using the search function, meaning that information can travel easily over great distances with no barriers. Murthy (2012) notes that the use of new technologies such as Twitter “blur the boundaries between public and private” (p.2), indeed this is true as users blog about their daily lives on Twitter among other things on a public stage.

Although as highlighted above, Twitter has many similarities to the introduction of other forms of communications. However, it of course has its differences, making it distinguishable from the rest, and therefore notable to research. Firstly, Twitter is free to use, however a user does need access to an internet enabled device to use the site. Secondly, Twitter is public, and by that nature anyone can use the search function to find relevant tweets. Thirdly, tweets are not directed at one individual or organisation, but are broadcast to all those who follow the author of the tweet. Fourth, it is interactive and networked. The network structure is interesting as it is a directed network in that users choose who to follow and as such these followings are not necessarily reciprocal, a key difference from other popular sites such as Facebook, where users tend to be linked to people they know. Finally, as Twitter users choose who to follow it allows them to determine who they want to hear information from making it a tailored experience.

Despite only being in existence for less than a decade, the microblogging site has had an interesting role in the past few years. On a number of occasions Twitter has been temporarily banned by countries including Turkey, Egypt and Pakistan. In 2014 Turkey banned both Twitter (BBC, 2014a) and YouTube (BBC, 2014c). The ban was imposed on Twitter on 21 March 2014, with the reason for the ban related to Twitter failing to remove allegations relating to corruption by senior officials in Turkey (BBC, 2014b). Again in Egypt, Twitter and other social media sites were blocked in an attempt to manage the unrest in the country (Arthur, 2011). It has also been banned in Pakistan however the ban was in place for just a few hours before being removed (BBC, 2012). Other countries have a permanent ban on the site. The decision to ban the site is an interesting one as it confirms the importance of Twitter in information sharing. It highlights how it is facilitating communication and improving information sharing.

### 3.2.2 Twitter and Risk Events

Social media such as Twitter have demonstrated their usefulness in the quick dissemination of information both during and after risk events (Genes, Chary and Chason, 2014). Twitter is viewed as a particularly powerful social media as messages can have a global reach (Genes, Chary and Chason, 2014). Recent disasters such as the Haiti earthquake, Japan earthquake, H1N1 pandemic, Boston Marathon bombings, Superstorm Sandy and others have raised the profile and potential importance of Twitter during and after disasters. Large scale disasters provide the focus of many research studies, for example the Haiti earthquake is the focus of many studies (see Oh, Kwon and Rao, 2010; Muralidharan *et al.*, 2011; Starbird and Palen, 2011; Smith, 2010).

The use of Twitter, both during and after disasters is increasingly becoming a way to push and pull information. Research is beginning to focus on the way in which Twitter is being used. Twitter can be particularly useful during critical situations as it uses existing social networks to communicate information (Genes, Chary and Chason, 2014). The retweet aspect of Twitter is particularly important as users retweet messages allowing the further dissemination of information. The use of hashtags allows users to search Twitter to find information about the event in question.

Twitter has had a mixed reception by officials as it is seen as a channel to facilitate the sharing of misinformation and rumours (Genes, Chary and Chason, 2014). However, other research shows that despite the lack of an ‘editorial’ function, individual users will begin to correct misinformation (Merchant, Elmer and Lurie, 2011). In the case of the Boston Marathon bombings, Twitter became a key information source for many people (Cassa *et al.*, 2013). Information on Twitter is not vetted, therefore allowing incorrect information to enter the public sphere, and this information may be difficult to correct particularly if it is widely retweeted (Cassa *et al.*, 2013). A key aspect of social media is engaging with oth-

ers in two-way communication, using social media in a one-way manner clearly decreases the ability of social media to be interactive with users (Neiger *et al.*, 2013).

Merchant, Elmer and Lurie (2011) suggest that “[e]ngaging with and using emerging social media may well place the emergency-management community, including medical and public health professionals, in a better position to respond to disasters” (p.290). It is evident that social media is changing the way in which individuals are communicating and this extends past the daily activities to disasters threatening public health (Merchant, Elmer and Lurie, 2011). According to Cassa *et al.* (2013) there is an opportunity to use Twitter to quickly disseminate health related information in crises, thus approaches to integrate social media should be developed.

In the context of public health “social media has the potential to improve the way public health agencies engage, interact and communicate with its various audiences” (Thackeray *et al.*, 2012, n.p.). Neiger *et al.* (2013) argue that although social media can be used to disseminate health related information it should also be used to engage users. According to Neiger *et al.* (2013) engagement is key to maximising the benefit of social media. Smith (2010) agrees stating that “[i]nteractivity is a driving force of Twitter use” (p.332). Engaging with users in a two-way manner provides difficulties for organisations and this is discussed further in Section 3.3.3. Research in the United States shows that the most used social media by state health departments is Twitter (Thackeray *et al.*, 2012). During the 2009 influenza pandemic information was tweeted regarding where vaccinations were available, within minutes people went to these sites (Merchant, Elmer and Lurie, 2011). Also during the H1N1 pandemic, the number of followers of the Centers for Disease Control and Prevention’s account saw a surge in followers from 65,000 to 1.2 million within the space of a year (Merchant, Elmer and Lurie, 2011). Neiger *et al.* (2013) state that with the increasing popularity

of social media public health has an opportunity to communicate directly with audiences. With the ability to share information from mobiles and the ability to post messages to a large audience positions it as a media of interest for crisis events (Hughes and Palen, 2009).

To summarise, there is a dual role with social media use as “social media provide opportunities for engaging citizens in public health efforts by “pushing” information to the public and by “pulling” information from bystanders” (Merchant, Elmer and Lurie, 2011, p.290). The platform also facilitates self regulation: Merchant, Elmer and Lurie (2011) note that incorrect information, which is broadcast is, sometimes, quickly corrected by other users on the platform. On review of the literature Latonero and Shklovski (2011) propose four categories into which Twitter communication during times of emergency and crisis can fall, these are:

1. “Twitter users posting self-generated messages about the crisis to their social networks.
2. Twitter users retweeting messages received from members of their social networks, traditional media, official, and unofficial sources.
3. Emergency management professionals using Twitter in either official or unofficial capacities to send messages to the public in affected communities or the public at large.
4. Emergency management professionals monitoring Twitter feeds from the public to gather information during times of emergency”

(Latonero and Shklovski, 2011, p.3).

This provides a clear way of stratifying communication and this shows the four main types of communication. The next section introduces literature relating to

the use of Twitter by organisations. Section 3.4 discusses literature based on the public's use of Twitter.

### **3.3 Use of Twitter by Official Organisations During Events**

There is a growing body of literature focussing upon the use of Twitter during a risk or crisis event by the public which is discussed in Section 3.4. However, despite this increasing area of research Latonero and Shklovski (2011) highlight that there is limited research on the use of Twitter during crisis situations from an organisational perspective. Panagiotopoulos and Sams (2011) also note that more widely there is little research regarding the way public organisations are using microblogging tools. This section presents some of the literature relating to the use of Twitter by official organisations during risk events. This section details the changing news arena and identifies some of the changes in expectations and roles of communications members. The final aspect is that of organisational aspects which limit the use and development of social media.

#### **3.3.1 Changing News Arena**

Szomszor, Kostkova and St Louis (2011) identify that the internet has radically altered the way in which information is publicised and used. They identify that previously the news media and governmental organisations controlled what information was made available and the way in which it could be accessed by the public. However, the increased accessibility of the internet and increasing popularity of social media means that individuals can now post ungoverned information online, potentially to a global audience.

“Social media and communication technology have shifted the power of communication from public relations practitioners to social media users who may not

have a recognized role or defined interest in an organization. What results is a social model of public relations in which traditional public relations responsibilities are distributed to social media users, and which depends on interactivity, legitimacy, and a user's social stake" (Smith, 2010, p.329).

Traditionally the public rely on news media and emergency officials for the provision of information about crisis events (Hughes and Palen, 2012). However, with the increase in access to the internet along with the increase in popularity of social networking sites the public now expect emergency response organisations to provide information through social media sites and the organisations are facing challenges of these new demands (Hughes and Palen, 2012).

Twitter is now also used by the media to find and disseminate information (Crowe, 2011) and increasingly tweets form the basis of many stories in the media. The rate at which information is disseminated has increased significantly due to the high levels of mobile Twitter use as well as the retweet capability (Crowe, 2011). On 16 January 2009, a USA Airways plane was forced to make an emergency landing, after double engine failure, in the Hudson river, New York, the first reports of the event appeared on social media (Subasic and Berendt, 2011). Twitter users broke the news approximately fifteen minutes before the mainstream media (Beaumont, 2009) demonstrating how fast this medium is.

The public expect more information quicker than before, however traditional communication channels by official governmental organisations are unable to fulfil these expectations (Crowe, 2011). Latonero and Shklovski (2011) highlight how quick the speed of response can be by drawing upon an example of where the organisation responds to a Twitter user in three minutes. They recognise this is a 'double-edged sword' in that this kind of response time is "far surpassing any traditional broadcast medium" (p.9), however to maintain this level of response time and this level of interactivity "implies constant vigilance and a level of attention that is unheard of from large government organizations" (Latonero and

Shklovski, 2011, p.9). Therefore, it is recognised that although this kind of quick response builds “rapport and a feeling of community among the followers” (p.9), it also creates an expectation among the followers and such a quick response is not always possible due to staff limitations and other organisational aspects.

Comparing old and new media, Latonero and Shklovski (2011) highlight that “[p]art of the impetus to interact more with citizens directly derives from an explicit dissatisfaction with traditional media” (p.10). The aim, to bypass mass media, is shown to be the main motivation in the adoption of new media, including Twitter. Hughes and Palen’s (2012) research also echoes a similar perspective. The authors identify tension between public information officers and the media. The research discusses how the media misquote public information officers statements and raise the issue that in some instances this can be quite a significant difference. Furthermore, they also discuss specifically the misuse of numbers and the implications of this. The media, public and official organisations are bound by different regulations and this can also cause issues as public information officers are sometimes not able to respond fast enough (Hughes and Palen, 2012). Despite these issues the media is still recognised as an important aspect of emergency work.

There is a shift from appointment media, where they are referring to set time news such as the 6 o’clock news to real time media and they recognise that appointment media is dying and this shift to real time media has brought opportunities (Latonero and Shklovski, 2011). However, although there is this shift in the media and the addition of the new media it is noted that not all of the intended audience is on Twitter and the organisation still has the aim to get out as official verified information to the public in “as many ways as possible” (Latonero and Shklovski, 2011, p.10) means that the Twitter account and other new media are used in addition to traditional means to do this. Yet Twitter and other social media are recognised as a way to get information out rapidly.

The authors recognise a shortened news cycle and in light of this the demand on public information officers to collect information and to create a message for public release is an issue.

It is recognised that traditional media are an important station for information dissemination, however the issue with this extra station between organisation and public means that the message will be altered (Crowe, 2011). Social media, as it allows direct communication “can help to eliminate and/or control this process and allow emergency managers to have an outlet for unfiltered and fully developed preparedness or response message, which is critical to ensure that citizens receive clear and consistent information” (Crowe, 2011, p.412). It is recognised that social media will not replace traditional means of communication within health, as there are questions raised over the ability to reach at risk populations, but social media can be used to “bolster current systems” (Merchant, Elmer and Lurie, 2011, p.291).

Research finds that using Twitter and Facebook to provide updated information on the event reduces the number of enquiries by the media and others. Therefore the number of calls decreases (Hughes and Palen, 2012).

To summarise, the news arena is undergoing significant changes. Social media “can be empowering to its users as it gives them a platform to speak. It allows anyone with access to the Internet the ability to inexpensively publish or broadcast information, effectively democratizing media. In terms of time, social media technologies allow users to immediately publish information in near real time” (Bertot, Jaeger and Grimes, 2010, p.266). The speed at which information can be published on social media means it is often the source for the most up to date information. It provides challenges to official organisations as there is an increased expectation over the speed of information provision.

### 3.3.2 Role of Social Media

Merchant, Elmer and Lurie (2011) state “social media are changing the way people communicate not only in their day-to-day lives, but also during disasters that threaten public health. Engaging with and using emerging social media may well place the emergency-management community, including medical and public health professionals, in a better position to respond to disasters” (p.290). Panagiotopoulos and Sams (2011) highlight that “[m]icroblogging services are considered an emerging opportunity for authorities seeking to establish new communication channels with their public” (p.1). At this point it is worth considering the role of social media for organisations as already, it is clear that “social media provide opportunities for engaging citizens in public health efforts by “pushing” information to the public and by “pulling” information from bystanders” (Merchant, Elmer and Lurie, 2011, p.290).

According to Panagiotopoulos and Sams (2011) Twitter is becoming the most effective tool to address public’s expectations of increase transparency in the public sector in addition to openness and interactivity. Some of the potential benefits of using microblogging as part of communications include enhancing transparency, increasing interactivity, using it to disseminate information for regular and during risk events (Panagiotopoulos and Sams, 2011). Some researchers suggest that the use of Twitter assists in humanising the organisation (Smith, 2010).

The distinguishable feature of microblogging sites such as Twitter is the rate at which updating occurs and the immediacy of new content (Panagiotopoulos and Sams, 2011). Hughes *et al.* (2014) state “[t]he broadcast nature of Twitter can help distribute information as circumstances around an event change” (n.p.). “The immediacy that Twitter can provide as a communication channel certainly makes it a promising tool for timely official updates by authorities in unexpected conditions” (Panagiotopoulos and Sams, 2011, p.2). Additionally, authorities can use Twitter both to monitor the public reaction to the event and for rumours.

The Centers of Disease Control and Prevention used Twitter as a way to disseminate information about the spread of disease, they find that people who retweet messages in Twitter amplified the diffusion of information (Magro, 2012).

Furthermore, the use of social media also extend to the post-crisis stage with the recovery phase. As those affected by disasters use social networks it allowed them to quickly connect with the required resources (Merchant, Elmer and Lurie, 2011).

Merchant, Elmer and Lurie (2011) postulate that “[s]ocial media might well enhance our systems of communication, there-by substantially increasing our ability to prepare for, respond to, and recover from events that threaten the public’s health” (p.291). They also highlight that although social media is used by a wide range of people, it is important to consider its ability to reach the at-risk, vulnerable population.

Finally, Merchant, Elmer and Lurie (2011) state that more research is required on a number of things, firstly to “evaluate the reliability and validity of public health-related information communicated through social media” (p.291) and secondly research into “whether the integration of social media into public health efforts affects the costs, quality, or outcomes of healthcare” (p.291).

### **3.3.3 Organisational Aspects**

The use of Twitter often relies on individuals driving the use of these new technologies in the organisation; they are limited by their own workload and capacity and they may not have the support of the organisation (Latonero and Shklovski, 2011). To fully integrate the use of these technologies Latonero and Shklovski (2011) postulate that “[o]rganizational support and political will to initiate and support change is paramount if we are to see these kinds of services provided broadly, but it is also important for such organizations to recognize the function and value of information evangelists in their midst” (p.14).

Gaining approval for the use of social media can even be a difficulty in these organisations. In a study by Hughes and Palen (2012) a participant is quoted: “Most fire department and police agencies have shied away from using social media just because it’s government. Most agencies don’t feel comfortable going in to those areas and we’re usually slower, versus a public entity or a private entity. So we’ve really taken baby steps to try and alleviate the fears of our chief and our board of directors that this is not something that will back fire in our faces” (p.8). Clearly there are concerns in the organisation regarding negative future outcomes that may impact on the organisation and this is a limiting factor in the development of social media as part of the communication process.

Kavanaugh *et al.* (2012) find that those who typically handle the role of communication between government and public are not always comfortable in using social media and training is required. It also finds that local governments use social media without an understanding of “its costs and benefits, or who their actual audience is, who in the organization should monitor communications, how and when they should be responding, and what effect their social media communications have on the public” (Kavanaugh *et al.*, 2012, p.482). Similar findings are found by Latonero and Shklovski (2011) who note that the value of social media may not be understood by organisational leaders. Latonero and Shklovski also note that support for public information officers is limited by budgeting aspects of the organisation as well as political will that exists in the higher echelons of the organisation. If the organisation does not support the use of Twitter and other social media the resources will not be in place. This limits the use of social media to those who are comfortable using social media. Without the support of those higher in the chain of command a major challenge faced by those in the communication team is that of workload.

Finally, another issue of the use of social media by official organisations is the use of information, conversational style of posts that is favoured in social media.

Traditionally these organisations use formal language and the modification of this must be decided in the organisation (Crowe, 2011).

So far developing the use of Twitter in an organisation has received little attention. Latonero and Shklovski (2011) discover that it is individuals who are key in the process of developing a Twitter presence for the organisation: “while social media certainly was a point of concern, use of these technologies was intimately tied to individuals pushing the envelope, to the organisational structures within which these individuals are positioned and to political will to change modes of crisis response” (p.7). According to Crowe (2011) “[s]ocial media systems are not going away and neither are disasters, therefore, it is paramount for emergency managers and the profession as a whole to find ways to understand and embrace how social media are impacting their lives and communities” (Crowe, 2011, p.418). This section highlights the lack of organisational support in organisations. The generally slow development of the use of Twitter and other social media may relate to aspects of organisational culture.

### **3.3.4 Building Trust and Credibility**

There are issues over the credibility of using Twitter by official organisations but as Facebook and Twitter dominate in popularity these platforms must be taken into consideration by emergency management planners (Crowe, 2011). There is a difference between where emergency management organisations would like the public to spend their time and where the public actually spend their time, but it is argued that emergency management organisations must be using the means of communication that are popular (Crowe, 2011). The research highlights that emergency management organisations may perceive systems to lack credibility and systems have been developed to be used during emergencies but due to their lack of popularity have not been successful and have been shut down. Therefore it is suggested that emergency management should go where the public are on-

line to communicate. As social media are freely available it means emergency management no longer need to develop systems at their own expense (Crowe, 2011).

Crowe (2011) notes that developing trust between governments and the public is difficult and social media is viewed as a way to overcome these difficulties. “Social media also create an inherently higher trust factor for information because of the shared network of friends, contacts and organisations” (Crowe, 2011, p.410). Bertot, Jaeger and Grimes (2010) note that traditionally new forms of information and communications technologies favour those in power. Alternatively social media has the “potential to enhance existing and foster new cultures of openness” (Bertot, Jaeger and Grimes, 2010, p.267).

As access to government information increases and transparency is improved through the use of information and communications technology, it is shown to increase trust among the public (Bertot, Jaeger and Grimes, 2010). “Transparency and the right to access government information are now internationally regarded as essential to democratic participation, trust in government, prevention of corruption, informed decision-making, accuracy of government information, and provision of information to the public, companies, and journalists” (Bertot, Jaeger and Grimes, 2010, p.264).

Finally, Latonero and Shklovski (2011) explain how consistency allows people to “develop a reputation to maintain source credibility” (p.9) online and this is recognised as important as it gives weight to these internet users in online conversations. Indeed “[s]ource credibility is essential during crisis communications as evidenced by Starbird and Palen’s (2010) research that demonstrates that Twitter users overwhelmingly retweet messages from official information sources such as emergency management or news media organizations” (Latonero and Shklovski, 2011, p.9).

### 3.3.5 Twitter as Information Source

In any emergency a member of the public is generally first on the scene and they provide the role of an emergency responder between the time of the event occurring and for the first emergency response professionals to reach the scene (Hughes and Palen, 2012). As seen in Haiti earthquake, Twitter empowers the public to fulfil public relations activities (Smith, 2010). In addition to this, as a result of new technology, the public are also the first to report on incidents (Hughes and Palen, 2012). An example of this is that provided earlier where a plane made an emergency landing in the Hudson River in 2009 and the first photograph of this event was posted on Twitter by a member of the public (Hughes and Palen, 2012). The use of social media by the public can also cause issues as they propagate misinformation, which is mostly unintentional and this results in public information officers having to correct this misinformation (Hughes and Palen, 2012). Clearly Twitter allows organisations to gain an insight into the misinformation and rumours that are circulating quicker than before. Most commonly keyword searches are used to gain information. Participants recognise that if there are enough tweets on a given term there may be an issue to address. The main issue is the validation of information on Twitter, as sources are unofficial and could be anyone. Twitter can be used as a first step and then communications to gain further information from a member of the public can follow through more traditional means such as email or telephone (Hughes and Palen, 2012).

Hughes *et al.* (2014) carry out a basic quantitative analysis of official organisations for four different media during superstorm Sandy. The analysis identified a number of categories as a way of classifying messages. One of the categories is ‘Rumor’ which is defined as ‘Rumor and misinformation’ (Hughes *et al.*, 2014) and only a few instances where departments are correcting misinformation, however, of the three media examined for this aspect (Nixle, Twitter and Facebook), Twitter has the most instances of this, but it is still low in comparison to the

other categories. One category is ‘Reassurance’ where this category is defined as ‘Reassurance to the public that first responders are prepared for or actively monitoring the storm’ (Hughes *et al.*, 2014) and it is shown that Twitter is used to send reassuring messages. One final category to note is ‘Engagement’, this category is defined as ‘Invitations to engage with department on social media or direct responses to public posts/tweets’. In this case Twitter has the highest number of messages of this.

Kavanaugh *et al.* (2012) conduct an exploratory study with government officials. One aspect of the research goal is to understand the use of social media by government officials and the public. It also looks specifically at the use of social media for crisis situations ranging from routine e.g. traffic crises to the non-routine e.g. earthquakes. According to Kavanaugh *et al.* (2012) monitoring social media can provide governments with insights into the perception and the mood of their public that cannot be collected by traditional means. The most important aspect is the real-time insight.

### **3.4 Public Twitter Usage During Risk Events**

A popular cluster of research focuses on the use of Twitter by the public. This is a growing and new area of research which is gaining popularity. This section looks to present some of the research that has been carried out that mainly focuses on the use of Twitter during risk events by the public. The research, in this area, investigates the use of Twitter during events including earthquakes, grassfires and flooding as well as how Twitter can be used to track the spread of diseases and understanding public concern. In general, the research detailed below aggregates Twitter data (tweets) to provide information.

### 3.4.1 Backchannels of Communication

As noted, Twitter was launched in 2006, but its popularity began in 2007. Therefore, studies in this area only began to emerge from 2008 and the number of studies in this area is limited. One of the first aspects of research on Twitter and its usage during risk events is that by Sutton, Palen and Shklovski (2008) who recognised the existence of a ‘rapidly changing information arena’. In this research the authors use an online questionnaire to investigate ‘backchannels’ of communication, where backchannels refer to channels of communication that are not official, during two risk events (a river flooding and grassfires in the United States of America).

According to Sutton, Palen and Shklovski (2008) these backchannels, of which Twitter is one, are often viewed by public officials as having the potential to spread misinformation and rumours. The authors, however, note that these backchannels of communication allow the public to participate and engage in information creation instead of simply being information consumers. The spread of misinformation and rumours can prove to be detrimental to efforts and limited resources during risk events. Instead of viewing these backchannels as a way of spreading misinformation and rumours, organisations should focus on effective ways of communicating information.

The findings of this study are as follows. Firstly, a portion of respondents in this study started using Twitter during the crisis event. The survey finds that participants used a number of ways to gain information about the event. Respondents reported that traditional news outlets remain an important way of gaining information, however a number of respondents indicate that these sources are insufficient. The information was cited as insufficient due to the following reasons: information provided was not specific to the area, focused on metropolitan areas, inaccurate or focused on the sensational. A number of issues are raised about official sources. Respondents highlighted that these sources were

slow to update information. In relation to Twitter, the speed of updating is vital to efforts, Twitter is positioned to facilitate the communication of up-to-date information and organisations must be aware of this. Twitter accounts are also able to provide 'local' information as specific areas can have their own Twitter account which can be used to provide information to public in the area.

Looking at the specificity of information provided by national news media, the paper highlights that as the national news attempts to reach a broad audience the information provided can lose its relevance for local residents. Alternatively, the research shows that local news provide more relevant and local-specific information.

The paper comments on the changing role of backchannel communication using social media "they are being adopted as useful, viable sources of information not only by at-risk populations, but also by traditional media and some emergency management personnel - actors that traditionally comprise the "front channel"" (Sutton, Palen and Shklovski, 2008, n.p).

"Social media supports backchannel communication, allowing for wide-scale interaction between members of the public that has qualities of being collectively resourceful, self-policing and generative of information that cannot otherwise be easily obtained" (Sutton, Palen and Shklovski, 2008, n.p). Therefore, from this, it is expected that members of the public will take it upon themselves to become an information source.

In a number of research papers it is shown that people will begin using Twitter during an event to gain and provide information. Research shows that some users that begin to use Twitter during a large-scale event will continue to use Twitter in the long-term (Hughes and Palen, 2009).

### 3.4.2 Information Propagation by Retweeting

An important aspect of Twitter is the way in which information propagates through the Twittersphere. The retweeting function, as described earlier, which allows users to share a tweet of another Twitter user to their followers from another source that their followers do not necessarily follow. Retweeting “empowers users to spread information of their choice beyond the reach of the original tweet’s followers” (Kwak *et al.*, 2010, p.591). Retweeting is clearly an important mechanism on Twitter to facilitate the propagation of messages. In a risk event, this can be a helpful aspect as messages can gain a wider reach as they are retweeted. It is therefore common for users to attain information via retweets (Kwak *et al.*, 2010). Research investigating retweeting by Kwak *et al.* (2010) uses a corpus of 106 million tweets (no specific topic). The research finds that on average a retweeted tweet will reach an average of 1,000 users regardless of the number of followers of the original tweet. Their findings highlight that the median value is almost always below the average thus indicating that some retweets have a high number of additional recipients. Kwak *et al.* (2010) also investigate the time elapsed between tweet and retweet. Their findings show that 50% of retweets occur within one hour of the original tweet and 75% occur within one day of the original tweet. In the case of a risk event, it is expected that retweeting will increase as individuals seek to share information with their followers.

Several studies investigate what type of information is retweeted during a risk event. Starbird and Palen (2010) investigate the tweets generated during two different co-occurring natural hazards in 2009, namely a river flooding in the USA and one area of grassfires in the USA. Data was collected from Twitter using a number of key search terms. This dataset was then analysed to identify users who had sent more three keyword-containing tweets. The researchers then captured the entire Twitter streams for each individual user within a specified time frame. The tweets were then coded based as to whether they were

on 'on-topic' or 'off-topic' and then an analysis is carried out on the retweeting behaviour. When comparing retweeting behaviour relating to on-topic event versus off-topic events, users are more likely to retweet on-topic event tweets that contain keywords. The research then investigates further as to who is retweeted. The authors find that "Twitterers whose tweets were retweeted the most almost always belonged to mainstream media (especially local media), service organizations, or accounts whose explicit purpose was to cover the event" (Starbird and Palen, 2010, p.5). Investigation of what information is being retweeted shows that the information is of 'broad appeal', in this case the most tweet with the most retweets contained a link to images of the flooding. However, investigation on what is most retweeted by local users shows that these retweets contain locally relevant information. Their analysis of the tweets find that firstly local Twitter users are more likely to retweet information than non retweets about the event. In particular, the information that is retweeted originates from sources such as media, in particular the local media, as well as traditional service organisations (Starbird and Palen, 2010). In terms of retweeting during a crisis situation, Starbird and Palen (2010) show that there are specific types of organisations whose tweets will be retweeted by Twitter users and these include media and emergency management organisations, indicating the valued sources of information.

In the research by Chew and Eysenbach (2010) who compared original tweets and retweets related to the H1N1 outbreak find that original tweets contained more personal information than retweets. This suggests that people are retweeting more factual information.

Szomszor, Kostkova and St Louis (2011) investigate how online sources were discussed on Twitter relating to the Swine Flu pandemic. Data was collected from Twitter where tweets were collected that contained the term 'flu'. A focus is made on the popularity of trusted sources. The findings show that trusted sources are more popular than untrusted sources. Despite this there is still the

ability for information with less credibility to enter the network.

Weather related events also form a focus for research, Genes, Chary and Chason (2014) investigate users' sharing of official messages during two weather events. The research finds that the most shared tweets provide links (URLs) to further information. The retweeting of messages increased the reach of the messaging far beyond the user bases of the official Twitter accounts.

### **3.4.3 Self-Organisation of Volunteers Through Twitter**

Starbird and Palen (2011) examine the self-organisation of digital volunteers in the aftermath of the Haiti earthquake. Starbird and Palen (2011) demonstrate how microblogging platforms facilitate self-organisation. This research differs from others as the previous research has considered the way in which Twitter can be used to increase awareness during an event.

The method for data collection firstly collects data from Twitter using a number of keywords. A tweet content analysis is used to identify a target study population. The final stage is email-based interviews with those who were tweeting during the aftermath of the earthquake.

Starbird and Palen (2011) note that people's desire to help during a crisis has been evident in previous research, and this desire to help is an important aspect of response and recovery. In their research they see the same behaviour of people wanting to help and this can now be done remotely. Interestingly, Starbird and Palen's (2011) research finds that a portion of their respondents joined Twitter shortly after the earthquake because they had connections to Haiti. Hashtags are identified as an important way of finding information as well as identifying people in the conversation about the event. A key aspect of this research is that help can be provided remotely. People do not have to be in the area to contribute to help. Furthermore, Twitter data can be used to gain an understanding of what is happening on the ground and to provide information. Due to previous research

which highlights people's desire to help during crises it is not unexpected that this extends into the realm of Twitter.

#### **3.4.4 Tracking Disease Outbreaks**

The next area of empirical research on the use of Twitter by the public focuses on whether Twitter data can be used to track and predict the spread of disease in the population. Szomszor, Kostkova and St Louis (2011) state that Twitter can be used to track and predict the spread of diseases. The research takes two routes, firstly one route focuses on a particular disease to track such as H1N1, the second route looks to use Twitter data to gain information about numerous illnesses. Studies tracking influenza-like illnesses have been successful.

Firstly, a number of studies use Twitter as a means of tracking a specific disease outbreak (Signorini, Segre and Polgreen, 2011; Doan, Ohno-Machado and Collier, 2012; Lampos and Cristianini, 2010; Achrekar *et al.*, 2011). Many studies in this area focus on influenza-like illnesses. Studies in this area have been highly successful as shown in Lampos and Cristianini (2010) and Achrekar *et al.* (2011). In one such study by Lampos and Cristianini (2010) Twitter data is used to monitor influenza-like illness. By using textual markers they create a flu score for each tweet collected. The results of Lampos and Cristianini's study (2010) are highly correlated (>95%) with the Health Protection Agency's figures, namely the HPAflu score data. Similar results were found by Achrekar *et al.* (2011). Health Protection Agency reports are used to provide a reliable way to judge how well the flu is being tracked using Twitter. Other studies use data released by similar agencies to determine the successfulness of their methods.

Secondly, other studies do not pick a single health topic to track but instead casts the net wider. A study by Paul and Dredze (2011) which is motivated by the potential value of aggregation of tweets from millions of users, the value of which has been shown through previous studies. Paul and Dredze (2011) use

Twitter to track not just one specific disease, but poses a more general question of “what public health information can be learned from Twitter?” (p.265). Paul and Dredze (2011) find that Twitter can be used for public health research. They note a number of limitations of using Twitter. The use of aggregated data means that metrics cannot be provided at an individual level as there is often insufficient data (Paul and Dredze, 2011). Related to this, the volume of tweets limits the level of analysis i.e. country, state, city. Finally, it must also be noted that demographics of Twitter users is also viewed as a limitation.

There are a number of advantages of using Twitter to provide information about the spread of disease. As identified by Lampos and Cristianini (2010) an important advantage of Twitter is its ability to provide insights into what is happening within a few hours. Alternative sources such as releases from the Health Protection Agency can take several weeks, therefore an important benefit of Twitter is the timeliness of the information. Secondly it costs nothing to collect the data.

### **3.4.5 Tracking Public Concern**

An area of research closely tied to SARF and related to the research detailed above is tracking and monitoring levels of concern during disease outbreaks using Twitter data. As highlighted above many studies are using Twitter data to track and predict the spread of diseases. Some studies are also using Twitter data to monitor levels of concern relating to a disease. A popular technique which is being used to analyse Twitter data is sentiment analysis and in this section it is shown how the technique is being applied to Twitter data, both in relation to disease outbreaks and other situations. Sentiment analysis also known as opinion mining “refers to the application of natural language processing, computational linguistics, and text analytics to identify and classify subjective opinions in source materials (e.g., a document to a sentence...sentiment analysis

aims to determine the attitude of a writer with respect to some topic or the overall contextual polarity of a document)” (Luo *et al.*, 2013, p.53). Due to the high number of users and the information they post on Twitter daily, means that Twitter is an excellent source for opinion mining and sentiment analysis (Pak and Paroubek, 2010). Using information available online, such as Twitter posts allows researchers to gain insights into public opinion on a range of topics and this can be done in an unobtrusive manner (Thelwall, Buckley and Paltoglou, 2011). Like the research detailed above, the studies in this area rely mainly on keyword searches to filter Twitter data.

According to Chew and Eysenbach (2010) surveys are both a favourable way as well as the traditional way for public health officials to determine, understand and measure public perception during a crisis event, but they have their disadvantages, namely the cost and time involved. Chew and Eysenbach (2010) identify this issue and investigate an alternative ‘infoveillance approach’ using Twitter data collected during the H1N1 Pandemic 2009 due to the potential wealth of information on this pandemic. During this pandemic the most commonly used source for information was the internet (Chew and Eysenbach, 2010) providing an indication of the changing information arena. The authors note that the traditional method of data collection, a survey, has a long turn around time and therefore may lack use to public health officials. Twitter, however, offers immediate information of the public’s perception and this could be highly valuable to health officials if they can harness Twitter.

Chew and Eysenbach (2010) state: “With the rise of the participatory web and social media (“Web 2.0”) and resulting proliferation of user-generated content, the public potentially plays a larger role in all stages of knowledge translation, including information generation, filtering, and amplification. Consequently, for public health professionals, it is increasingly important to establish a feedback loop and monitor online public response and perceptions during emergency situa-

tions in order to examine the effectiveness of knowledge translation strategies and tailor future communications and educational campaigns” (p.1). Ji, Chun and Geller (2013) also highlight that “monitoring public panic about health issues is so critical not only to public health specialists but also government decision makers” (p.335), this is due to the behaviour and wider effects that public concern can have in society. Although the authors do not explicitly make the links, the wider effects discussed in the paper as motivation have similarities to those discussed in SARF.

To track public interest and concern in the Twitter data Signorini, Segre and Polgreen (2011) look at the percentage of tweets relating to certain issues, include vaccination, travel and preventative hygiene. Although they do not find any sustained interest in these issues instead spikes are identified. Chew and Eysenbach (2010) use two search terms: ‘swine flu’ and ‘H1N1’ to collect Twitter data (tweets) the research finds that 52.6% of H1N1 related tweets contain news and information. They find the content of tweets changed over time, with humour cited as a common aspect of tweets in the early stages, decreasing over time as the event unfolded. Changes in tweeting are found to be influenced by external events, one example case is the announcement of the pandemic status of level 6 by the World Health Organisation, suggesting that “perceived severity and intense news coverage news coverage are likely factors that dictate tweet posting activity” (p.10).

Signorini, Segre and Polgreen (2011) find that Twitter can be used as a “measure of public interest or concern about health-related events” (p.1). As Twitter can be used on hand held devices such as mobile phones, the information is available on Twitter faster than by other other social media (Signorini, Segre and Polgreen, 2011).

Chew and Eysenbach (2010) examine the tweets collected to identify the prominence of misinformation and find that only 4.5% were coded as ‘possi-

ble misinformation or speculation’. According to Chew and Eysenbach (2010) tracking “tweeted misinformation and questions is potentially useful for public health agencies to address information needs of the public and direct online and offline health education initiatives and campaigns” (p.11). “These tweets can be used for near real-time content and sentiment analysis and knowledge translation research, allowing health authorities to become aware of and respond to real or perceived concerns raised by the public” (Chew and Eysenbach, 2010, p.12). In previous emergencies media monitoring has been used by the Centers for Disease Control to inform risk communication strategies (Chew and Eysenbach, 2010). Ji, Chun and Geller (2013) postulate that “[t]he early discovery of public health concerns can help governments to make timely decisions to refute rumors, and thus prevent potential social crises” (pp.335-336).

It must be recognised that “[p]ublic health agencies do not act in a void, but rather are part of a larger feedback loop that includes both the media and the public” (Chew and Eysenbach, 2010, p.1).

### **3.4.6 Other Studies**

Thelwall, Buckley and Paltoglou (2011) investigate whether popular events on Twitter are associated with increases in sentiment. The findings of the research indicate that popular events are typically associated with negative sentiment. “Sentiment analysis is useful for research into online communication because it gives researchers the ability to automatically measure emotion in online texts” (Thelwall, Buckley and Paltoglou, 2011, p.408). Thelwall, Buckley and Paltoglou (2011) identify that prior to their study no research had been conducted into the role of sentiment in important online events. Their research finds “important events in Twitter are associated with increases in average negative sentiment strength...it seems that negative sentiment is often the key to popular events in Twitter” (Thelwall, Buckley and Paltoglou, 2011, p.415). The authors note that

their study was conducted over a period of one month, examining 30 events and more research is required.

Finally, an interesting study by Bollen, Mao and Zeng (2011) investigates whether the collective mood of Twitter messages is correlated with the value of the Dow Jones Industrial Average. The research is motivated by behavioural economics and psychology research that has shown emotions play an important role in behaviour and decision making. The authors use a collection of tweets gathered between a given time period, with approximately 2.7 million users. The corpus of tweets was reviewed so that only tweets that contained explicit statements about the authors mood remained. Seven different moods were identified and the tweets a timeseries plot of each mood is created. The results of the research show that the mood “calm” as detected in the tweets is a predictor of the movement of the DJIA values. The research has an accuracy of 86.7% in predicting the daily increase or decrease of the daily closing values. This study highlights the diversity of the application of Twitter data. A number of important points are raised by Bollen, Mao and Zeng (2011) when they note the difficulties of other methods to collect data to understand the public mood. The authors note the issues of achieving a representative sample, the time consuming nature of surveys and the costs associated. Twitter is chosen as it produces a large volume of information which is free. Although users’ posts are short, just 140 characters, aggregating millions of tweets could be used to indicate the public mood.

### **3.5 Limitations of Studies**

There are a number of limitations to the research presented above and these must be considered. Firstly, the majority of the research is carried out in the United States with a lack of research in other countries. Secondly, the majority of studies focus on the way in which the public use Twitter. Although the number

of studies in the area is relatively small, more consideration is required to the official organisations and their use of the Twitter accounts. Third, the research generally focuses on the use of police and fire department accounts with a lack of focus on the use of Twitter by health organisations. Studies are often limited to just one organisation and typically within one country. Signorini, Segre and Polgreen (2011) highlight that Twitter users are not representative of the general population and as such the population who are tweeting about health related incidents is unknown. It is also worth noting that Twitter usage is not consistent across every day, but instead the busiest day on Twitter is a Monday and these trends need to be considered in more quantitative analyses. Finally, the use of Twitter is dependant on location.

### **3.6 Discussion and Summary**

This chapter summarises literature relating to the role of social media, mainly Twitter, as a means of communication during various risk events. To summarise all research relating to the use of Twitter is in the earlier stages of development. However, research of the use of Twitter by the public is more popular than the investigation of the role of Twitter by official organisations.

It is clear that the news arena is undergoing change and this a a direct result of the Web 2.0 media such as Twitter, Facebook and YouTube as well as technology. An aspect which is clear from the literature is the immediacy of Twitter and the way in which the platform positions itself as the place for the latest information. Indeed the “changing nature of risk and crisis communication in light of the proliferation of Internet-based social media technologies that far outpace the constraints of traditional media” (Latonero and Shklovski, 2011, p.14). With the popularity of these new media there is an expectation for official organisation to also be using these.

The role of Twitter is not only pushing out information and pulling in information, but for official organisations it provides an opportunity to build trust and credibility with the public. For these organisations it allows direct communication with the public. It is recognised that traditional means of communication use the media as an intermediate station. This intermediate station has the ability to change the message and this can be an issue. Research shows that messages which are retweeted tend to be from credible sources such as these organisations. It is recognised in the literature that the internet is becoming increasingly popular as a source of information for the public.

Twitter is a valuable source of information as it provides information from the ground quicker than ever before as members of the public post text and images on the site from mobile devices. There is an issue over validation of this information as official organisations are unable to check who the user is. One way to overcome this issue is to monitor the number of tweets about an issue and if there is a substantial number of tweets and users tweeting about the same issue it will carry more weight. It also allows the identification of rumours and misinformation and organisations can correct this information. There are concerns over the way in which information can propagate through the Twittersphere. However, research shows that other users will begin to correct misinformation. A number of research studies also tracks and monitors the degree of concern using Twitter data.

Difficulties exist in the organisations and their ability to fully integrate such platforms into their communications strategy and this relates to a number of aspects from training to organisational culture. The above research highlights that in many cases the use of Twitter in organisations is driven by a key individual and it lacks support from the organisation.

Although the majority of the literature detailed above does not directly link to SARF there are clearly a number of aspects common to both. These will be discussed in more detail in Chapter 4 which brings together aspects of Chapter

2 and Chapter 3 to develop the conceptual framework and research questions of the study.

# Chapter 4

## Conceptual Framework

### 4.1 Introduction

The purpose of this chapter is to present the development of the conceptual framework which explains the main aspects to be studied. To begin, a summary of the two literature chapters is provided. The chapter then provides an argument for bringing together SARF, Twitter and system dynamics. The definition of risk and risk event for this study is provided before introducing the conceptual framework which is based on SARF, but simplified to reflect the focus of the research. Finally, the chapter concludes by presenting a number of research questions which guide the research.

### 4.2 Summary of Literature

The main focus of Chapter 2 is the introduction and investigation of research surrounding three key approaches in risk research. The chapter argues that although the psychometric paradigm and Cultural Theory offer interesting insights neither alone are considered comprehensive. However, both bodies of work and their importance is recognised and incorporated within SARF. By drawing upon aspects of the psychometric paradigm as well as Cultural Theory, SARF is con-

sidered as one of the most influential frameworks developed. The framework aims to link the “technical assessment of risk with psychological and cultural perspectives on risk-related behaviour” (Burns *et al.*, 1993, p.612) and is able to account for findings from a range of studies (Kasperson *et al.*, 2003). Furthermore, SARF explicitly encompasses a dynamic element within the framework. The dynamic element is viewed as highly important as it allows the study over the course of a risk event which is necessary for this research. It is therefore argued that SARF provides the most appropriate basis for this interdisciplinary study and provides the theoretical lens for the research.

The research field relating to SARF is a well established one. The framework itself is developed in five key publications (Kasperson *et al.*, 1988; Renn, 1991; Kasperson, 1992; Burns *et al.* 1993; Kasperson and Kasperson, 1996). To date a vast body of empirical research exists.

The core aspect of SARF is that as risk signals travel between transmitters and receivers amplification and attenuation effects can occur. Indeed, some degrees of amplification can cause wide indirect effects in society which come unexpectedly to experts. The framework clearly identifies feedback and iteration between the sub-processes ‘sources of information’; ‘information channels’; ‘social stations’; ‘individual stations’ and ‘institutional, group, and individual level behaviour’. This dynamic behaviour is an aspect of SARF which is not recognised in Cultural Theory or the psychometric paradigm. Risk perception and risk communication is clearly a dynamic aspect and the way in which signals travel through transmitters and receivers and iteration and feedback will influence the ripple effects and the risk perceptions.

As shown in SARF the way in which communication occurs is a complex system. One approach capable of modelling complex systems is system dynamics. To date research modelling SARF through system dynamics approaches are limited. However, the link and evidence for the suitability of the application of system

dynamics approaches to SARF is clear. Of the few research studies the system dynamics technique used is stock and flow diagrams (see Burns, 2009; Burns and Slovic, 2007; Busby and Onggo, 2013). It is strongly argued that the concept of amplification can be seen in system dynamics when feedback in a system occurs. Feedback occurs when a change in an element indirectly causes a change in itself through one or more elements. A reinforcing feedback loop, where the original behaviour is reinforced (Sterman, 2000) can be likened to amplification.

A substantial aspect of existing research relating to SARF focuses on the role of the media as station of amplification. However, it is clear that social media is changing the way in which information is communicated. Part of the power of Twitter and other social media is “that they are designed to provoke and call forth regular updates from their users” (Murthy, 2012, p.1061) meaning that Twitter provides a continually updating, open news source. Twitter and other social media are not adequately addressed in previous SARF research which may be partly due to their newness. Despite this, these are clearly shown to be an important aspect in risk communication as noted by George (2012) and should be considered within organisations communication strategies.

With the information channel of interest identified as Twitter, Chapter 3 presents the emerging body of research focussing on Twitter during crisis, emergency and disaster events, known as crisis informatics which “examines the technical, social and information aspects of disasters and crisis” (Palen, 2008, p.76). Chapter 3 clearly demonstrates the increasingly important role of Twitter during emergency and crisis situations. It provides a way for organisations to communicate directly with citizens, bypassing the media. However, the media is still recognised in much of the research as a key component in communication for official organisations with the use of Twitter as a means to strengthen communications. The majority of research focuses on the use of Twitter by the public, but another important aspect of research is the way it is being used by official

organisations. To date, the limited studies focus on fire and police.

What is evident from the body of research is a link with SARF. However, only one paper by Chew and Eysenbach (2010) touches upon the link of SARF and Twitter. The remainder of the research does not draw upon the framework. Despite this, aspects such as rumours and misinformation, trust, information filtering, credibility, expectation and the changing dynamics in information provision and receiving have a striking resemblance to aspects outlined in SARF. It is evident that the hierarchy of communication is changing and no longer do the public wait on information from sources. They are now becoming the source of information and through Twitter, allows them to reach, potentially, a global audience and it facilitates information sharing. During a risk event mediums such as Twitter are of key importance to official organisations as they provide a dual role as it can be used as a way to release information directly to the public but also a way to gain information from the public. From the literature it suggests that some of the mechanisms outlined in SARF for the amplification and attenuation of risk signals also exist in Twitter and this provides an interesting aspect of study.

To summarise, SARF is one of the only frameworks which brings together risk perception and risk communication bodies of research and this combination is essential for understanding the way in which risk signals are amplified and attenuated. This is why the framework is viewed as more comprehensive than Cultural Theory and the psychometric paradigm. Previous research relating to SARF focuses on the role of the media, but as is evident in Chapter 3 social media, and in particular Twitter is providing new means of communication. This research seeks to extend research relating to SARF by considering the framework in light of the new medium Twitter. Finally, the research identifies that system dynamics approaches to be a suitable way of modelling SARF. Although SARF does not explicitly acknowledge that appreciation of the entire system is necessary,

there is an indication, implicitly, within the framework that the system needs to be considered in its entirety opposed to by parts. Therefore, the system dynamics technique causal loop diagrams is used to model the use of Twitter during health risk events by organisations.

#### **4.2.1 Definition of Risk Event**

Before introducing the conceptual framework the definition of a risk event must be established. This definition will carry through the remainder of the thesis. As highlighted in Chapter 2, the definition of risk is a highly contested one with disparate views between disciplines. Rosa (2003) outlines a definition of risk specifically for SARF and this is the one adopted in this study. The definition of risk is “a situation or an event where something of human value (including humans themselves) is at stake and where the outcome is uncertain” (Rosa, 2003, p.56).

The definition of a risk event is adopted from Kasperson *et al.* (1988) who define it as: “occurrences that are manifestations of the risk and that initiate signals pertaining to the risk. Risk events thus include routine or unexpected releases, accidents (large and small), discoveries of pollution incidents, reports of exposures, or adverse consequences. Usually such risk events are specific to particular times and locations” (p.178).

The type of risk and risk events are bounded in this study. As there is a focus on the use of Twitter by health organisations, the research narrows the above definitions within the remit of health. The type of risk event specifically relates to events for which the health organisations are responsible for, with a focus made upon acute events which impact on human health.

### 4.3 Conceptual Framework

The conceptual framework is based on SARF. This research focuses specifically on the perceptions of professionals in health organisations in Nova Scotia and Scotland regarding the use of Twitter during health related risk events and in order to reflect this the conceptual framework is a simplification of SARF. The conceptual framework (shown in Figure 4.1) begins with risk and risk events as is seen in SARF, but risk and risk events are health related. In the original framework by Kaspersen *et al.* (1988) the first stage of the model describes the process of communication. There are five sub-processes identified: ‘sources of information’; ‘information channels’; ‘social stations’; ‘individual stations’ and ‘institutional, group, and individual behavior’. Within each of these, more specific elements are identified. Feedback and iteration is shown between the sub-processes and between the detailed elements.

For the conceptual framework, within the first stage of the model the five sub-process are simplified to three: ‘information sources’; ‘information channel’ and ‘social and individual stations’. Within the communication process, information source is identified as important in the literature. Chapter 3 highlights that during crisis events there are three main sources of information. They are the public who are posting information from the ground, the media and official organisations. In this research the official organisations are limited to health organisations who would be taking the lead official role. Clearly, there are numerous ways in which to communicate, i.e. the information channel. Previous research focuses upon traditional forms such as newspapers. However, in this study the focus is on just one: Twitter. Thirdly, the conceptual framework combines social and individual stations to show the third sub-process. Within this, social and individual stations are identified as the health organisations, the media and the public. Feedback and iteration is shown between these sub-processes to reflect the dynamic nature of communication and the way in which it changes over the

course of an event. Organisational culture is shown acting upon Twitter. This reflects the organisational culture within organisations and its role on the use of Twitter as part of the communications strategy.

In the second stage of the conceptual framework ripple effects are shown highlighting the wider impacts that amplification effects can cause. Specifically, wider impacts relevant to this study include loss of confidence, community concern, litigation and increase/decrease in physical risk.

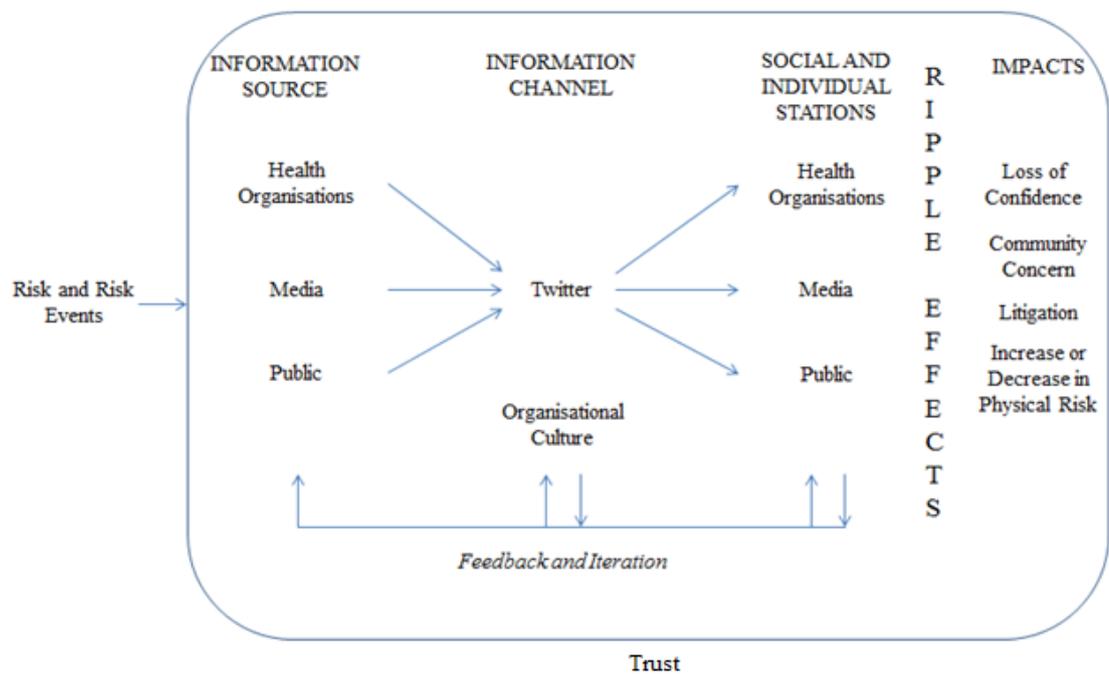


Figure 4.1: Conceptual framework showing the key variables and relationships to be studied.

Finally, trust emerges as a key theme in all of the approaches described in Chapter 2 and throughout the risk literature. Although current literature has little consensus on the role of trust, it is recognised as important in aspects of risk communication. Therefore, trust is shown in the conceptual framework encompassing the sub-processes as it is acknowledged that the process of risk communication and risk perception occurs within the context of trust.

## 4.4 Development of Research Questions

Drawing upon the literature reviews and the conceptual framework, the following research goal is proposed:

*Support the development of an effective communication strategy within public health through social media.*

Based on the conceptual framework detailed in Section 4.3 and shown in Figure 4.1 four research questions are established. The four questions are:

1. What is the current role of Twitter in health organisations in Nova Scotia and Scotland?
2. What is the role of Twitter in the amplification and attenuation of risk signals by health organisations?
3. What are the differences and similarities of Twitter use between organisations?
4. To what extent can causal loop diagrams adequately represent interdependency among factors during a risk event?

Firstly, it can be seen that there is a growing body of research focussing on the use of Twitter during crisis and disaster events. However, it is noted that majority of research presented in Chapter 3 typically focuses on organisations such as police and fire, or on use of Twitter by the public. In contrast to this, much research related to SARF focuses on health related events. Therefore, this research seeks to focus on the use of Twitter during health risk events by official organisations and to begin this exploration Question 1 is posed.

The literature presented in Chapter 3 suggests that Twitter has a role in amplification and attenuation of risk signals despite the lack of linkage with SARF. Although Twitter is a new channel Chew and Eysenbach (2010) note that with

the increased use of the internet, and specifically Web 2.0 where there is more user-generated content, the public may have an increasingly important role in all stages of “knowledge translation, including information generation, filtering and amplification” (p.1). Thus it is of interest for public health organisations to draw upon this source and it is critical to create a feedback loop through which public response and perceptions are monitored online during critical incidents (Chew and Eysenbach, 2010). This motivates Question 2.

Thirdly, much of the research presented in Chapter 3 addresses just one organisation or one area for investigation. In general the majority of research relating to crisis informatics to date is carried out in the United States of America, typically focussing on urban areas and cities. This research investigates two areas, Scotland and Nova Scotia, providing the ability to compare the two areas to identify similarities and differences between the two in the usage of Twitter by health organisations. Thus Question 3 is established.

Finally, as highlighted, an important aspect of this research is a methodological contribution where a system dynamics technique, causal loop diagrams, is used to model aspects of SARF. To date few studies have brought together system dynamics and SARF yet aspects of the type of modelling appear well suited to modelling elements of SARF and this leads to the formulation of Question 4.

## 4.5 Summary

To summarise, this chapter presents the development of the conceptual framework. Succinctly, the original model presented by Kasperson *et al.* (1988) is simplified to reflect the focus on the use of Twitter by health organisations during a health risk event. The model additionally highlights organisational culture explicitly and its impact upon the use of Twitter. A number of research questions are established from the conceptual framework. The research questions reflect the

purpose of the research which is to provide a theoretical contribution to SARF by extending research to include a new channel of communication, Twitter; a methodological contribution through the application of causal loop diagrams to SARF and a comparison between health organisations in two areas, Nova Scotia and Scotland, on their use of the new medium as a means of communication. Chapter 5, explains the methodology of the study, where an overview of the approach of the study is detailed.

# Chapter 5

## Methodology, Methods and Modelling

### 5.1 Introduction

This chapter introduces the methodology and the methods of the study. Initially the chapter addresses the philosophical position of the research which underpins the research. The philosophical position draws upon the work of Rosa (2003; 1998) who sets out a hierarchical epistemology and realist ontology for the study of post-normal risk and SARF. The second part of the chapter introduces the research design which uses a two case qualitative comparative case study approach. The methods of data collection and data analysis are detailed. Finally, the chapter is concluded by addressing ethical issues.

### 5.2 Research Philosophy

It is common that philosophical beliefs are not explicitly stated within research. However, philosophical beliefs of the researcher and beliefs held within a particular field of study will influence the research and this needs to be identified before designing the study (Creswell, 2009). Therefore, to begin this chapter, the

philosophical underpinnings of the research are addressed.

In order to define the philosophical position of the research, consideration is made to epistemological and ontological beliefs. Epistemology “is concerned with providing a philosophical grounding for deciding what kinds of knowledge are possible and how we can ensure that they are both adequate and legitimate” (Maynard, 1994, p.10 cited in Crotty, 1998, p.8). Ontology “is the study of being. It is concerned with ‘what is’, with the nature of existence, with the structure of reality as such” (Crotty, 1998, p.10).

Three common epistemological positions are objectivism, constructivism and subjectivism. According to Crotty (1998) “[o]bjectivist epistemology holds that meaning, and therefore meaningful reality, exists as such apart from the operation of any consciousness” (p.8). Thus, the researcher is independent from the aspect of study. A constructivist epistemology, alternatively, “rejects this view of human knowledge. There is no objective truth waiting for us to discover it. Truth, or meaning, comes into existence in and out of our engagement with realities in our world. There is no meaning without a mind. Meaning is not discovered, but constructed” (Crotty, 1998, pp.8-9). The third position is subjectivism, here “meaning does not come out of an interplay between subject and object but is imposed on the object by the subject. Here the object as such makes no contribution to the generation of meaning” (Crotty, 1998, p.9). It is clear from the description of the three common positions that there are substantial differences between epistemological beliefs.

This study has a basis in SARF, therefore it is appropriate to explore the philosophical position of this framework. According to Pidgeon and Henwood (2010) “[a]n advantage of SARF is that it is clear in foregrounding an essential epistemological and ontological tension, often implicit within many risk studies, that, while hazards are real enough, our knowledge of them can only ever be socially constructed (Rosa, 2003; Pidgeon *et al.*, 2008)” (p.55). However, as noted

in Chapter 2, one criticism of SARF relates to the metaphor of amplification. Rosa (2003) notes that the metaphor “opens the framework to the following challenging question: what, in fact, is being amplified: something real, or only claims about something real? The difficulty may also account for the recent practice of shifting the focus of the meaning of risk from an a priori specification to a consequentialist explanation” (p.50).

Rosa (2003; 1998) thoroughly considers the metatheoretical foundations of risk and SARF in detail. Rosa proposes a hierarchical epistemology and realist ontology for the study of risk and argues that this basis is applicable also for SARF. The following defines hierarchical epistemology and realist ontology and provides a summary of the argument.

To begin, Rosa (2003) sets out the case for a realist ontology. A realist ontology asserts the position that a world exists independent of humans (Mingers, 2000). Rosa (2003) argues through pan-cultural knowledge such as the knowledge that a lunar year is 365 days as evidence that “supports the notion that certain features of the world transcend cultural and phenomenological contexts” (p.52). Despite this, Rosa (2003) argues that this is not empirical proof of realism. In order to argue for realism Rosa (2003) considers the alternative, of an entirely constructed reality. However, Rosa rejects the possibility of this, noting that “even if our senses are always unreliable, they are being activated by some external source” (p.54). Therefore, the argument is that there is an external source, independent, which provides the ‘raw material’ from which these constructions are formed. Essentially the “ontological subjectivity of the socially constructed reality requires an ontologically objective reality out of which it is constructed...a socially constructed reality presupposes a nonsocially constructed reality” (Searle, 1995, p.191 cited in Rosa, 2003, p.54). While this justification for ontological realism, as discussed above, is general, Rosa also argues that this case for ontological realism can also be applied to risk.

To consider the case of ontological realism for risk, Rosa (2003) first addresses the issues surrounding the definition of risk. As noted in Chapter 2, there is little agreement of the meaning of risk (Rosa, 2003). However, the most common definition of risk is a positivist one; risk “is the probability of an adverse event (e.g. injury, disease, death) times the consequences of that event (e.g. the number of injuries or deaths, types and severity of diseases)” (Rosa, 2003, p.55). The constructivist paradigm alternatively “eschews defining risk” (Rosa, 2003, p.55). Furthermore, within this paradigm the “harshest criticism has come from a strong form of subjectivism within the constructivist paradigm that is entirely opposed to the notion of objective risk. This strong form, a relativistic view of social constructivism derived from phenomenological philosophy, views risk as nothing more than subjective perceptions shaped by the filters of culture and social structure (Wynne 1992a)” (Rosa, 2003, p.55).

Rosa (2003) argues a number of elements which must be present in the definition of risk, namely 1) the risk must pertain to something of human value, 2) the outcome must be possible, and 3) there must be a notion of uncertainty. Therefore the proposed definition is: “Risk is a situation or an event where something of human value (including humans themselves) is at stake and where the outcome is uncertain” (p.56). The definition of risk, as proposed by Kasperson (1992) is: “Risk, in our view, is in part *an objective threat of harm* to people and in part *a product of culture and social experience*. Hence, hazardous events are ‘real’” (p.154). Rosa (2003) argues that their new definition of risk provides greater depth than that proposed in SARF and according to Rosa, their definition “independent of context, provides a defensible rationale for adopting a position of realism as the core” (Rosa, 2003, p.62).

Now to consider the epistemological basis. Rosa (2003) notes that “[h]uman perceptual and cognitive capabilities are inherently limited. As a consequence, we can neither generate perfect knowledge about the world, nor can we create a

“true” understanding of our physical and social environments...The world “out there” and our understanding of it can never be isomorphic: human understanding can only approximate the world we seek to explain. Thus, our claims to knowledge about our worlds are always subjective, and always fallible” (p.62). This argument appears plausible, indeed that while there is a real world ‘out there’, our ability to gain knowledge about this world is limited by the tools we have access to to measure that. Therefore, it is considered appropriate to argue that we can only ever make an approximation. Additionally, it is recognised that the weaker the tools are for measuring aspects of the world, the more subjective it appears. Rosa (2003) proposes a hierarchical epistemology. Epistemological “hierarchicalism does not deny the fallibility of all knowledge claims. What it denies is that all knowledge claims are equally fallible...hierarchicalism comprises variations in the quality of knowledge claims along a continuum ranging from those of considerable agreement to those of great disagreement. Knowledge claims, while always short of absolute truth, admit to degrees of approximation to what is true” (Rosa, 2003, p.63). Thus, the epistemology, as defined here, appreciates variations between knowledge claims in that there is the ability to rank knowledge claims, meaning it can be argued that some are stronger than others.

Therefore the hierarchical epistemology, realist ontology “admits to differences in the types, the quality, and the aptness of knowledge” (Rosa, 2003, p.63). With respect to SARF an ontological position of realism fits well. SARF recognises there is ‘an objective threat of harm’, but does not necessarily mean that objective knowledge is attainable. Instead, it is argued that objective knowledge of that reality “is generally unreachable because of the inherent limitations in our capacity for understanding and because of the huge volume of “noise” from the social world” (Rosa, 2003, p.63). The hierarchical epistemology, where it is argued that knowledge claims “occupy a broad continuum of acceptability; a hierarchy of credibility” (Rosa, 2003, p.64), although it fits with SARF, the framework does

not indicate agreement or disagreement on the credibility of knowledge claims (Rosa, 2003). Therefore, the argument made by Rosa (2003) appears appropriate for the basis of the study and provides a strong philosophical position for the research.

### **5.3 Research Design**

This section summarises the research design of the study, the aim is to provide an understanding of the different aspects of the research and how they combine together. The following section provides in-depth details of the methods of data collection and data analysis discussed here. A summary of the research design is shown in Figure 5.1.

As evident in Figure 5.1, the initial stage of the research was composed of the literature reviews and the pilot study. These were carried out concurrently. The research began with a detailed investigation into previous literature. It was recognised from review of previous studies that there was a lack of studies specifically focussing on the use of Twitter by health organisations. Therefore, initially, a pilot study was conducted to identify whether health organisations were using Twitter during a health risk event. The pilot study collected Twitter data during an outbreak of Legionnaires' disease in Edinburgh, Scotland in 2012. The purpose of collecting the Twitter data was to investigate whether Twitter was being used by health organisations during the health risk event. The Twitter data was analysed based on elements emerging from SARF highlighting tweets which amplified or attenuated the outbreak of Legionnaires' disease. Additionally, a basic quantitative analysis of frequency of retweeting was carried out.

The second stage of the research employed a two case comparative case study approach. Two cases were selected for comparison based on the similarity of the two areas, meaning they were appropriate for comparison. The two cases were

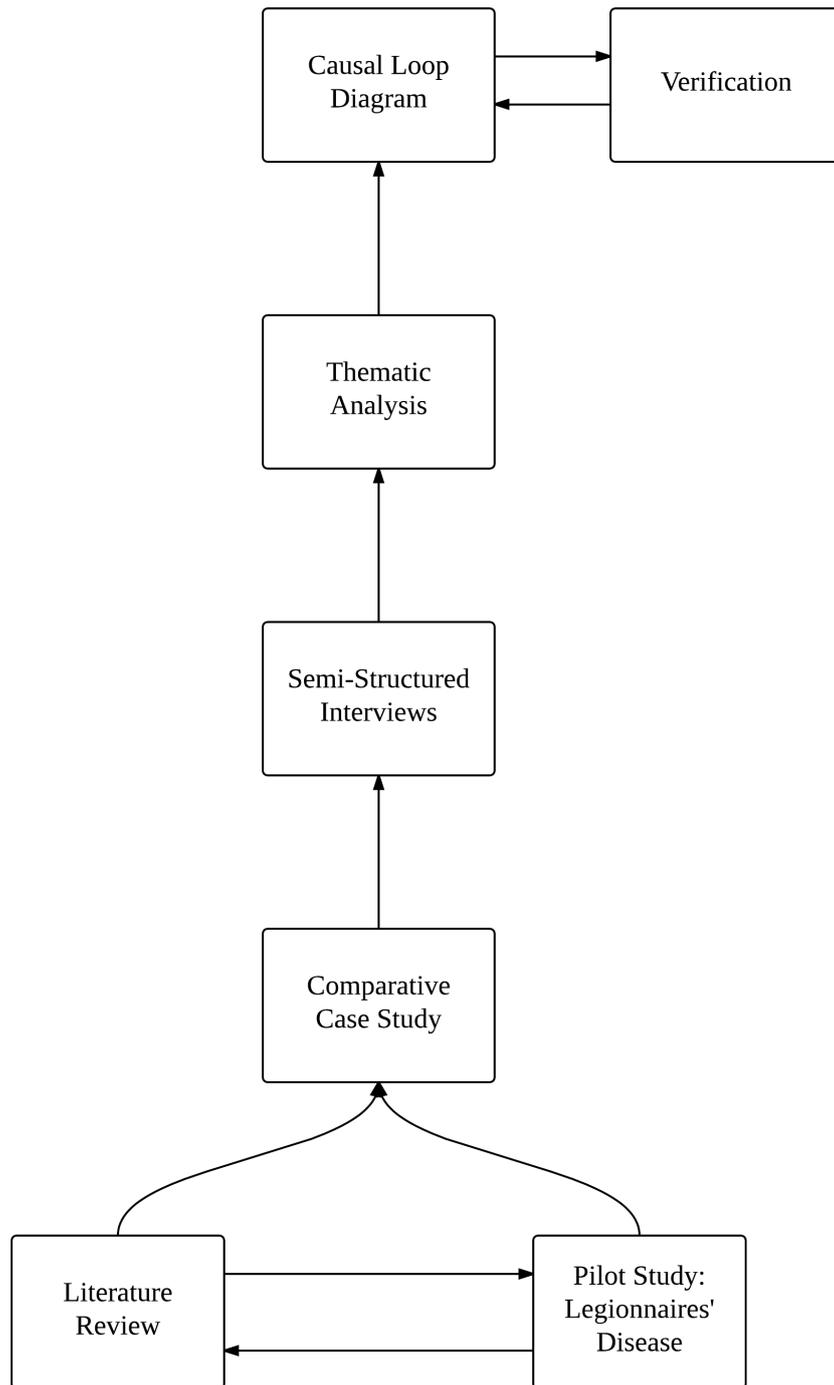


Figure 5.1: Research design.

Nova Scotia and Scotland. Justification of the choice is provided in Chapter 6. In both areas semi-structured interviews were conducted. The analysis of the Twitter data had a secondary role; by collecting and conducting an analysis on a small sample of Twitter data it provided the researcher with a better understanding of the use of Twitter. Hence, the findings of the analysis, along with the literature in the field, informed the development of interview questions. Semi-structured interviews were conducted with participants in health organisations in Nova Scotia and Scotland to gain an in-depth understanding of the use of Twitter by the organisations during health risk events. The interview data was analysed using a thematic analysis to identify issues emerging from the data.

The final aspect of the research was the development of a causal loop diagram to model the interdependencies among factors during a health risk event. The model was developed using interview data from both areas to create a general causal loop diagram. Verification of the model was achieved through presentation of the model to a number of participants in both areas.

A more detailed explanation of the individual methods, methods of analysis and type of modelling is provided in the following sections.

## **5.4 Research Methods**

As the philosophical approach and the research design are established the next aspect of this chapter focuses on the research methods. Creswell (2009) states that research methods “involve the forms of data collection, analysis, and interpretation that researchers propose for their studies” (p.15). The following five sections provide detailed explanation and justification of the suitability of the chosen research methods. Section 5.5 introduces the collection of Twitter data for specific Twitter users. Section 5.6 details the analysis of the Twitter data. Section 5.7 details the two case comparative case study approach which was adopted. Section

5.8 introduces the use of semi-structured interviews, outlining the justification and appropriateness of this method of data collection. Section 5.9 outlines the analysis of the interview data which is a thematic analysis. Section 5.10 introduces the type of modelling which was used to model the structure of the system and justification of the use of modelling.

## 5.5 Twitter Data Collection

Twitter data was collected relating to the outbreak of Legionnaires' disease in Edinburgh, Scotland. The first case of Legionnaires' disease was identified May 31, 2012 and the outbreak was officially declared on June 3, 2012. The outbreak was declared over July 17, 2012. Therefore, data was collected during this time period. Data was collected from the Twitter accounts of three health organisations who were involved in managing the disease outbreak. The three organisations were NHS Lothian (@NHS\_Lothian), Scottish Government Department of Health (@scotgovhealth) and NHS 24 (@NHS24). NHS Lothian is a regional NHS Health Board which is responsible for providing healthcare to the public within its geographical boundaries. As the outbreak of the disease occurred in Edinburgh, within the geographical boundaries of NHS Lothian, this meant NHS Lothian was the regional health board responsible for managing the outbreak. NHS 24 is a special health board providing out-of-hours advice by telephone and online. NHS 24 set up a special helpline during the disease outbreak to deal with calls relating to the outbreak. Finally, the Scottish Government Department of Health which is the government arm of the health service was also selected. The process of data collection is detailed below.

### 5.5.1 Historical Collection of Specific Users

To collect the tweets of the three health organisations the software NVivo was used. A Windows add-on was available in this software called 'NCapture'. This web browser extension allowed the capture of web content, in this case it was used to collect Twitter data from specific users. To collect Twitter data through the add-on a Twitter account is required. Without being logged into Twitter, data cannot be collected. To capture the data of a particular Twitter user their page needs to be opened and this shows a timeline of all their tweets. The NCapture was able to capture up to the last 2000 tweets of the user. In addition to the tweets, details of the tweet were also, automatically, collected and this was done by choosing 'Source type' as 'Tweets as Dataset'. The data was stored and then opened in NVivo. NVivo allowed the export of Twitter data to an Excel file. The Excel sheet for each Twitter account (NHS Lothian, Scottish Government Health and NHS 24) showed all the Legionnaires' disease related tweets, the variables, in the Excel sheet, were: 'Row ID', 'Username', 'Tweet', 'Date', 'Time', 'Tweet Type', 'Retweeted By', 'Number of Retweets', 'Hashtags', 'Mentions', 'Name', 'Location', 'Web', 'Bio', 'Number of Followers' and 'Number Following'. A summary of the data collected is shown in Table 5.1.

Collection of the Twitter data was repeated for the three organisations, producing three Excel sheets. As NCapture automatically captured up to 2000 tweets a number of tweets were automatically discarded as they fell out with the outbreak period. Therefore all tweets before and after the outbreak were removed. The next step identified tweets which were related to the outbreak with unrelated tweets also being removed. This resulted in the Excel sheets containing just the tweets which related to the event.

Organisation	Twitter Account	No. of Tweets	Approx No. of Followers
NHS Lothian	@NHS_Lothian	112	3607
Scottish Government Health	@scotgovhealth	90	2365
NHS 24	@NHS24	24	1685

Table 5.1: Twitter data from organisational Twitter accounts.

## 5.6 Twitter Data Analysis

The purpose of the pilot study was to investigate whether Twitter was being used by health organisations during a risk event. Analysis of data collected from the health organisations was guided by elements of SARF. With the knowledge that these organisations were responsible for the management of the event, their use of Twitter was considered with respect to their role in the event. Specifically, the Twitter data were analysed with respect to elements of SARF, with a specific focus upon amplification and attenuation of risk signals a basic analysis was conducted to investigate they way in which they used Twitter to manage amplification and attenuation of events.

To begin, a basic analysis of the data was carried out addressing the volume and distribution of their Twitter activity over the course of the event. Second, leading on from this, a basic investigation was made to identify the most retweeted tweets of the three organisations. This was done to identify the tweets which were shared with followers' followers, thus identifying the types of tweets which had the greatest reach. Third, a general analysis was done to identify different types of tweets specifically looking for the way in which the tweet may contribute to the amplification and attenuation of the risk event, therefore investigating focused upon whether the tweet was providing reassurance, information, answering questions, retweeting other organisations, correcting misinformation etc. Finally, a comparison was made of the three accounts to identify similarities and differences in the use of Twitter between the three.

## 5.7 Comparative Case Study

This research used a qualitative two case comparative case study research method. Case studies, as defined by Creswell (2009), “are a strategy of inquiry in which the researcher explores in depth a program, event, activity, process, or one of more individuals. Cases are bound by time and activity, and researchers collect detailed information using a variety of data collection procedures over a sustained period of time (Stake, 1995)” (p.13). The use of case studies has been used in both research related to SARF (see Bakir, 2005; Busby, Alcock and MacGillivray, 2009; Poumadere and Mays, 2003; Renn, 2003; Kasperson and Kasperson, 1996) and also social media research (see Latonero and Shklovski, 2011).

According to Yin (1981) the case study represents a research strategy and, as a research strategy, the distinguishing characteristic of the case study “is that it attempts to examine (a) a contemporary phenomenon in its real-life context, especially when (b) the boundaries between phenomenon and context are not clearly evident” (p.59). Yin (2009) explains in more detail that the case study method therefore “would be used because you wanted to understand a real-life phenomenon in depth, but such understanding encompassed contextual conditions - because they were highly pertinent to your phenomenon of study” (p.18).

There are a number of variations within the method of case studies. Case study research includes both single cases and multiple cases (Bryman and Bell, 2007). Evidence used within a case study, although predominantly associated with qualitative approaches, can be qualitative, quantitative or a mix of qualitative and quantitative (Stake, 2005). It is identified that the case study is positioned as the main method of data collection and then within this there are different sub-methods (Gillham, 2000). Therefore, there is no specific type of evidence for case study research, with the focus being more upon the case in question (Stake, 2005). Due to the exploratory nature of the study, this research employs as a sub-method, a qualitative method, within the two case comparative

case study, namely semi-structured interviews.

In the design of case study research, the decision to use a single or multiple case study is a key point as there are benefits and limitations of both choices. Yin (2009) argues that there are five types of case through which the selection of a single case is ‘eminently justifiable’, these are “where the case represents (a) a critical test of existing theory, (b) a rare or unique circumstance, or (c) a representative or typical case, or where the case serves a (d) revelatory, or (e) longitudinal purpose” (p.52). Yin (2009) notes that multiple case studies designs are generally considered more robust whereas single case study research is typically criticised for the lack of generalisability of the results. However, there are clear issues of multiple case studies research and this includes the demand on resources and time (Yin, 2009).

This research used a multiple case study approach, also referred to as a comparative case study, where two cases were selected. For the selection of cases in the multiple case study approach it is noted that “[e]ach case must be carefully selected so that it either (a) predicts similar results (*a literal replication*) or (b) predicts contrasting results but for anticipatable reasons (*a theoretical replication*)” (Yin, 2009, p.54). The two cases, Nova Scotia and Scotland, were selected for a number of reasons, first, as identified in Chapter 3, there is a limited body of research focussing on the use of Twitter outside the United States of America. Additionally, research typically focuses on one organisation, or one area. Therefore, this study identified two cases, out with the United States of America to provide the focus for the research. Nova Scotia, a province of Canada, and Scotland, one of four countries which make up the United Kingdom, are similar in a number of ways including governmental and healthcare provision. Their similarity allowed the comparison of the two cases. Additionally, in each case the same method of data collection was used, namely semi-structured interviews. Participants, and their respective organisations, were selected on a like-for-like

basis. Further justification of the selection of the two cases is provided in Chapter 6 where more detailed information of the two areas is presented.

Silverman (2010) highlights that each case has boundaries and that these boundaries should be identified and acknowledged. In this study the two cases were bounded by a number of aspects. Firstly, the research was interested in the role of Twitter in public health organisations in Nova Scotia and Scotland. This provided both a geographic bound on the study as well as focus with respect to the participants. Therefore, the public and media are not directly addressed in the research, but instead are addressed through the view of the health organisations. In terms of health organisations, the choice was made to investigate public health bodies responsible for the provision of healthcare to the populations of the two areas. A further bound on the cases was imposed through the focus of the use of Twitter during health risk events. The final bound of the research was time. The empirical data collection of this research was conducted between 2012 and 2014 and this bounded the case.

Yin (1981) identifies three types of case study: exploratory, descriptive and explanatory. The selection of case study type is related to the research question; it is stated that certain types of ‘what’ questions “is a justifiable rationale for conducting an exploratory study, the goal being to develop pertinent hypotheses and propositions for further inquiry” (Yin, 2009, p.9). Due to the nature of the research, which was a ‘what’ question, means that it was an exploratory case study design.

### **5.7.1 Issues of Case Study Research**

Despite the case study being recognised as a distinctive form of empirical inquiry, there are some criticisms of it. At this point it is worth exploring some of these aspects.

Yin (2009) identifies a number of common concerns regarding case study re-

search, these are 1) a lack of rigour, 2) issues around generalisability of case study findings, and 3) their time consuming nature. The first concern relates to the issue of rigour in how the case study is conducted. Yin (2009) notes that this perceived lack of rigour is attributable to the researcher not following a systematised procedure, or “has allowed equivocal evidence or biased views to influence the direction of the findings and conclusions” (p.14). However, it must be noted that bias can enter many types of research in many ways and the researcher must ensure that evidence is reported in such a way that is fair (Yin, 2009).

The second concern relates to generalisability, Yin (2009) notes a commonly asked question: “How can you generalize from a single case?” (p.15). Yin (2009) distinguishes between two types of generalisation, statistical generalisation and analytic generalisation, to highlight how case study research can be generalised. According to Yin (2009) the goal of case study research is not to achieve statistical generalisation, but instead to achieve analytic generalisation, to expand and generalise theories.

The third concern “is that they take too long, and they result in massive, unreadable documents” (Yin, 2009, p.15), but it is noted that case study research does not need to be this way, despite how they may have been carried out in the past and this concern relates more to case studies where ethnographies are used.

### **5.7.2 Validity of Case Study Research**

Based on the criticisms as noted above, it is noted that Robert Yin is the best known “exponent of case study method in the social sciences” (Easterby-Smith, Thorpe and Jackson, 2012, p.54). In an attempt to respond to criticisms of the method, Yin has proposed a number of aspects to increase the validity of the method and these are discussed in this section.

Yin (2009) identifies four tests for judging the quality of case study research design. The four tests are:

- *Construct validity*: identifying correct operational measures for the concepts being studied
- *Internal validity* (for explanatory or causal studies only and not for exploratory studies): seeking to establish a causal relationship, whereby certain conditions are believed to lead to other conditions, as distinguished from spurious relationships
- *External validity*: defining the domain to which a study's findings can be generalized
- *Reliability*: demonstrating that the operations of a study - such as the data collection procedures - can be repeated, with the same results

(Yin, 2009, p.40).

As this study is exploratory, the tests of construct validity, external validity and reliability are considered in more detail. According to Yin (2009), the first test, construct validity, which focuses on the way in which the aspects of interests are operationalised and correctly measured, is difficult within case study research. However, Yin (2009) suggests three tactics for this test: 1) use multiple sources of evidence, 2) establish chain of evidence and 3) have key informants review a draft case study report (p.41). The second test of external validity, relates to the generalisability of the findings beyond the present case study. As noted earlier the specific type of generalisability which is relevant to case study research is analytic generalisability, where the researcher "is striving to generalize a particular set of results to some broader theory" (Yin, 2009, p.43). The theory is tested by replicating the findings on another case study. Within multiple case studies, the choice of cases is crucial in the generalisability of the findings. It is proposed that a

replication design is used in order to substantiate generalisability of findings. Yin (2009) suggests two tactics for this test: 1) use theory in single-case studies and 2) use replication logic in multiple-case studies (p.41). In this research replication logic is used as the same method is used in both cases: semi-structured interviews, conducted in a similar time period using the same interview questions in both areas with similar participants. The final test, reliability, is to ensure that if another researcher were to follow the same procedures that were described by the initial researcher and therefore conducted the same case study, that the later researcher would come to the same conclusions as the first (Yin, 2009). Yin (2009) suggests the following two tactics: 1) use case study protocol and 2) develop case study database (p.41) and by doing so producing guidelines for doing the same case study, with the same procedures and hence arriving at the same conclusions.

## **5.8 Semi-Structured Interviews**

Interviewing is a popular method within qualitative research. Bryman and Bell (2007) highlight that there are two main types of interviews: unstructured and semi-structured. In an unstructured interview, the interviewer may ask just one question and the interviewee is allowed to respond freely (Bryman and Bell, 2007). In a semi-structured interview the research has a predefined set of questions (Bryman and Bell, 2007). The semi-structured interview allows flexibility for the researcher to change the ordering of the questions and to ask questions not defined prior to the interview (Bryman and Bell, 2007). It is this flexibility which positions the semi-structured interview as a strong research method for many types of study (Gillham, 2000). However, despite the flexibility of the interview, generally all questions predefined will be asked and the wording of the questions will be similar from one interview to another (Bryman and Bell, 2007).

The decision of whether to choose an unstructured or semi-structured inter-

view is partly reliant on the stage of the researcher. Bryman and Bell (2007) note that if the researcher “is beginning the investigation with a fairly clear focus, rather than a very general notion of wanting to do research on a topic, it is likely that the interviews will be semi-structured ones” (p.479). In this research, through the literature review and the Twitter data analysis, a number of topics were identified for investigation, therefore a semi-structured interview was identified as the most appropriate type of interview.

### **5.8.1 Justification of Method**

There are a number of reasons as to why semi-structured interviews were chosen as a method of data collection. These are summarised here.

It is noted that semi-structured interviews are just one type of interview available and several different types of interview are available. At this point it is worth addressing two other types of interviews: unstructured and structured to highlight why they were not as suitable for the research. In an unstructured interview, as noted earlier, the researcher may have just one question to which the interviewee then responds to freely (Bryman and Bell, 2007). Considering this type of interview with respect to the comparative case study approach, Bryman and Bell (2007) note that in multiple case study research a degree of structure and order is required to ensure cross-case comparability. Comparing the ability of the unstructured interview with the semi-structured interview it is clear that the semi-structured interview is more able to provide cross-case comparability due the structured nature of the interview. Gillham (2000) argues that in case study research, the semi-structured interview is the most important type of interviewing and if done well it “can be the richest single source of data” (p.65). Furthermore, revisiting the tests outlined by Yin (2009), the test of reliability is more achievable using semi-structured interviews. The test of reliability detailed earlier states that if another researcher follows the same procedures on the same

case they would arrive at the same results. Yin (2009) notes that to do so it is necessary to make as many steps as “operational as possible” (p.45). Again, this is far more suited to semi-structured interviews as opposed to unstructured interviews. Thus, it is argued that the use of semi-structured interviews will better ensure the quality of case study research.

Alternatively, an entirely structured interview was also deemed less suitable as this research, despite having a defined focus, is exploratory in nature. Thus, an entirely structured interview would not allow for depth in answering as well as the ability to follow-up unanticipated avenues of enquiry. Furthermore, it was also recognised that due to the lack of previous research in this specific area, an entirely structured interview was difficult due to insufficient previous research from which to develop questions.

Another consideration was also made to the development of the causal loop diagram. Sterman (2000) indicates that the best method of data collection to build a causal loop diagram is semi-structured interviews. This will be discussed in more detail in Section 5.10 where causal loop diagrams are introduced in more detail.

At this point it is worth noting alternative sources of data which could potentially be used within the case studies. One clear source of evidence is policy documents related to the use of social media in the organisations. Investigation was made by the researcher into policies related to the use of social media. It was found that the organisations had either not developed social media policies or the policies were very basic in nature. The superficial nature of the documents meant they wielded very little insight into the use of social media by the organisations during risk events, meaning that the dominant form of empirical evidence in the research were the semi-structured interviews.

To summarise, as highlighted in the literature reviews there is limited research in this area, therefore it was decided to take an exploratory approach. While a

highly structured interview did not seem appropriate as it does not have flexibility, the semi-structured interview was viewed as the most suitable type of interview. The semi-structured interview provided a degree of structure in the questions which lends itself well to both case study research design and that of data collection for the development of causal loop diagrams, but also enough flexibility to suit this research. The research does have a comparative element within the design between Nova Scotia and Scotland and the use of semi-structured questions allowed the comparison of organisations, based on responses to questions. Finally, investigation was made into policy documents in the organisation to support the semi-structured interviews and provide an additional source of evidence, however the social media policies available were basic in nature and provided very little insight into the role of social media in the organisation. This positioned semi-structured interviews as the key source of empirical evidence.

### **5.8.2 Selection of Participants and Organisations**

Participants were identified in different ways in Nova Scotia and Scotland. In Nova Scotia, through previous research projects, the researcher had one formal contact in the organisation. An initial meeting was set up with the participant and at the meeting the research was explained, as well as the type of participants suitable for the research. The participant, due to their position in the organisation, was able to identify key participants across the province. As a means of introducing the researcher to these individuals, the contact sent an email to those relevant with details of the study. The researcher then followed up this email by contacting each of these people individually. Some further recommendations were made by participants during the interviews and, again, these were followed up through email.

In Scotland basic research was conducted on the organisations as the researcher had no formal contacts in any organisation. From the preliminary re-

search a number of relevant organisations were identified. It was noted that a number of organisations had recently used Twitter during a health risk event and were selected on that basis. Additionally, a paper available online indicated that one health board was in the process of developing their social media strategy. Contact to relevant participants were made by email and in some cases the person contacted was the most suitable person and in other cases the person contacted would direct to a more suitable person. Lastly, in two cases participants also recommended other people to get in contact with, and these were followed up with through email.

The roles of participants in the organisations included the following: Director of Communications, Communication Officers, Head of PR and Engagement, Public Involvement Officer, Emergency Planning Officer, Chief Medical Officer, Deputy Chief Medical Officer, Medical Officer and Director of Health Services Emergency Management. The diversity of the roles allowed for the collection of a wide range of views.

Participants in both Nova Scotia and Scotland were gained from District Health Authorities and Regional Health Boards, respectively, serving a predominantly urbanised location. Secondly, from District Health Authorities and Regional Health Boards serving a predominantly rural location. As health is the responsibility of the Nova Scotia Provincial Government and a devolved power of the Scottish Government, participants were gained from each of these. In total the research conducted interviews with 21 participants; 12 from Nova Scotia and nine from Scotland.

### **5.8.3 Development of Interview Questions from Twitter Pilot Study**

The pilot study conducted on the Legionnaires' Twitter data provided insights into the use of Twitter during a health risk event by three organisations involved in

the management of the disease outbreak. The results of this pilot study assisted in the development of some of the semi-structured interview questions. This section provides three examples of how the findings of the pilot study contributed to the development of interview questions, illustrating the role of the pilot study.

The pilot study revealed that the organisations were correcting information on Twitter. In one case, NHS Lothian corrects a BBC presenter on the number of people being treated in intensive care. This indicates that Twitter was being used by the organisations to monitor the discussions on Twitter related to the event. This led to the development of the question: Is there any type of monitoring of Twitter during risk events to understand what the public are tweeting about and if so is that taken into consideration?

Secondly there was evidence in the pilot study to indicate that some of the organisations were using Twitter to engage with the public and there were instances where the organisation had replied to a Twitter user. This indicates that Twitter can be used as a two-way means of communication. This aspect led to the inclusion of the interview question: Will Twitter and other social media be used to engage with the public?

Thirdly, the use of Twitter by the organisation was not immediate. Instead, the first use of Twitter by the organisations occurred several days into the outbreak. It leads to consideration of the degree of integration of the information channel within the wider communications strategies in the organisation. This lead to the development of the question: In terms of structure, how and where does social media fit within risk communication?

#### **5.8.4 Interviews**

The purpose of the interview was to investigate the use of Twitter within communications in selected health organisations, with a specific focus upon the use of Twitter during a health risk event. Questions were developed based on the liter-

ature reviews presented in Chapter 2 and Chapter 3. The analysis of the Twitter pilot study, of how health organisations used Twitter during the outbreak of Legionnaires' disease in Edinburgh, also informed the interview questions. The interview questions were grouped so that there were four main parts of the interview. These focused on 1) background to the organisation, 2) communications within the organisation, 3) wider use of social media within the organisation, and 4) Twitter during a risk event.

### **Interview Location and Timing**

Face-to-face, Skype and telephone interviews were conducted in Nova Scotia and Scotland. Due to the familiarity with Scotland and the transport network, interviews were conducted across Scotland in person. The majority of Nova Scotian interviews were conducted in person, however due to time constraints and transport issues, several Nova Scotian interviews were conducted by telephone and Skype. Face-to-face interviews were conducted within the organisations. Interviewees arranged locations in their organisation or a location convenient for themselves. Typically this was in a meeting/conference room, office, social area within the organisation. One interview was held in the room which was used when emergencies occur. On two occasions the interview was conducted in a local cafe out with the organisation. The interviews lasted between one hour and two hours. Most interviews were conducted one-to-one, however in two cases the interview had more than one participant.

### **Interview Protocol**

To ensure the interviews were conducted in the same manner, an interview protocol was developed prior to interviewing. A protocol can contain the following:

- “A heading (date, place, interviewer, interviewee)

- Instructions for the interviewer to follow so that standard procedures are used from one interview to another
- The questions (typically an ice-breaker question at the beginning followed by 4-5 questions that are often the subquestions in a qualitative research plan, followed by some concluding statement or a question, such as, “Who should I visit with to learn more about my questions?”)
- Probes for the 4-5 questions, to follow up and ask individuals to explain their idea in more detail or to elaborate on what they have said
- Space between the questions to record responses
- A final thank-you statement to acknowledge the time the interviewee spent during the interview”

(Creswell, 2009, p.183).

To begin, participants were asked to read and sign a consent form. The consent form detailed the purpose of the interview, storage of interview data and anonymity. At this stage participants were invited to ask any questions they had about the research.

Participants were initially asked to explain their role in the organisation. This question was chosen as it was expected to be a question that all participants could answer comfortably therefore creating a relaxed interview setting. The interview questions were generally asked in the order listed, but as the researcher tried to maintain the flow of the interview, in a number of cases questions were asked out of the predefined order, as appropriate. All interviews were concluded by asking if there was anything else the interviewee would like to add. Finally, a thank you statement was given at the end as it was recognised that the time of the participants was fundamental to the research.

It is noted that it is important that researchers should record information during the interview and this can be done either by hand-written notes or audio-recording or videotaping if the participant consents. On a practical note, it is recommended that even if the interview is recorded digitally the researcher should still take notes should the digital recording fails (Creswell, 2009). In all cases the interviews were audio-recorded. In addition to this, detailed notes were taken during the interview in case the audio-recorder failed. At the beginning of the interviews participants were asked if they consented to being audio-recorded. Participants were also told during emailing prior to the meeting and they were asked again on the day to be certain. Due to participants roles in the organisations interviewees were comfortable with being recorded, with many commenting that they were used to it due to their job role.

All participants were very interested in engaging in a discussion around Twitter. It was evident that this was a topic which was “of-the-moment”. At the end of the interview participants explicitly stated how valuable participating in the interview had been. It allowed them to discuss Twitter and think about its usage. Participants stated that if I needed anything to contact them. Some participants followed up the interview with an email expressing how interesting it was to participate and, again, welcoming future interaction.

### **Post Interview**

To ensure that all data was recorded, immediately after the interview or as soon as possible, the hand written notes taken during the interview were reviewed. These notes were added to with any details that could be remembered by the interviewer, thus provided rich detailed notes. Additionally, for the benefit of the researcher, initial key points emerging from the interviews were noted.

## **5.9 Thematic Analysis**

Creswell (2009) states that in qualitative research “the process of data analysis involves making sense out of text and image data. It involves preparing the data for analysis, conducting different analyses, moving deeper and deeper into understanding the data...representing the data, and making an interpretation of the larger meaning of the data” (p.183). Creswell (2009) outlines five steps which researchers should follow to look at qualitative data, these are 1) organise and prepare the data, 2) read through all the data to gain a general sense of the information, 3) coding, 4) generate a number of themes from the coding as well as a description of the setting/people 5) convey findings, typically through a narrative passage and 6) making an interpretation of meaning of the data. This study, followed these five steps and are presented in detail in the following sections.

### **5.9.1 Organisation and Preparation of Data for Analysis**

The first stage of the qualitative data analysis was to organise and prepare the data for analysis. As stated the interviews were both audio-recorded and detailed notes were taken during the interview. In addition to this, as soon as possible after the interview, further details were added to these noted with other details, thoughts and anything that could be recalled from the interview.

Gillham (2000) states that transcription of interviews should be carried out as soon as is possible after the interview, this particularly assists in understanding of what is said as it is still in the researcher’s memory. There are a number of options identified for transcribing interviews, the decision can be made to transcribe only the relevant parts of the interview or the interview in full. Transcribing parts of the interview makes the process quicker, however by only transcribing parts of the interview means that context may be lost on review of the transcripts

(Gibbs, 2007). The decision was made to transcribe the interviews in full by the researcher and this was done shortly after each interview meaning that the transcription of interviews was an ongoing process. These were typed up into a document, meaning a separate document was created for each interview.

### **5.9.2 Familiarisation with Data**

The second stage of the analysis was familiarisation with the data. To do this the researcher first read through the notes taken by hand and then each of the transcripts. The transcripts were read a number of times to gain a sense of familiarity with the data and to gain a general sense of the interviews. On the initial reading of the transcripts very general comments and thoughts were noted in the document, the notes were recorded as comments shown in the margin. Furthermore on identification of aspects which had been previously noted by other interviewees, these were also noted in the margin with the transcript number of the other interview. This aided in identifying common aspects between interviews.

### **5.9.3 Coding**

The third stage of the process is coding the interview data. A code is a word or short phrase which captures the essence of part of an interview (Gibbs, 2007) and within qualitative analysis it is the dominant first stage of analysis (Seale, 1999). Essentially coding refers to the assignment of codes, to parts of the interview data (Easterby-Smith, Thorpe and Jackson, 2012). Coding interview data assists in “organising the material into chunks or segments of text before bringing meaning to information” (Rossman and Rallis, 1998, p.171 cited in Creswell, 2009, p.186).

There are three general approaches to coding. First, codes can be developed inductively from the data, therefore based only on the information collected second, codes can be predetermined, meaning that the interview is fitted to the codes and third, a combination of predetermined and emerging codes (Creswell, 2009).

The decision, here, is between using concept-driven i.e. predetermined codes or data-driven coding i.e. inductive or open coding. In concept-driven coding, codes are predetermined through research literature (Gibbs, 2007). Alternatively, inductive coding, takes a data-driven approach starting with zero codes (Gibbs, 2007). It is noted that it is difficult to start with absolutely no preconceptions about the data, however the focus in this approach is to, as far as possible, understand what is happening from the data as opposed to drawing upon existing theory (Gibbs, 2007). Easterby-Smith, Thorpe and Jackson (2012) highlight that if there is a lack of empirical evidence in the area of study, it is common for the interest of the researcher to be on what will emerge from the data.

In this research interview transcripts were analysed using an inductive approach where codes were developed based primarily on the interview data. This type of coding approach was chosen due to the absence of prior research in the area meaning it was difficult to develop codes prior to interviewing. An interview transcript was chosen randomly to begin with, a way suggested by Creswell (2009), and the transcript was addressed in a much more formal way than the previous stage. Working through the transcript, parts of the transcript were highlighted and a word or phrase which was viewed as capturing the essence of the section was written in the margin. The codes written in the margin wherever possible used similar wording as that of the interviewee. This process was repeated for all of the interviews. It was noted that the use of language and terms was surprisingly similar between interviewees even across the two areas of Nova Scotia and Scotland, meaning that codes that were identified in the first few interviews could also be used in later interviews. Naturally, when coding later interviews codes which had been established in prior interview transcripts were in the researchers mind and thus these codes were used in later interviews. Once all the interviews had been read, the codes were reviewed. A list of codes was created and then the interviews were read again and the codes were revised.

This was an iterative process of reading interviews and reviewing codes. This was repeated until the interviews were coded.

#### **5.9.4 Development of Themes**

The coding process is then used to establish broader themes or categories which bring together a number of codes, where the themes or categories are generated from the codes (Creswell, 2009). It is these themes which tend to form headings or sections within the research findings (Creswell, 2009).

To create themes the codes were reviewed. Codes which were similar or related were grouped together to form themes. Again, this was an iterative process. As these codes were grouped together to generate themes, the themes were reviewed and there was some regrouping until the themes were finally established.

#### **5.9.5 Reorganising Data Based on Themes**

The next stage involved reorganising the data based on theme. A new document was created where themes were listed as sections. Interview transcripts were reviewed individually and any part of the interview related to the theme was copied into the new document. This was done for each interview to create a single document which contained all the themes and relevant sections from the interviews. This assisted when reviewing the data by theme as all the relevant interview data was located within the same transcript.

#### **5.9.6 Writing-up Themes**

A narrative passage is the most popular way to convey findings (Creswell, 2009) and this approach was used in this research. The next and final step of the thematic analysis of the interview data was the construction of written text summarising the findings of the thematic analysis. The themes which were developed

earlier were used as headings to present the qualitative data. Whenever possible a quote was used from the interviews so as to conserve the interview data. Creswell (2009) states that the themes “should display multiple perspectives from individuals and be supported by diverse quotations and specific evidence” (p.189). Therefore, in the write-up of the findings, the narrative passages aimed to represent the evidence of the interviews whether in agreement or disagreement of an issue and this was supported whenever possible with an appropriate quotation from the interview. Reflecting back to one of the criticisms of case study research, in that it can result in difficult to read documents, consideration was made to the layout of the findings of the interview data. To create structure and flow in the narrative of the themes, they were written as a mixture of text and quotations in a theme-by-theme format. Due to the similarity of the two cases, the thematic analysis draws upon data from both, presenting the findings together. There are some differences evident between the two areas, particularly socio-political differences and the stage of development of the two areas in the use of Twitter. These differences are acknowledged in Chapter 6 and then discussed in further detail in Chapter 8.

## **5.10 System Dynamics and Causal Loop Diagrams**

The final aspect of the research developed a causal loop diagram from the interview data. Causal loop diagrams are a qualitative modelling technique used within system dynamics. To begin, this section provides an introduction to system dynamics modelling. The section then introduces causal loop diagrams. Justification for the use of causal loop diagrams is made. The section then presents an overview of the construction of a causal loop diagram and finally details the process of model verification.

### 5.10.1 System Dynamics

Causal loop diagrams are qualitative diagramming tools used within system dynamics. Therefore, to provide an understanding of this tool, this section first gives a brief introduction to system dynamics. It then discusses the difference in qualitative and quantitative system dynamics, highlighting the appropriateness of the use of qualitative causal loop diagrams for the research problem.

Wolstenholme (1990) defines system dynamics as: “A rigorous method for qualitative description, exploration and analysis of complex systems in terms of their processes, information, organisational boundaries and strategies; which facilitates quantitative simulation modelling and analysis for the design of system structure and control” (p.3). Sterman (2000) defines system dynamics as “a perspective and set of conceptual tools that enable us to understand the structure and dynamics of complex systems. System dynamics is also a rigorous modelling method that enables us to build formal computer simulations of complex systems and use them to design more effective policies and organizations” (p.vii). Both definitions make it clear that there are two distinct aspects of system dynamics: qualitative and quantitative.

Wolstenholme (1990) further explains that system dynamics is “concerned with creating models or representations of real world systems of all kinds and studying their dynamics (or behaviour). In particular, it is concerned with improving (controlling) problematic system behaviour” (p.2). Wolstenholme (1990) uses the term ‘system’ “to denote any combination of real world elements which together have a purpose and which form a set which is of interest to the inquirer” (p.1). Additionally, system dynamics “is grounded in control theory and modern theory of nonlinear dynamics. There is an elegant and rigorous mathematical foundation for the theory and models we develop. System dynamics is also designed to be a practical tool that policy makers can use to help them solve the pressing problems they confront in their organizations” (Sterman, 2000, p.ix).

Sterman (2000) notes that “much of the art of system dynamics modelling is discovering and representing the feedback processes, which, along with stock and flow structures, time delays, and nonlinearities, determine the dynamics of a system” (p.12). Sterman (2000) notes that the most complex behaviours of a system are not due to the individual components within the system, but instead it is the interactions (feedback) among these components which result in complex behaviour. Therefore, system dynamics focuses on a system opposed to focussing on individual events. Kirkwood (1998) notes that higher leverage for lasting change can be achieved by making changes to the system structure rather than changes in individual events as shown in Figure 5.2. A strong focus within system dynamics is on dynamic thinking. “Dynamic thinking is the ability to see and deduce behavior patterns rather than focusing on, and seeking to predict, events. It’s thinking about phenomena as resulting from ongoing circular processes unfolding through time rather than as belonging to a set of factors. Dynamic thinking skills are honed by having to trace out patterns of behavior that change over time and by thinking through the underlying closed-loop processes that are cycling to produce particular events” (Richmond, 1993, p.122).

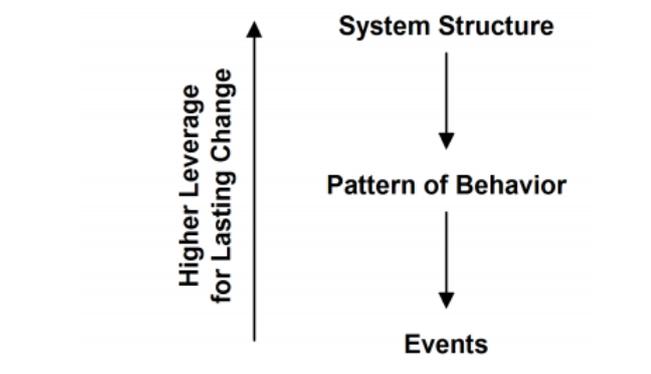


Figure 5.2: Higher leverage for change (Source: Kirkwood, 1998, p.2).

As noted, system dynamics include both qualitative and quantitative approaches. Wolstenholme (1990) provides an overview of the differences of qualitative and quantitative system dynamics, shown in Table 5.2. At this point it is

worth exploring the two and identifying the suitability of qualitative modelling. According to Wolstenholme (1990) qualitative system dynamics is the ‘diagram construction and analysis phase’ and quantitative system dynamics is the ‘simulation phase’. It is argued that the different phases are suitable for different types of systems. Qualitative system dynamics is more appropriate for softer systems “which are difficult to structure and quantify” (Wolstenholme, 1990, p.7), whereas quantitative system dynamics is more appropriate for harder systems “which are easier to structure” (Wolstenholme, 1990, p.7). In general qualitative system dynamics is concerned with the exploration and analysis of the system (Wolstenholme, 1990). The purpose is to make the structure of a given system explicit. This explicit representation of the system allows consideration of alternative structures, identification of feedback behaviour and helps in the communication of these systems to relevant actors. Quantitative system dynamics, alternatively, is reliant on computer simulation modelling. It is concerned with quantitative analysis of variables, testing the robustness of the system, optimisation of variables and design of alternate system structures.

For this research qualitative system dynamics is appropriate due to the exploratory nature of the problem. Qualitative approaches allow exploration of the system of interest and consideration of alterations to the structure to better improve the system. Finally, it facilitates understanding of the system.

### **5.10.2 Causal Loop Diagrams**

Causal loop diagrams, also known as influence diagrams or dynamic hypotheses, are qualitative diagramming tools used within system dynamics. These diagrams are able to communicate quickly and concisely the essential components and interactions in a system (Richardson, 1986). Causal loop diagrams have been used for a number of decades and this qualitative tool has gained much popularity. The popularity of causal loop diagrams is partly due to their qualitative nature

Qualitative System Dynamics	Quantitative System Dynamics	
(Diagram construction and analysis phase)	(Simulation phase)	
	<i>stage 1</i>	<i>stage 2</i>
To create and examine feedback loop structure of systems using resource flows, represented by level and rate variables and information flows, represented by auxiliary variables.	To examine the quantitative behaviour of all system variables over time.	To design alternative system structures and control strategies based on (i) intuitive ideas. (ii) control theory analogies. (iii) control theory algorithms. in terms of non-optimising robust policy design.
To provide a qualitative assessment of the relationship between system processes (including delays), information, organisational boundaries and strategy.	To examine the validity and sensitivity of system behaviour to changes in (i) information structure (ii) strategies (iii) delays/uncertainties.	To optimise the behaviour of specific system variables.
To estimate system behaviour and to postulate strategy design changes to improve behaviour.		

Table 5.2: An overview of qualitative and quantitative system dynamics (Source: Wolstenholme, 1990, p.4).

meaning that system dynamics is more accessible to a wider range of people (Richardson, 1986). Although causal loop diagrams appear simple, they are diagrams created “according to precise and rigorous rules...to explore and analyse the system” (Wolstenholme, 1990, p.4) and these rules need to be acknowledged. A causal loop diagram shows the structure of a given system. Once the causal loop diagram is constructed, the diagram “can be used to qualitatively explore alternative structure and strategies, both within the system and its environment, which might benefit the system” (Wolstenholme, 1990, p.5). Furthermore, even without simulation it is possible “from a study of feedback loop structure of the diagrams, to estimate their likely general direction of behaviour” (Wolstenholme, 1990, p.5). This allows a degree of insight into the behaviour of the system without undergoing simulation.

As causal loop diagrams provide a visual representation of the system, it can be used in a qualitative manner to think holistically about the structure as well as possible alternative structure and strategies (Wolstenholme, 1990). By individual actors sharing their thoughts and assumptions regarding the system, the model can be used to broaden the understanding of each individual actor by providing a model that is able to capture the whole system (Wolstenholme, 1990). Like the wider approach of system dynamics, as described earlier, the key aspect of the diagram is the identification of feedback loops. “Feedback is one of the core concepts of system dynamics. Yet our mental models often fail to include critical feedbacks determining the dynamics of our systems” (Sterman, 2000, p.137).

As noted, causal loop diagrams are simple models. The key components of a causal loop diagram are variables and the arrows between the variables that denote the causal influences between the variables (causal links) (Sterman, 2000). Figure 5.3 shows a simple causal loop diagram. It shows a single reinforcing feedback loop with three variables.

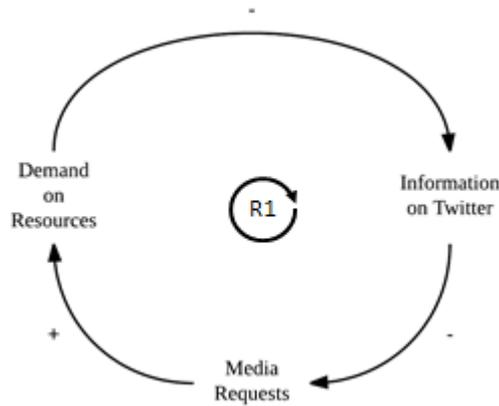


Figure 5.3: Example of causal loop diagram.

### Variables and Causal Links

Causal loop diagrams consist of a number of variables that are connected using arrows. The arrows link the variables to highlight the direction of the causal influence between the two. Causal links are denoted with either a '+' or a '-' sign which represents how the dependent variable changes when the independent variable changes. The causal link '+', i.e. a positive link, means "if the cause increases, the effect increases above what it would otherwise have been, and if the cause decreases, the effect decreases below what it would otherwise have been" (Sterman, 2000, p.139). The causal link '-', i.e. a negative link, means "if the cause increases, the effect decreases below what it would otherwise have been, and if the cause decreases, the effect increases above what it would otherwise have been" (Sterman, 2000, p.139). To assess the polarity of the causal links, the two variables are analysed in isolation, i.e. assuming all other variables are constant - *ceteris paribus*.

It is noted that every causal link in the diagram must represent what the modeller believes to be a causal relationship (Sterman, 2000). Correlations should not be included in the diagram.

## Feedback Loops

An important aspect of the causal loop diagrams are the feedback loops. A loop is formed when a path can be traced, following the direction of the arrows, such that the initial variable can be reached by passing through at least one other variable. “Systems can be classified as “open” or “feedback” systems” (Forrester, 1968, p.1-5). An open system is one where the outputs have no influence over the inputs. Alternatively a feedback system, which can also be known as a closed system, has a closed loop structure meaning that the system is influenced by its past behaviour (Forrester, 1968). “A feedback system has a closed loop structure that brings results from past action of the system back to control future action” (Forrester, 1968, p.1-5). There are two types of feedback, namely positive and negative feedback (Senge, 2006). Dynamics in the system arise from interaction between the two types of feedback loops: positive and negative (Sterman, 2000).

To determine the polarity of a loop, the researcher must firstly assign polarities to each causal link. The polarity of a loop can be determined by tracing the effect a change in one variable has on the other variables in the loop and then the resultant change in the first variable (Sterman, 2000). If the change reinforces the original change then it is a ‘positive loop’, alternatively if the original change that occurs opposes the original change then it is a ‘negative loop’. A second, quicker, way to identify the behaviour of a loop is to count the number of negative links. If the number of negative links is even, then the loop is a reinforcing loop and if the number of negative links is odd then the loop is a balancing loop (Richardson, 1999). Although counting the number of negative links is quicker, tracing the effects of a change in a variable provides a checking mechanism to ensure that the polarity of the link has been correctly assigned.

Positive feedback results in growth as the original change in a variable is reinforced with even more change, thus reinforcing (amplifying) the original change (Senge, 2006). The type of growth observed in a positive loop is known as ex-

ponential growth. This type of growth can appear insignificant early on, but the rate of growth increases over time. Crucially, this means that the effects of a positive feedback loop can appear insignificant early on, but can quickly become an issue in a system. These effects should not be underestimated. Negative feedback is goal orientated, the system will seek a given level and the system will respond as it fails to meet that goal (Forrester, 1968). Negative feedback loops can provide stability in the system, but they can also resist change (Kirkwood, 1998).

Loops are identified in the diagram by specific notation with either a 'B' with a circular arrow in the direction of the loop, or a 'R' with a circular arrow in the direction of the loop. The letter 'R' denotes a reinforcing loop which means the overall polarity of the loop is positive. The letter 'B' denotes a balancing loop that means the overall polarity of the loop is negative. In the diagram the letters 'B' and 'R' will also have a number and this helps when writing a report or presenting the diagram. Additionally, it is also good practice to name the loops. Naming loops helps communicate the results of the causal loop diagram back to participants (Sterman, 2000). The name of the loop should be a short phrase that captures the essence of the loop and this will be shown underneath the 'B' or 'R'. Alternative notation for the behaviour of the loop is the use of '+' and '-' signs. A '+' sign can be used instead of 'R' and a '-' sign is sometimes used instead of 'B'.

One further aspect to note is delays. Delays may occur in the feedback processes "interrupting the flow of influence which make the consequences of actions occur gradually" (Senge, 2006, p.79). Time delays in negative feedback loops can cause oscillation in the system (Sterman, 2000). Significant time delays should be recognised in a system and this is shown in a causal loop diagram with two parallel lines perpendicularly crossing the appropriate causal link at which there is a delay. Different types of behaviour arise as positive and negative loops (with

or without delay) combine. The patterns of behaviour arising from these interactions is discussed in Chapter 7.

### **5.10.3 Justification of Modelling Technique**

At this point it is appropriate to address the selection of modelling technique; there are two aspects to be addressed. First, the suitability of the modelling technique with respect to the underlying framework, SARF. Second, the decision to use qualitative system dynamics opposed to quantitative system dynamics.

Burns and Slovic (2007) note that there has been extensive studies on SARF but limited previous examination of the dynamic aspect of SARF. There are a number of aspects of system dynamics modelling that make it a suitable type of modelling to apply to SARF. The first aspect of system dynamics is that it is capable of dealing with complex systems. Additionally, system dynamics allows the inclusion of difficult to measure variables. System dynamics modelling deals with dynamic systems, a core aspect of this is feedback. In relation to SARF, feedback and the way in which aspects become amplified or attenuated, can be modelled through the different types of feedback loops seen in causal loop diagrams. This type of modelling facilitates consideration of a system, allowing understanding of how changes in one area of a system cause changes in itself and elsewhere in the system. This knowledge provides better understanding of the complexity of the system and therefore how to manage that system.

The second aspect to consider is the selection of qualitative system dynamics opposed to quantitative system dynamics. There are a number of aspects which make a qualitative approach more suitable for this problem. The problem is exploratory in nature and also deals with aspects which are difficult to model. The purpose of the model was to represent the interdependencies among factors during a risk event, specifically the use of Twitter by health organisations. Therefore, qualitative modelling is able to explicitly show the structure of the system, allow

consideration of alternative structures and make explicit feedback loops. The qualitative modelling is able to capture complex system structure and facilitate the communication of the structure to relevant actors. Quantitative modelling was considered out with the scope and purpose of the research due to its focus on quantification of variables. Quantitative modelling is considered as an aspect for future research and is discussed in more depth in Chapter 9, where future research considerations are addressed.

#### **5.10.4 Constructing a Causal Loop Diagram**

Consideration must be made when choosing the method of data collection to build a causal loop diagram. Sterman (2000) states that semi-structured interviews have been found to be a particularly effective way of gathering data to formulate a causal loop diagram. Other methods such as surveys do not yield enough rich data to develop a system dynamics model (Sterman, 2000). Specifically, Sterman (2000) recommends the use of semi-structured interviews, where the researcher has a degree of flexibility allowing the modeller to ask a set of predefined questions, but is able to depart at points of interest to explore issues further, to be the best way to construct the diagram, and it is also the most common way. With regard to choosing participants it is necessary to interview a number of participants as a single participant will only have their understanding of the system. Therefore, to develop a more complete understanding of the system multiple interviews, with participants from different roles should be selected. Furthermore Sterman (2000) also suggests that other sources should also be used to supplement the interviews. The modeller should try to triangulate using a number of different sources (Sterman,2000).

From the interview data the modeller should formulate the model by 1) using interviewees statements to identify the structure of the system, 2) create variable names such that they are similar to those used by the interviewees (variable

names should still adhere to modelling rules, i.e. noun phrases with a clear sense of direction), 3) every causal link should be able to be identified in the interview transcript (Sterman, 2000). The third step is debated. Causal links identified by the modeller but not explicitly stated by the interviewees should/should not be added to the model depending on the model's purpose. If the model is to be developed as a representation of a person's mental model, extra causal links should not be added (Sterman, 2000). Alternatively, if the purpose of the model is to develop a 'good model of the problem situation' (Sterman, 2000, p.158) then additional links can be added to develop a good model through alternative data sources.

Causal loop diagrams are simple models with few rules, however, although there are only a few rules these should be 'followed faithfully' (Sterman, 2000, p.137) and this is key to the successfulness of the causal loop diagram. Some general modelling rules exist in the creation of causal loop diagrams, these have been taken from Sterman's chapter on causal loop diagrams (2000):

- The variable name should be nouns or noun phrases
- Every link must be what the researcher believes to be a causal relationship
- Every causal link should have either a '+' or '-' sign to identify the polarity of the link
- Number and name loops
- Use curved lines to connect variables
- Make the goals of negative loops explicit.

The above, details the suggested means of constructing a causal loop diagram. The construction of the causal loop diagram for this research is provided in detail below.

To develop this causal loop diagram semi-structured interviews were used. As noted, semi-structured interviews are recognised as the most effective way to gather data to construct a causal loop diagram. This is due to the flexibility of this type of interview, allowing sufficient depth but also freedom for the interviewer to ask appropriate follow up questions but still following a predefined theme. Interviewees were selected based on their role in the organisation such that they had varying perspectives on the problem. This was achieved by including participants who had differing roles in the organisation as well as selecting participants from multiple organisations. The variety of perspectives meant that the interview data provided a more complete understanding of the problem. It was recognised that a person will only have their perspective on the problem, so to gain a more complete understanding a number of perspectives were required. Interviewees differing job roles helped to develop a more holistic view of the problem.

Sterman (2000) states “[c]ausal links should be directly supported by a passage in the transcript” (p.158). However, the decision to supplement the causal loop diagrams with additional links, which cannot be identified in the transcript, depends on the purpose of the model. If the purpose is to create a person’s mental model, then the additional links should not be added (Sterman, 2000). Alternatively, if the purpose is to develop a good model then the participants’ statements should be supplemented. These links can draw on other sources such as observations and archival data. The modeller can also draw upon their own experience to add further links to the diagram. For this research the aim was to develop a complete model, therefore the model was supplemented using other sources. This included review of the Twitter accounts of health organisations; review of social media policies and observation of Twitter use during health risk events.

As noted earlier the interviews were transcribed in full. In order to develop

the structure of the diagram the data was reviewed and causal relationships were identified from the transcripts. Where possible variables were named using specific words of the interviewees or as close as possible. The model boundary was established from the interview data which was guided by the interview questions.

To begin with a number of variables were identified from the interview data and the causal links between them noted. These variables were written on paper and the causal links between them were drawn. The layout of these variables were not important at that point. As further reviews of the interview data were done more variables and causal links were identified and added. Once the variables had been identified and causal links established, the development of the layout of the causal loop diagram was an iterative process. To begin, variables were identified and their causal links were shown in no particular format. The first stage was simply to establish the variables and how they were linked together. As noted earlier, there are rules to follow to produce the layout of the diagram as identified by Sterman (2000) to which these modelling rules were adhered. Numerous revisions of the layout of the model was done with the aim to reduce the number of crossed lines and to present feedback loops in a circular or oval shape, consistent with the recommendations for building a causal loop diagram. Consideration was then made into different software that could be used to make a computerised version of the causal loop diagram. PowerPoint was used to create a suitable version of the model.

The next stage was to assign polarities to each of the causal links. Loop behaviour of individual feedback loops was identified by tracing the change in the behaviour around the loop. Feedback loops are identified using 'R' or 'B', indicating whether the behaviour of the loop - reinforcing or balancing. As the model is complex only the variables, causal links and link polarities are shown in the overall diagram. Individual loop details, including whether the loops are reinforcing or balancing are shown when considering the system at an individual

feedback loop level.

Finally, on completion of the model by the modeller, and prior to meeting participants for the second time during model verification, a number of checks were made on the model. The model was firstly tested on peers with a knowledge of the research and secondly those with a specialist knowledge in system dynamics. This allowed the model to be checked for coherence and identify any inconsistencies. The aim of this was also to ensure the final model adhered to the rules which are in place regarding the construction of a causal loop diagram. Lastly, the presentation of the model, to those external to the research, allowed the development of the delivery of the model for the presentation to the interviews.

### **5.10.5 Model Verification**

The final stage of model development was model verification. The model was verified by returning to a number of participants and presenting the model in face-to-face meetings. This section first covers issues of verification and validation. It then moves on to detail the process of verification with participants.

#### **Issues of Model Validation and Verification**

Pidd (2009) argues that “a model is an external and explicit representation of part of reality as seen by the people who wish to use that model to understand, to change, to manage and to control that part of reality” (p.10). Model verification and model validation can be distinguished between as follows. Model verification is defined as “the process of making sure that the model...does what the model builder intends” (Mitchell, 1993, p.128) however there are few systematic ways of model verification. Model validation, alternatively, “is the process of testing that the model does actually represent a viable and useful alternative means to experimentation” (Mitchell, 1993, p.128). Sterman (2000) argues that both “validation and verification of models is impossible” (p.846) as all models

are simplifications of the real world. Furthermore it is argued “No model has ever been or ever will be thoroughly validated ... “Useful”, “illuminating,” “convincing,” or “inspiring confidence” are more apt descriptors applying to models than valid” (Greenberger, Crenson and Crissey, 1976, pp.70-71 cited in Sterman, 2000, p.846).

In light of the above argument that validation and verification is impossible Sterman (2000) puts forth a number of alternatives, that a researcher should focus on and these are shown in the list below. These questions are general and some are not specific to causal loop diagrams. Questions deemed relevant by the researcher to causal loop diagrams are marked with an asterisk and these guide the process of model verification for this research.

### **Purpose, Suitability, and Boundary**

- What is the purpose of the model?\*
- What is the boundary on the model?\* Are the issues important to the purpose treated endogenously? What important variables and issues are exogenous, or excluded?\* Are important variables excluded because there are no numerical data to quantify them?
- What is the time horizon relevant to the problem?\* Does the model include the factors that may change significantly over the time horizon as endogenous elements?\*
- Is the level of aggregation consistent with the purpose?\*

### **Physical and Decision Making Structure**

- Does the model conform to basic physical laws such as conservation of matter? Are all equations dimensionally consistent without the use of fudge factors?

- Is the stock and flow structure explicit and consistent with the model purpose?
- Does the model represent disequilibrium dynamics or does it assume the system is in or near equilibrium all the time?
- Are appropriate time delays\*, constraints, and possible bottlenecks taken into account?
- Are people assumed to act rationally and to optimize their performance? Does the model account for cognitive limitations, organizational realities, noneconomic motives, and political factors?
- Are the simulated decisions based on information the real decision makers actually have?

### **Robustness and Sensitivity to Alternative Assumptions**

- Is the model robust in the face of extreme variations in input conditions or policies?
- Are the policy recommendations sensitive to plausible variations in assumptions, including assumptions about parameters, aggregation, and model boundary?

### **Pragmatics and Politics of Model use**

- Is the model documented?\* Is the documentation publicly available? Can you run the model on your own computer?
- What types of data were used to develop and test the model (e.g., aggregate statistics collected by third parties, primary data sources, observation and field-based qualitative data, archival materials, interviews)?\*

- How do the modellers describe the process they used to test and build confidence in their model? Did critics and independent third parties review the model?\*
- Are the results of the model reproducible? Are the results “add-factored” or otherwise fudged by the modeller?
- How much does it cost to run the model? Does the budget permit adequate sensitivity testing?
- How long does it take to revise and update the model?
- Is the model being operated by its designers or by third-parties?
- What are the biases, ideologies and political agendas of the modellers and clients? How might these biases affect the results, both deliberately and inadvertently?

(Sterman, 2000, p.852).

The above list highlights a number of measures to aid the modellers assessment of the model. This research only seeks to verify the model, this process of verification is detailed below.

### **5.10.6 Process of Verification with Participants**

As noted, verification was carried out by presenting the model back to a number of participants. Two further sessions were held with participants, one in Scotland and one in Nova Scotia. The purpose of this aspect of the verification was to ensure that the interviewees responses to questions had been correctly translated into the model. The presentations of the model were carried out in April and May 2014, approximately one year after the first meeting.

In Nova Scotia, the model was presented to four participants, two of which had been involved in the first round of interviews. The roles of the individuals were Medical Officer, Director of Health Services Emergency Management, Communications Officer, and Training and Development Officer. These participants were from two organisations and were in the early stage of development of their Twitter accounts. The presentation was done in person. The meeting had been arranged with three of the interviewees who had participated the previous year. However, as noted, the meeting consisted of four participants. Two of the participants had been interviewed the previous year. The other two were new to the research. In terms of position in the organisation, one directly replaced one participant in terms, both being part of the communications team. The fourth participant was involved in training and development in the organisation. As the participants had varying roles in the organisation it provided a number of interesting perspectives on the model and Twitter usage in the organisation. The presentation took place in the organisation in a room which was used during emergencies. The room was chosen as those arranging the meeting identified the benefits of being in the room that would be used in an emergency situation and familiarising themselves with the technology and set up of the room. The meeting lasted two hours.

In Scotland, the model was presented to two individuals in person, both of whom had been in the first round of interviews. These participants were from one organisation which was in the earlier stages of development of the use of Twitter. The roles of these individuals were Emergency Planning Officer and Communications Officer. The model was presented over the course of a two hour meeting. The model gained a lot of positive feedback, with participants particularly appreciating a visual representation of the relationships and the ability to follow the relationships within the map. As the participants had differing roles in a risk event it meant two perspectives for the model to be verified.

In Nova Scotia, the meeting consisted of a number of different roles allowing discussion between seniors in the organisation and those in the communications teams as well as emergency planning. In Scotland, the meeting consisted of emergency planning roles and communication roles allowing for feedback from different perspectives. The model was not presented back to all participants due to time constraints. Additionally, it was difficult to gain access to some participants as they had changed roles from the previous year.

Prior to the meeting, the model and a description of how to understand the model was provided to the participants, at their request. The meeting was structured into three sections. The first section of the meeting briefly recapped the research. As most of the participants had been interviewed the previous year most were familiar with the research, but as a year had passed a reminder was identified as necessary. The second aspect of the meeting introduced a summary of the thematic findings from the interviews. The thematic findings were intended to help build context and understanding of the findings before introducing the model. It was also anticipated that presenting the type of modelling may have been overwhelming, therefore introducing the thematic analysis was done to make the participants comfortable in the meeting. The third stage of the meeting introduced the causal loop diagram. Finally the meeting was opened up into a discussion allowing the conversation to cover topics the interviewees felt relevant and allowed additional questions to be asked.

The initial step in the verification of the model was to introduce the participants to this type of modelling and ensure that they understood the symbols in the model. To do this, a simple example of a causal loop diagram was presented and through this example the different aspects of the model were explained.

First the entire model was shown. Three key areas of the model were then highlighted and an explanation was given on what these three areas, generally, showed. It was explained to participants that the model would be worked through

in parts.

To ensure the model did not overwhelm participants each loop was presented individually. Each loop was named, where loop names were chosen that captured the essence of the loop and when possible phrases interviewees had used were given to these. This was to help in the communication of the causal loop diagrams to the participants, giving an indication of the what the loop showed. It was acknowledged that presenting the entire model can be overwhelming and the aim of the session was to gain as much feedback as possible.

Each participant was provided with print out of the map and the individual loops so they were able to follow the presentation. Participants were encouraged to make amendments on the map and to draw on the maps with changes they thought were appropriate.

The model was presented systematically, the researcher guided the participants to relevant areas and providing discussion on different aspects. The aim of this was to, firstly, ensure that each causal link and variable was considered, and, secondly, not to overwhelm participants with a complicated diagram. The model was built aspect by aspect until the complete model was addressed. The final stage of the meeting was discussion and feedback. In this stage of the meeting the participants were welcomed to comment and give feedback on the model or more generally, topics of interest to them.

During the meeting notes were taken of the participants' feedback to ensure this was captured. Where participants felt that the model was incorrect, they were asked to elaborate on what they felt was wrong and an appropriate change. Participants agreed with the model, with only a few minor changes which have been made to the model and updated. From the session feedback from the model was gained. The feedback and discussion of the model is detailed in Chapter 7.

## 5.11 Ethical Considerations

Part of the data collection involved participants from organisations in Nova Scotia and Scotland, therefore ethical consideration was made with respect to these participants. Although the interviewees did not fall into any ‘at-risk’ groups there were still ethical issues to consider. The first consideration related to their agreement to participate. Interviewees were viewed as generously giving their time to be involved in the research. The researcher did not want any participants to feel forced to enter into the study. Initial contact with participants was made by email. It was felt that email was most appropriate as the potential participant could read the email in their own time and make a decision on whether to reply or not. The email contained details about the researcher, the study, why the potential participant was being approached and details of the study. The email was sent to their work email account. It was decided that one follow-up email would be appropriate if the interviewee did not respond and if there was still no response there would be no further contact with the participant as it was assumed they did not want to participate.

The study gained ethical approval through the University of Strathclyde’s ethical committee which passed the design of the study. As required by the University of Strathclyde’s ethical standards all participants were provided with an information sheet. The information sheet stated that participation in the study was voluntary and the participant could withdraw from the study at any point without reason or consequence. Prior to interviews participants were given the opportunity to withdraw from the study, none did so. Consent forms were signed prior to the interview beginning and at this point the participants were given the opportunity to ask any questions.

Ethical considerations were also made to the questions asked in the interview. Interviewees were not asked any questions that were out with the scope of the interview. For example, no questions were asked regarding personal details.

Another ethical consideration related to the experience of the participants with Twitter usage. The questions were phrased in such a way that it did not imply any expectation of use. The researcher made it clear that this was an exploratory study.

Consideration was also made to audio-recording the interviews. Again, trying to ensure the participants felt comfortable, within the email setting up the interview time it was stated that the interview would be audio-recorded, if the participant agreed. Therefore, at the interview it did not come as a surprise. Related to this, details of data storage were also noted so that the participant felt comfortable. Due to the type of roles participants had, all were comfortable with being audio-recorded.

Participants time was highly valued by the researcher and therefore at the beginning and the end of the interview the researcher expressed gratitude for their time. Furthermore, any emails from participants were responded to.

A final ethical consideration was made to the inclusion of Twitter usernames in the reporting of pilot study data, specifically in citing tweets. In this thesis the decision was made to include the usernames of Twitter users. This decision was taken as Twitter is a microblog which allows users to publish information, in the form of tweets, to a public, global audience. Tweets cited in the thesis provided general comments on the outbreak of the disease and contained no personal information regarding the Twitter users. If tweets had of contained sensitive or personal information and alternative decision on whether to include the username would have been considered.

## **5.12 Data Storage**

Data storage of the interview recordings were held on a university computer. On transcription of the interview data any details identifying the participant were

anonymised. Data will be held on the computer until the PhD is completed and then deleted.

### **5.13 Summary**

To summarise this research adopts a philosophical position of hierarchical epistemology and realist ontology. The research used a two case qualitative comparative case study research design. The case study had clear boundaries, specifically the study was concerned with health organisations in Nova Scotia and Scotland and it focused on the use of Twitter during health risk events by these health organisations. The process of the empirical data collection was as follows. Initially a pilot study was conducted to collect data from Twitter. This pilot study was conducted to understand if health organisations were using Twitter during a health risk event. It provided insight into the use of Twitter by three organisations during an outbreak of Legionnaires' disease in Edinburgh. These data, along with the literature informed the development of semi-structured interview questions. Semi-structured interviews were conducted with participants in health organisations in Nova Scotia and Scotland. The interview data was first analysed through a thematic analysis in which an inductive approach was used to identify themes. The empirical interview data was then used to develop a causal loop diagram. The model was verified by returning to a number of participants and presenting the model. The next chapter, Chapter 6, presents the findings of the pilot study and the thematic analysis of the semi-structured interviews. Chapter 7 presents the development and analysis of the causal loop diagram.

# Chapter 6

## Research Findings from Interviews

### 6.1 Introduction

This chapter forms the first part of the empirical investigation, presenting the findings of the pilot study and the thematic analysis of semi-structured interviews. The chapter is structured as follows. In order to provide context, the chapter initially provides an overview of the two areas, Nova Scotia and Scotland. This includes summaries of the geographical areas, governmental systems, health systems and population demographic information. The chapter then presents the pilot study which investigated the use of Twitter by health organisations during an outbreak of Legionnaires' disease in Edinburgh, Scotland in 2012. The chapter then presents a short reminder of the participants and their organisations who were interviewed. Finally, the 16 themes developed from the interview data are introduced, followed by the thematic findings. A summary diagram of this is shown in Figure 6.1.

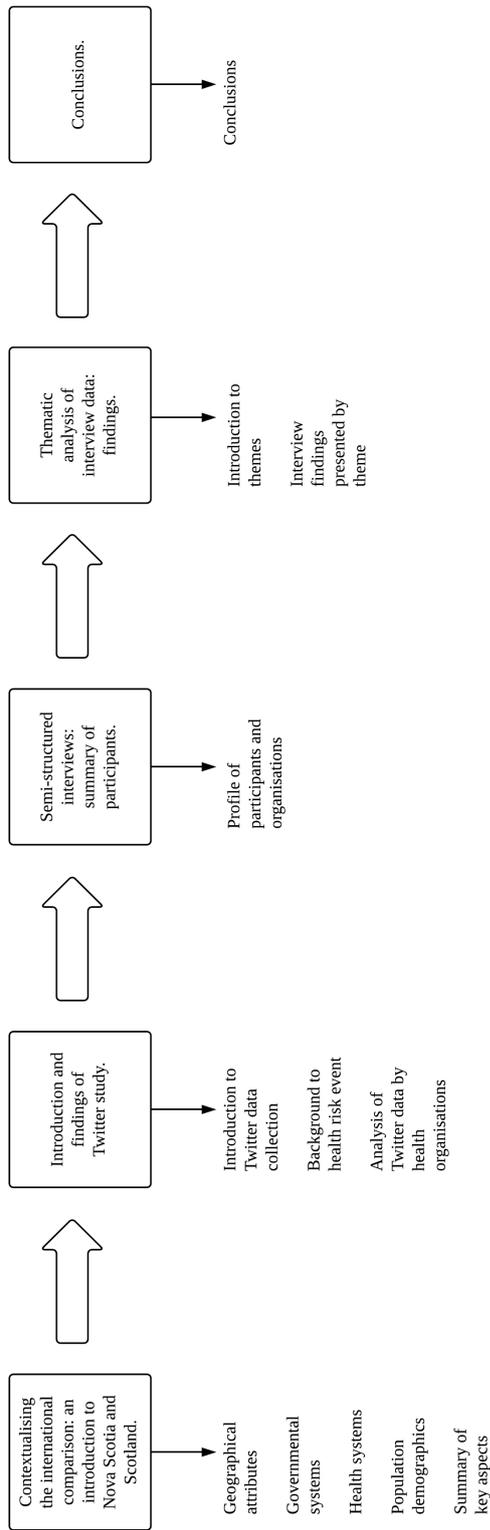


Figure 6.1: Structure of Chapter 6.

## **6.2 Nova Scotia and Scotland**

The empirical aspect of this research draws upon participants from a number of health organisations in Nova Scotia and Scotland. Each area forms a case within this research. To begin this chapter, an overview of the two areas is provided and this is used to provide context for the interview findings. Additionally, this overview justifies the selection of Nova Scotia and Scotland. The following subsections provide details of the two areas including geography and population distribution; political systems; details of the health care systems and their Twitter usage and finally, population demographics.

### **6.2.1 Geographic Attributes**

To understand the two areas, this first aspect addresses geographical attributes of the two. This section addresses the geographic location of the Nova Scotia and Scotland, as well as population distribution and population density within each.

#### **Nova Scotia**

Canada is made up of ten provinces and three territories (Privy Council Office, 2013) and these are shown in Figure 6.2. Nova Scotia is one of the ten provinces and is a peninsula located on the east coast of Canada. Based on land area Canada is the second largest country in the world. The population of Canada is approximately 33.5 million (Privy Council Office, 2013). The population of Nova Scotia is 921,727 thus, it is home to just 2.75% of the Canadian population (Privy Council Office, 2013).

The land area of Canada is 8,965,121.42 square kilometres giving it an average population density of 3.7 persons per square kilometre (Statistics Canada, 2014b). This low population density is partly due to the population distribution in the country. The three territories (Northwest Territories, Nunavut and Yukon) which

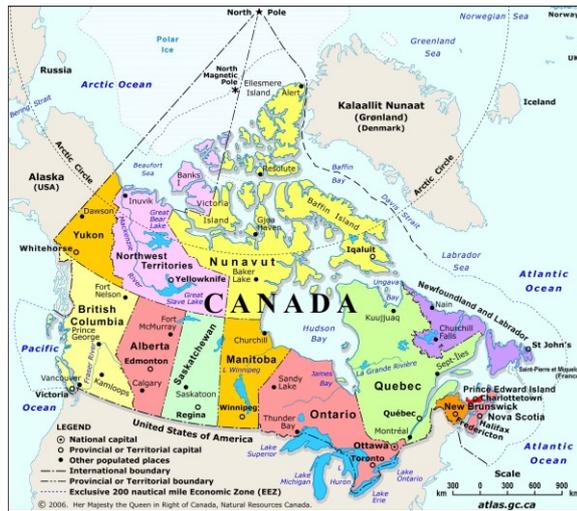


Figure 6.2: Map showing the geographical boundaries and locations of Canada’s provinces and territories (Source: Natural Resources Canada, 2006).

are located in the north part of the country make up 40% of Canada’s land mass (see Figure 6.2) but only 0.3% of the population lives in these territories (Statistics Canada, 2012).

Nova Scotia is one of four Atlantic provinces. Based on population, the largest city in Nova Scotia is Halifax with 390,096 residents (Statistics Canada, 2014a). Halifax is also the capital city of the province and is located centrally within the province on the southern coast.

The land area of the province is 52,939.44 square kilometres, meaning Nova Scotia has a population density of 17.4 persons per square km (Statistics Canada, 2014a) and by land area it is the second smallest province. The land area of Halifax is 5,490.28 square km, therefore Halifax has a population density of 71.1 persons per square km (Statistics Canada, 2014a). In Nova Scotia 57% of the population live in urbanised areas and 43% in rural areas (Statistics Canada, 2011).

## Scotland

Scotland is one of four countries which make up the United Kingdom and geographically, it is located in the north third of Great Britain (Scotland, 2014c).

The population of the United Kingdom is 64.1 million and the population of Scotland is about 5.2 million (Scotland, 2014a) meaning that 8.3% of the British population reside in Scotland.

Despite this, Scotland's land area is 78,772 sq km (Scotland, 2014a) and accounts for 32% of the United Kingdom's land area. The population density of Scotland differs significantly from that of the United Kingdom, with a density of 64 persons per square kilometre (Scotland, 2014a).

Scotland can be divided into three main parts, these are the Northern Highlands and Islands, the Central Lowlands (or Central Belt) and the Southern Uplands (The Scottish Government, 2010). The population of Scotland is mainly located in the Central Belt of Scotland with four main cities located in this area: Glasgow, Edinburgh, Stirling and Dundee. Scotland has one of the most unevenly distributed populations in Europe, with approximately 80% of the population residing in the Central Belt (The Scottish Government, 2010). Rural areas of Scotland, which account for 89% of the land area, are inhabited by one third of the Scottish population (The Scottish Government, 2010).

The biggest city in Scotland, based on population, is Glasgow, with 592,820 residents, and the second largest is Edinburgh, the capital city of Scotland, with 486,120 residents (Scotland, 2014b). Both are located in the Central Belt of Scotland. The largest, and only city, in the Highlands and Islands is Inverness which is located in the north of the country with 56,660 residents (Scotland, 2014c).

### **6.2.2 Political Systems**

Both Nova Scotia and Scotland are part of larger countries with governmental systems. Nova Scotia has a provincial government and Scotland has a devolved government. This section aims to provide understanding of the political context and what powers each of the areas have.

## **Nova Scotia**

Canada is a democratic constitutional monarchy (Canada, 2014). There is an elected Prime Minister who is Head of Government and a Sovereign as head of State. “Canada has a federal system of parliamentary government, where federal, provincial and territorial governments share government responsibilities and functions” (Canada, 2014). Canada consists of ten provinces and three territories, each of the provinces and territories have their own provincial level or territorial governments. The powers of provincial and territorial governments differ. As a province of Canada, Nova Scotia has its own government.

## **Scotland**

The United Kingdom is a parliamentary democracy and a constitutional monarchy, where there is an elected Prime Minister who is head of the United Kingdom Government. A number of aspects of government are devolved in Scotland. Some of the areas which the Scottish Government are responsible for include health, education, culture, the environment and sport (GOV.UK, 2014). The Scottish Government and Scottish Parliament were officially convened on 1 July 1999. It is this date that marks the transfer of powers in the devolved matters (The Scottish Government, 2012a). The Scottish Government is led by a First Minister who is elected by the Scottish Parliament (The Scottish Government, 2012b). The Scottish Parliament “comprises all elected Members of the Scottish Parliament (MSPs) and is the law making body for devolved matters” (The Scottish Government, 2014b).

### **6.2.3 Health Systems**

This section introduces the health systems which operate in the two areas. Additionally, this section provides an overview of the use of Twitter in the two areas.

## **Nova Scotia**

The health care system in Canada is commonly referred to as Medicare; this is Canada's national health insurance program (Health Canada, 2010). The program ensures that all residents "have reasonable access to medically necessary hospital and physician services, on a prepaid basis" (Health Canada, 2010). Each province and territory has its own health insurance plan and these 13 plans, together, create a national plan (Health Canada, 2010).

The roles and responsibilities for the health care system in Canada is shared between federal government and the provincial and territorial governments (Health Canada, 2010). In order to gain their full share of federal cash contribution, there are a number of criteria and conditions set out by the Canada Health Act which must be satisfied by the provincial and territorial health care insurance plans (Health Canada, 2010). "Provincial and territorial governments are responsible for the management, organization and delivery of health services for their residents" (Health Canada, 2010).

Nova Scotia has nine district health authorities and the IWK Health Centre which provide health services to the province. These district health authorities "deliver health care services to residents and are responsible for all hospitals, community health services, mental health services and public health programs in their districts" (Nova Scotia, 2013).

The geographical boundaries of the nine district health authorities is shown in Figure 6.3. The IWK is located in Halifax. The size of geographical area of each of the health authorities are similar.

The age profiles of the health boards is shown in Figure 6.4. As can be seen the age profiles are similar. The exception is Capital Health which serves the Halifax region. Capital Health has a higher percentage of '20-44 year olds' than the other districts, and a lower percentage of '60 and over' age group of the population.

Capital Health serves the largest population. The remaining health authorities

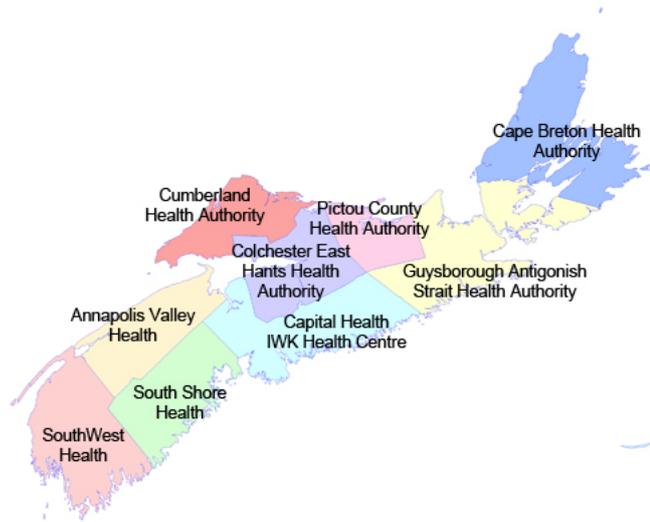


Figure 6.3: District Health Authorities in Nova Scotia (Source: Nova Scotia, 2013).

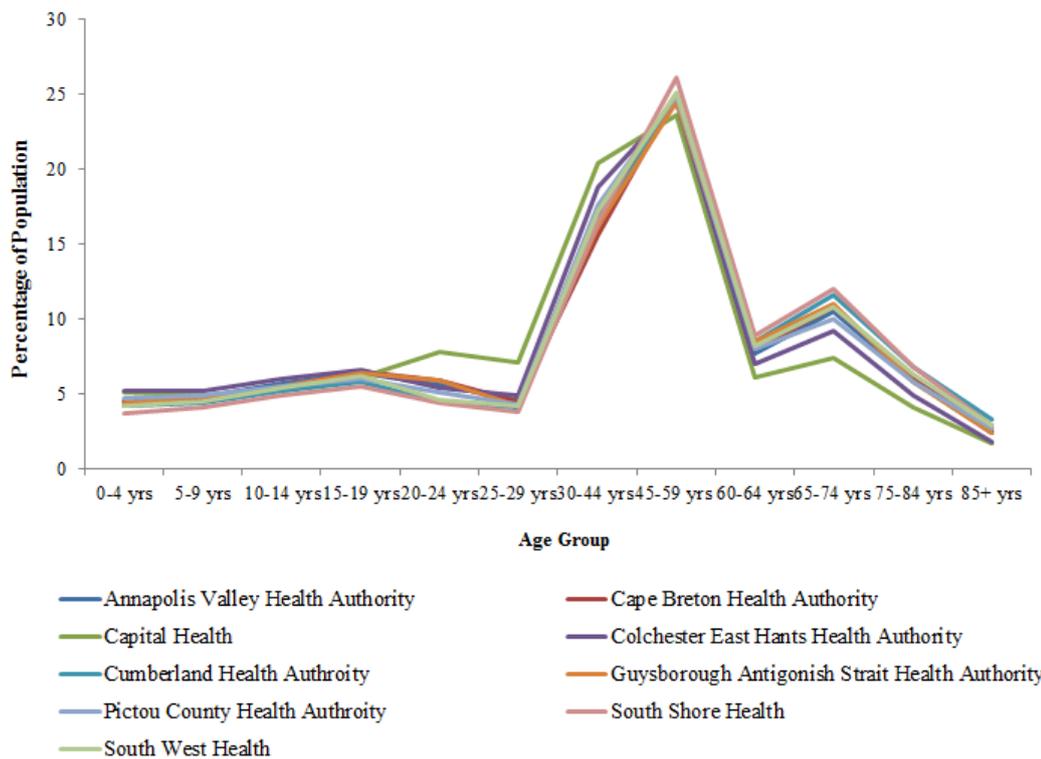


Figure 6.4: Age profiles by District Health Authority (Data Source: Nova Scotia, 2014).

are similar. The populations of the different district health authorities are shown in Figure 6.5.

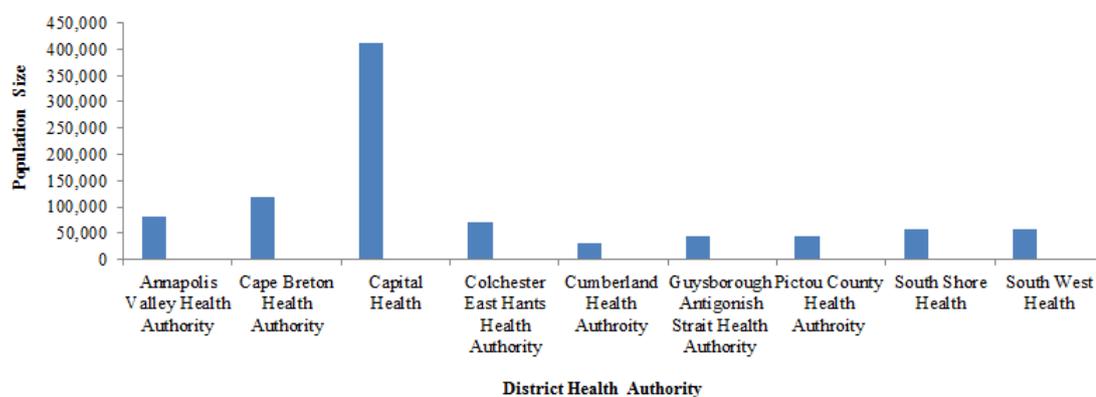


Figure 6.5: Populations of health districts. (Data Source: Nova Scotia, 2014).

Finally, of the nine district health authorities, four have Twitter accounts. One of these is that of an individual member in the health organisation of Cape Breton, therefore it is not a corporate account. The Twitter account of Capital Health has the largest number of followers of Nova Scotian district health authority accounts.

## Scotland

As stated health is a devolved power in Scotland for which the Scottish Government is responsible. The health system in Scotland is NHS Scotland and is publicly funded. “The provision of health and care services in Scotland is governed by a number of legal frameworks and guided by strategy and policy designed to ensure sustainable services which are safe, effective and person-centred.” (The Scottish Government, 2014d).

There are 14 regional health boards in Scotland which are “responsible for the protection and the improvement of their population’s health and for the delivery of frontline healthcare services” (SHOW, 2012). The geographical boundaries of the 14 are shown in Figure 6.6. There are also seven Special NHS Boards and one public health body supporting the regional health boards providing national and

Health Authority	Twitter Account	Twitter Name	No. of Followers	Following
Annapolis Valley Health Authority	No			
Cape Breton District Health Authority		@Monika_Dutt	2,303	2,129
Capital Health	Yes	@capital_health	6,963	2,857
Colchester East Hants Health Authority	No			
Cumberland Health Authority	No			
Guysborough Antigonish Strait Health Authority	Yes	@gashanovascotia	179	59
Pictou County Health Authority	No			
South Shore Health	Yes	@SouthShoreDHA	286	70
South West Health	No			

Table 6.1: Twitter accounts of health districts Nova Scotia (Data taken on 22 October 2014).

specialist services (SHOW, 2012). Each of the NHS Boards are accountable to the Scottish Ministers, supported by the Scottish Government Health and Social Care Directorates (The Scottish Government, 2013a).

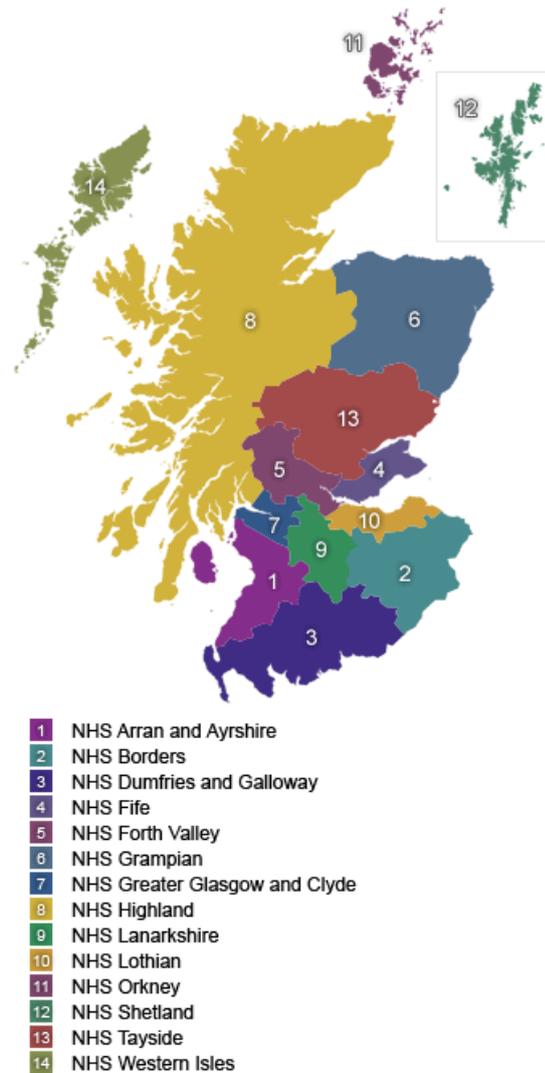


Figure 6.6: NHS Health Board Map Scotland (Source: SUDI Scotland, 2014).

The Scottish Government Health and Social Care Directorate is responsible for allocating resources and setting the strategic direction for NHS Scotland as well as development and implementation of health and social care policy (The Scottish Government, 2014a). Within Health and Social Care there are three ministers: The Cabinet Secretary for Health and Wellbeing, The Minister for Public Health and Minister for Commonwealth Games and Sport (The Scottish

Government, 2014c). There is also a Director-General Health and Social Care and Chief Executive of NHS Scotland.

The geographical boundaries of the 14 regional NHS Boards are shown in Figure 6.6. As is evident, the size of the geographic area of each differs significantly. NHS Highland has the largest catchment area of the regional NHS Boards. Greater Glasgow and Clyde serves the largest population. The smallest health boards are the Orkney, Shetland and the Western Isles. Population of each health board is shown in Figure 6.7. As can be seen the population size varied greatly.

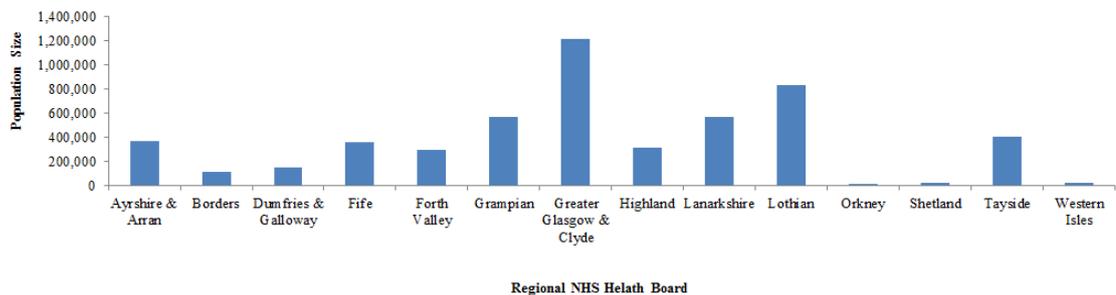


Figure 6.7: Population of each NHS Board (Data Source: Scotland’s Census, 2014).

The age demographics of the 14 regional health boards is shown in Figure 6.8. As can be seen the age profiles of the 14 boards are similar.

As shown in Table 6.2 of the 14 regional health boards just one did not have a Twitter account. The number of followers varied between Twitter accounts with the highest being NHS Lothian.

### 6.2.4 Population Demographics

To be aware of the types of population the health organisations are interacting with this section provides an overview of population demographics. Specifically focussing on age, population by age group, migration, gender, and literacy.

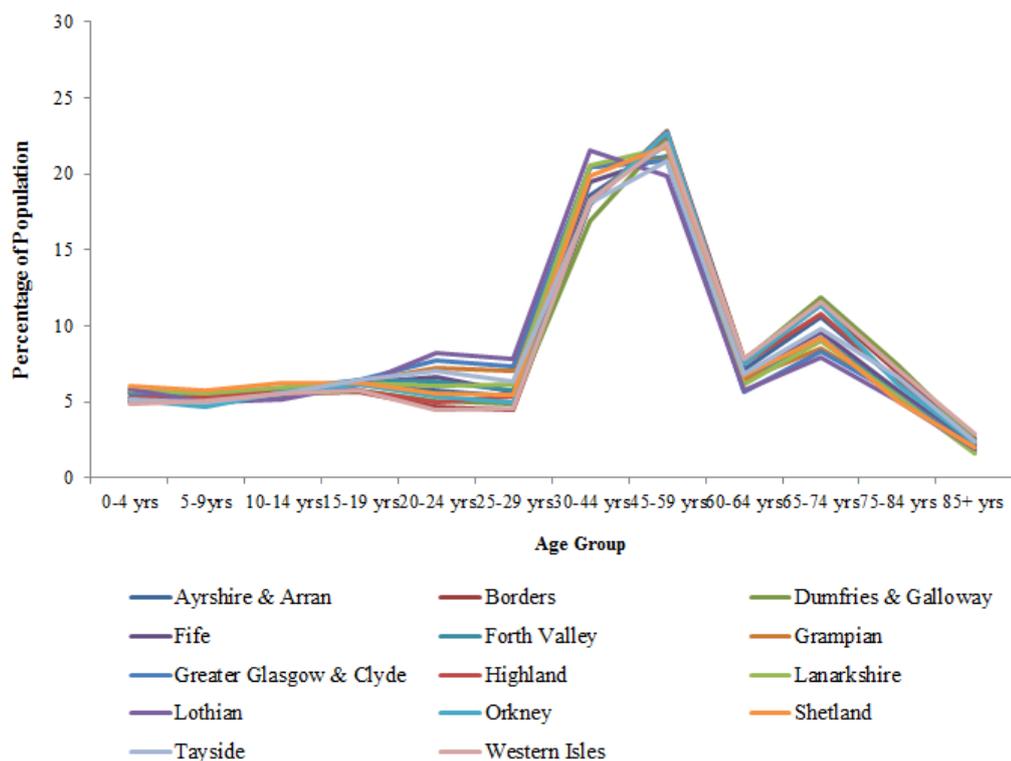


Figure 6.8: Age profiles by NHS Health Board (Data Source: Scotland’s Census, 2014).

Regional Board	Twitter Account	Account Name	No. of Followers	Following
NHS Ayrshire and Arran	Yes	@NHSaaa	4,124	229
NHS Borders	Yes	@NHSBorders	391	70
NHS Dumfries and Galloway	Yes	@DGNHS	2,989	278
NHS Fife	Yes	@nhsfife	5,859	339
NHS Forth Valley	Yes	@NHSForthValley	4,136	228
NHS Grampian	Yes	@NHSGrampian	5,182	152
NHS Greater Glasgow and Clyde	Yes	@NHSGGC	2,266	237
NHS Highland	Yes	@NHSHighland	4,551	259
NHS Lanarkshire	Yes	@NHSLanarkshire	7,049	1,218
NHS Lothian	Yes	@NHS_Lothian	9,031	488
NHS Orkney	Yes	@NHSOrkney	552	78
NHS Shetland	No			
NHS Tayside	Yes	@NHSTayside	5,275	160
NHS Western Isles	Yes	@NHSWI	920	118

Table 6.2: Twitter accounts of Scottish regional health boards (Data taken on 22 October 2014).

## Nova Scotia

The estimated population of Nova Scotia was 921,730 in 2011 (Statistics Canada, 2012). A breakdown of the age profiles of Nova Scotians is shown in Table 6.3.

Age	Number	Percentage
0-14	138,215	15%
15-64	630,140	68%
64 and over	153,375	17%
Total	921,730	100%

Table 6.3: Nova Scotia's age demographics (Data Source: Statistics Canada, 2012).

The study is concerned with information provided in the written form, therefore it is important to consider the literacy levels of the public in Nova Scotia. Literacy is measured on a continuous scale zero to 500 points, scores are then grouped into levels indicating proficiency in literacy ability where Level 1 is the lowest level of literacy and Level 5 is the highest level of literacy (Employment and Social Development Canada, 2014a). It is stated to function well within Canadian society a reading level of at least 3 is required. Level 3 is the lowest level which is considered that a Canadian can function well within society (Employment and Social Development Canada, 2014b). The percentage of Canadians (16-65 year olds) achieving a literacy score of Level 3 or above was 51.5% (Employment and Social Development Canada, 2014b). In 2012 Nova Scotia had 49.7% of the 16-65 population with a literacy Level 3 or above, meaning that 50.3% had a literacy level below Level 3 (Employment and Social Development Canada, 2014b).

## Scotland

The estimated population of Scotland in 2012 was 5,313,600 (The Scottish Government, 2014e). Table 6.4 shows a breakdown of the population ages.

Addressing the literacy level of the Scottish population, the most robust study to date carried out in 2009 found that 73.3% of the 16-65 year old Scottish

Age	Number	Percentage
0-15	903,312	17%
16-64	3, 506,976	66%
64 and over	903,312	17%
Total	5, 313,600	100%

Table 6.4: Scotland’s age demographics (Data Source: The Scottish Government, 2013b).

population has a literacy Level 3 or above (St.Clair, Tett and Maclachlan, 2010). The study noted that the distribution of literacy skills is related to the poverty in the communities (St.Clair, Tett and Maclachlan, 2010).

### 6.2.5 Summary of Nova Scotia and Scotland

At this point a summary of the two areas is provided. In terms of political systems both are very similar in style. Both areas form part of a larger country where certain powers are within the remit of provincial level government or devolved government. Health is one such aspect which falls within the powers of the provincial and devolved government in Nova Scotia and Scotland, respectively. In terms of the provision of healthcare, primarily this is done through district health authorities (Nova Scotia) and regional health boards (Scotland) of which there are 9 and 14, respectively. Each health authority and regional health board serve a different geographical area in the two. In terms of distribution of age populations, the two are similar. Prevalence of the use of Twitter varies between the two, with Twitter being used in almost all the regional health board accounts in Scotland, but only within four district health authorities in Nova Scotia. Differences between the two areas do exist in terms of population and geographic size, in both cases Scotland is larger than Nova Scotia.

## 6.3 Twitter Pilot Study: Findings

This section presents the findings of the pilot study which analysed the use of Twitter by three health organisations during the outbreak of Legionnaires' disease in Edinburgh in 2012. This section first provides an overview of the event. It then presents findings of the analysis of Twitter usage of three health organisations. The findings show that Twitter was used as a platform for communication during the event.

### 6.3.1 Overview of Event

In 2012 an outbreak of Legionnaires' disease occurred in Edinburgh, Scotland. Legionnaires' disease is a serious form of pneumonia caused by legionella bacteria and can result in a fatal lung infection (NHS Lothian, n.d.). It is spread through infected droplets of water which are inhaled, therefore it is not contagious (NHS Lothian, n.d.). Depending on the source, potentially thousands can be at risk. In this case, the source of the outbreak was a cooling tower meaning that the population of the south-west area of Edinburgh was affected by this outbreak (NHS Lothian, 2013).

The first case of Legionnaires' disease was identified May 31, 2012 and the outbreak was declared on June 3, 2012. Throughout the outbreak Nicola Sturgeon, the Health Secretary for Scotland (at the time) released daily updates on the number of infected and suspected cases, as well as the identification and treatment of the source. A special helpline was set up on June 6, 2012. This dedicated helpline was available for the Scottish population to contact if they had any concerns, to ask about symptoms and to seek advice. Information leaflets were also sent to households in the affected area on June 7, 2012. Media coverage of the event from June 3, 2012 led to increased public awareness of the outbreak of the disease in Edinburgh (NHS Lothian, 2013). From the week commencing

June 4, 2012 NHS Lothian primary care practices in the affected area experienced increased telephone and face-to-face consultations (NHS Lothian, 2013). This increased further after the establishment of the special helpline and leaflet drop (NHS Lothian, 2013).

Although regulations are in place in Scotland to keep water out with the temperature range which is suitable for legionella bacteria to breed, outbreaks do occur. A total of 92 cases were identified in the outbreak, of these 56 were confirmed cases and 36 were identified as probable cases (NHS Lothian, 2013). Of the formally identified cases, four died (NHS Lothian, 2013). With respect to the size of the outbreak, there was less morbidity and fewer fatalities than in previous cases (NHS Lothian, 2013). An outbreak the size of the one which occurred in 2012 had not been seen in over 20 years.

### **6.3.2 Findings from Official Twitter Accounts**

The following is an analysis of the use of Twitter by three organisations throughout the outbreak of Legionnaires' disease in Edinburgh. To begin, a summary of the use of Twitter by the three organisations is provided. The section then focuses upon highlighting the different types of messaging that was used during the outbreak of the disease.

#### **NHS Lothian**

NHS Lothian's Twitter account, @NHS\_Lothian, had 3607 followers at the time of collecting the data. Between their first tweet related to the event, on June 5, 2012, and when the outbreak was declared over, July 17, 2012, a total of 112 tweets were posted through their account that related to the outbreak of Legionnaires' disease. Of these, 44 were authored by NHS Lothian and the remaining 68 were retweets of other users.

Twitter was first used by the organisation on June 5, 2012, two days after the

outbreak of the disease was announced. The Twitter activity of NHS Lothian is shown in Figure 6.9. As can be seen the highest amount of Twitter activity occurred on June 6 and June 7, which coincided with the establishment of the helpline and the leaflet drop. After the initial surge of activity, on June 6 and June 7, there was a decreasing trend in the number of tweets released by the organisation per day.

On review of the tweets authored by NHS Lothian, the two most retweeted tweets were:

*Read our fact sheet on legionnaires'. It's full of up-to-date and accurate health information and advice <http://t.co/MpohZCzF>*

- 15 retweets June 6, 2012

*If you have questions about the Legionella outbreak in Edinburgh contact the special NHS24 Helpline on 08000 858 531*

- 10 retweets June 10, 2012

The two tweets provided factual information about the event. The first directing users to an online fact sheet about the outbreak and the second tweet provided details of the special helpline which was set up to deal with questions about the disease.

### **Scottish Government Department of Health**

The official Scottish Government Twitter account for news on public health, sport and Scotland's NHS is @scotgovhealth. At the time of data collection the account had 2365 followers. Between the release of their first tweet on June 6, 2012 and July 18, 2012, a total of 90 tweets related to the Legionnaires' outbreak were tweeted through the account. The highest volume of activity occurred on June 6 and June 7 after which there was a general decreasing trend as shown in Figure

6.9. Of the 90 tweets, 13 were retweets of other users. This meant that the majority of messages were authored by the account.

On review of the Twitter account, of the tweets authored by Scot Gov Health, the two tweets which received the most retweets were:

*#legionnaires The number of confirmed and suspected cases of Legionnaires' disease now stands at 80 - 36 confirmed and 44 suspected*

- 19 retweets June 9, 2012

*A dedicated helpline has been set up by @NHS24 to provide advice on #Legionnaires - call 0800 0858 531*

- 18 retweets June 6, 2012

The two tweets provided factual information. The first tweet provided details of the latest figures of the number of people confirmed with the disease and the number of suspected cases. The second most retweeted tweet provided information of the special dedicated helpline set up by NHS 24.

## **NHS 24**

Finally, NHS 24 Twitter's account was also analysed. At the time of collecting the data, NHS 24 had 1685 followers. Compared to NHS Lothian and Scottish Government Health accounts, NHS 24 had far less Twitter activity related to Legionnaires' outbreak with 24 tweets identified as being related to the event. Of the 24, 13 were original tweets and the remaining 11 were retweets of other users. The first tweet by the organisation related to the outbreak was tweeted on June 5, 2012.

The majority of tweets related to the outbreak occurred in the first few days. The distribution of the tweets is shown in Figure 6.9.

Although NHS 24 had a lower number of followers than the other two, one of their tweets gained a higher number of retweets than any of the tweets released by NHS Lothian and Scot Gov Health. The most retweeted tweets were:

*The Special Helpline number to provide advice on the recent Legionella outbreak in Edinburgh is 08000 858 531 #Legionnaires*

- 32 retweets June 6, 2012

*NHS 24 medical director issues advice following Legionnaires outbreak in Edinburgh <http://t.co/lbCGBkhhk> #Legionnaires*

- 17 retweets June 8, 2012

The first tweet provided factual information in which the details of the special NHS 24 helpline was given. The second tweet provided a link to advice regarding the outbreak issued by NHS 24 Medical Director.

### **Review of Twitter Messaging**

The above provides a basic overview of the use of Twitter by the organisations. It was observed that the three accounts were not used immediately. The first Twitter account to tweet about the outbreak of Legionnaires' disease was NHS 24, who did so on June 5, 2012. Figure 6.9 shows the distribution of tweets by the three organisations, with similar trends in all three. At this point the types of tweets are now considered to gain an understanding of the type of messaging used by the three organisations.

In total, 226 tweets were collected from the organisations. To provide an understanding of the types of tweets released during this risk event, the following provides a number of tweets from the three Twitter accounts and presents a short discussion around the different types of tweets.

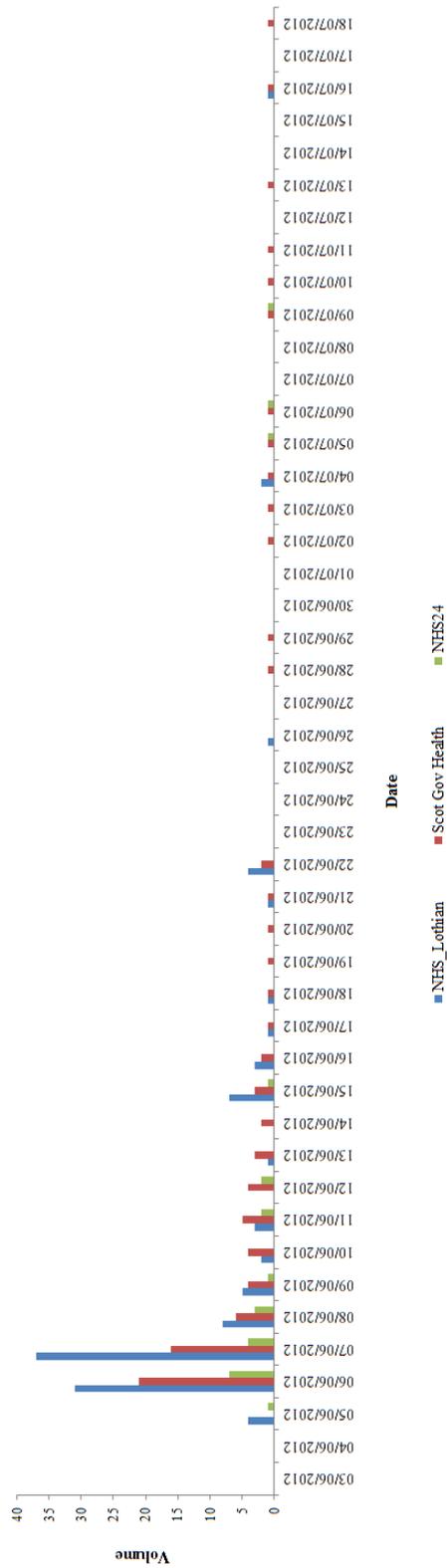


Figure 6.9: Twitter activity of three health organisations over the outbreak period of Legionnaires' disease.

The following tweet, was the first tweet by NHS 24, it acknowledged that the outbreak of the disease was continuing to feature in the media. It provided a link to more information about the symptoms of the disease.

*Legionnaires disease continuing to feature in the news. Further information on symptoms <http://t.co/PHok8cgo> #Legionnaires*

@NHS24 (June 5, 2012)

A number of tweets focused upon the drinking water as there were concerns that the virus could be contracted through drinking water. The following tweet is an example of this.

*@NHS\_Lothian Drinking water is completely safe - the virus is not passed on by drinking water #legionnaires*

@scotgovhealth (June 6, 2012)

Several tweets were used to reassure the public that the risk to the population was low. The following tweet is an example of this.

*@NHS\_Lothian Doc advises there is a very low risk to the public and people should go about their daily business as usual #legionnaires*

@scotgovhealth (June 6, 2012)

The following tweet by @scotgovhealth shows Twitter was used to correct misinformation. In this case, the tweet corrected Twitter user @BBCJamesCook. The tweet corrected the incorrect information which had been tweeted by @BBCJamesCook in a previous tweet that 12 were intensive care, not 24.

*@BBCJamesCook 12 are being treated in intensive care not 24 #legionnaires*

Many Twitter messages were used as a directional tool, directing users to further information sources.

@scotgovhealth (June 6, 2012)

*The Special Helpline number to provide advice on the recent Legionella outbreak in Edinburgh is 08000 858 531 #Legionnaires'*

(@NHS24 June 6, 2012)

Twitter was also used to try to stop people blaming 'sources' for the outbreak of the disease as shown in the following tweet by NHS Lothian. This tweet is one in which NHS Lothian had retweeted by Twitter user @STVNews.

*RT @STVNews: Health Secretary urges against pointing fingers over Legionnaires cases <http://t.co/guXOOxI0>*

@NHS.Lothian (June 6, 2012)

The next tweet is also a retweet of another user. This tweet quoted Nicola Sturgeon to state that the risk of the disease was low and that it was not contagious. The tweet exceeded the 140 character limit, hence why it is truncated.

*RT @GillianWheelan: Sturgeon: Risk to general public is low. Legionnaires' disease is not contagious. Can't be passed person to person o...*

@NHS.Lothian (June 6, 2012)

Twitter was used to retweet praise from other Twitter users. In the tweet below, it highlighted that the management of the outbreak of the disease was being managed well.

*RT @EmmaBurnettx: Great praise for NHS Lothian dealing with #legionnaires in the Scottish Parliament meeting this morning*

@scotgovhealth (June 7, 2012)

The following tweet showed that Twitter was used to reply to individual users and stemming from the reply the Twitter user replied to them with thanks. In this case NHS Lothian retweeted a reply by a Twitter user. The tweet compliments NHS Lothian and acknowledges the prompt response of the organisation.

*RT @89Hannah89: @NHS\_Lothian thanks for prompt response:-)impressed with how hard NHS Lothian staff r working,v appreciated by local res...*

NHS Lothian (June 7, 2012)

The following tweet highlighted that the key message was the risk to public health was low in the certain area of Edinburgh affected by the contaminated water.

*STATEMENT: The key message within south-west Edinburgh is that the risk to public health is low #legionnaires*

@scotgovhealth (June 7, 2012)

Twitter was also being used to note that GPs in the community were handling the identification of cases well. The following tweet is an example of this.

*Number of legionnaires' cases treated in community shows GPs are doing well to identify cases quickly*

@NHS\_Lothian (June 7, 2012)

Another tweet was used to state that the health services were busy, but they were coping with demands. This was a retweet of a news organisation tweeting a quote of NHS Lothian.

*RT @STVEdinburgh: NHS Lothian services are “busy but coping”  
with the demands on them #Legionnaires*

@NHS\_Lothian (June 7, 2012)

The following tweet is another example of how Twitter was used to state that the risk to the public was low. Additionally this tweet also references Nicola Sturgeon’s official Twitter account, stating that the public should still look out for symptoms.

*MT @NHS\_Lothian: Advice is the risk to the general population is low.  
@NicolaSturgeon reminds us to look out for symptoms #legionnaires*

@NHS24 (June 7, 2012)

The next tweet used informal language. The tweet directed users to further sources of information, in this case the special helpline.

*Good morning all, just a reminder that anyone still worried about  
#legionnaires should call the @NHS24 special helpline on 0800 0858  
531*

@scotgovhealth (June 15, 2012)

The following tweet stated that there had been another death related to the outbreak, however the message also stated that they believed that the outbreak had peaked.

*Sadly a second person linked to the Legionnaires outbreak has died.  
Despite this sad news we still believe the outbreak has peaked*

@NHS\_Lothian (June 15, 2012)

### 6.3.3 Pilot Study Findings: Summary

The analysis of Twitter data from the three organisations showed that Twitter was being used as a means of communication by health organisations during the outbreak of Legionnaires' disease. The analysis of the official Twitter data showed that there were examples of reassuring messages; Twitter being used to directly correct misinformation; Twitter being used as a platform through which the organisations were asked and responded to questions; the organisations receiving praise and then sharing that praise by retweeting the message; organisations factually stating correct information; responding to concerns raised by the public regarding drink water and contracting the disease; organisations retweeting tweets of other health organisations; organisations retweeting media organisations; Twitter accounts being used as a directional tool, providing links to further information; providing information of the status of the event and providing details of the helpline.

As the Twitter accounts were also used to retweet tweets of partner organisations, this meant that the same message was released by multiple organisations providing consistency in the messaging. Furthermore, it also extended the reach of the messaging. NHS Lothian retweeted a lot throughout the event. They retweeted partner organisations as well as news media, showing they were engaging with other users through Twitter.

In general many tweets contained the hashtag with the word 'legionnaires'. Almost all tweets contained the word 'legionnaires' or 'legionella'. The use of hashtags differed between accounts, with the Scottish Government Health account using the hashtag in almost all of their tweets.

To summarise, Twitter was used to varying extents by the three organisations. The messages on Twitter predominantly provided information about the event, but it was also used to respond to Twitter users creating a dialogue. A number of messages were reassuring and from review of the Twitter accounts it was very clear

that the risk to the public was low. It was clear that the Twitter accounts were being used to highlight that drinking water was safe to consume. The Twitter accounts appeared positive with regard to the handling of the event, highlighting that GPs were doing well to identify cases and that although services were busy, they were coping and finally praise from other sources also highlighted that the organisation was handling the event well.

## **6.4 Semi-Structured Interviews: Findings**

Semi-structured interviews were carried out with participants in health organisations in Nova Scotia and Scotland. To begin, this section provides a brief reminder of the participants. The remainder of this section, and the chapter, details the findings of the interview data which were thematically analysed.

### **6.4.1 Profile of Participants**

The interviews aimed to understand the role of Twitter in health organisations as a platform for communication during a risk event. Participants from organisations in Nova Scotia and Scotland had varying roles in the organisations. The roles of participants included Directors of Communication, Communication Officer, Emergency Planner, Chief Medical Officer, Medical Officer and Public Involvement. Many participants were professionals within the communications teams in the organisations. As identified, a number of participants with other roles in the organisations were also interviewed. The varying roles allowed insight into some of the organisational aspects. Finally, a number of participants held senior positions in the organisations and provided a different perspective on the use of Twitter providing insights into organisational aspects.

In both areas, participants were drawn from a range of organisations based at both governmental and local level; as well as from organisations predominantly

serving an urbanised area and organisations predominantly serving a rural area and lastly, differing organisational experience of Twitter. The varying roles of the participants and the different organisations allowed insight into a range of perspectives on the use of Twitter.

## **6.4.2 Introduction to Themes**

From the analysis of the interview data 16 themes were inductively identified. Each theme is listed in Table 6.5 along with a short description. The findings of each theme are presented in Section 6.4.3. The findings from the two cases, Nova Scotia and Scotland, are presented together due to the similarities of the two. A summary of the differences between the two cases is addressed, in detail, in Chapter 8.

## **6.4.3 Thematic Findings**

In order to present the interview data in a logical and concise manner the themes are introduced individually and a narrative summary has been developed for each theme. To preserve the interview data, the thematic summaries are presented in a quote driven approach. The themes and their associated findings are presented below.

### **Purpose of Twitter Account**

*“[W]e have to ensure we are speaking to as many people as possible in direct a way as possible and social media is a great way of doing that”*

Interviewees were asked to explain the purpose of the organisation’s Twitter account. It was found that there were a number of purposes of the organisations’ Twitter accounts, these were 1) to directly communicate with the public, 2) a way to release positive information about the organisation, 3) as a way of having

<b>Theme</b>	<b>Description of Theme</b>
Purpose of Twitter Account	This theme details the issues around the purpose of the organisations Twitter account.
Using a Mix of Communication Channels	This theme highlights the use of Twitter as part of multiple communication channels.
Media	The role of the media in communications.
Managing the Perception of a Health Risk Event	Use of Twitter to help manage the public's perception of a health risk event.
Consistent Messaging	Addressing messaging from the organisation and multiple partner organisations during a risk event.
Information Source for Organisation	The way in which Twitter was able to provide information to the organisation about a particular risk event.
Information Seeking	Relating to the way in which the public and media seek information during a risk event.
Misinformation and Rumours	Use of Twitter to identify and correct misinformation and rumours.
Engagement	The use of Twitter to engage with other Twitter users, both public and media users.
Trust	How Twitter use can build trust and confidence in the organisation.
Organisational Aspects	Organisational aspects impacting upon the use and development of Twitter.
Control of Messaging	Control of messages released through Twitter.
Individual Staff Knowledge	The knowledge and experience of staff within the organisation
Staff Training	Training in the organisation to support the use of Twitter
Potential Future Issues and Concerns	Addressing potential future issues of using Twitter and concerns of its use.
Audience	Expected Twitter followers of official account.

Table 6.5: List of themes with their respective descriptions.

a conversation with the public, and 4) to improve robustness of communications strategies.

A number of interviewees recognised that the way in which people accessed information was changing, many recognised that a growing proportion of the population were using social media to gain information and therefore, the organisation must also use the medium to provide information. Related to this, a strong motivation to use Twitter was to ensure they were doing their duty of effective communication. They therefore had to have a presence on Twitter to fulfil these communication duties. One Scottish interviewee noted that they have to be reaching as much of the public as possible: “we have to ensure we are speaking to as many people as possible in direct a way as possible and social media is a great way of doing that”.

Related to this, interviewees in both Nova Scotia and Scotland also stated that the Twitter account was being used as a way to directly engage with the public. One Scottish interviewee stated that the Twitter account provided the organisation “another way of directly engaging the public”. Similarly, a Nova Scotian interviewee stated that the Twitter account cannot be used only to push messages out but must also be used to engage: “we recognise that [our Twitter account] can’t just be a vessel to put out information without being able to engage and interact, because what we want to do is engage Nova Scotians through it”.

Twitter accounts were used as a way to release “proactive messaging”. Many Twitter accounts were being used to “disseminate good news about health services” and to release positive information about the organisation. Participants viewed Twitter as a suitable platform to “talk around the good news”, something which cannot be done with other mediums. Many noted that the short posts allowed informal, chatty-like conversations to take place. Participants explained that there was really no other medium available to them which allowed this informal communication. A Scottish interviewee highlighted that Twitter

was being used “to show the NHS does have a human side as well”. The respondent added “what we are trying to be is more open” and the Twitter account was being used “to be more accessible”.

One participant highlighted how it was also used to gain a sense of what else is happening on Twitter and to respond to that. So part of their use of Twitter was “to make sure that we are not just logging on, sending our stuff out, and logging off. We are checking to see what else is out there, that we might be interested in and we want to retweet and respond to [that] ... Making sure we are interacting with people and I am very, very strong on that: making sure that someone doesn’t send us something and it gets ignored”. Related to this, a number of interviewees highlighted that “it is also a way of having a conversation with members of the public”.

One interviewee stated that because Twitter “is quite an established channel now, people do use it as a point of asking questions”. Participants noted that Twitter was not always capable of answering these questions for various reasons. This included patient confidentiality and limited character length, therefore responses to these questions was more of a “signposting exercise” to other appropriate resources within the organisation or to partner organisations.

Several organisations explicitly mentioned that they were using it to improve their communication strategies. One organisation discussed how Twitter was being used to strengthen their communications. On a related note, other organisations had felt there was a gap in their communications and they felt this gap was the lack of use of social media.

Finally, the Twitter account was also used during a health risk event and “that was about disseminating information to the public at a time of crisis, at a time when the public needed reassuring but also reliable information”. Another interviewee stated “[s]o in an emergency mode it will be another tool in the box”, highlighting how it added to other more traditional aspects in the organisation.

## Using a Mix of Communication Channels

*“We want to make sure the information provided is going to be useful, timely, accurate, and efficient.”*

Participants from both Nova Scotia and Scotland recognised a need for a mix of communication tools. Traditional means alone were considered insufficient. Issues that emerged within this theme were: 1) multiple communication channels, 2) the public’s changing information preferences, 3) aspects differentiating Twitter from other communication channels, and 4) the extent to which social media was integrated into the organisations’ communication strategies. Findings about these issues are presented below.

Participants in both Nova Scotia and Scotland stated that effective communication required the use of multiple communication channels as the public had different preferences on how to access and gain information. When considering different channels of communication one Nova Scotian participant stated “we can’t rely solely on one or the other because we know that not everybody is there and not everybody ever will be there and ... we have an ageing population here in the province so we can’t always guarantee that everybody is going to be using one platform or another”. A Scottish participant stated: “I think we use [Twitter] as a way of talking to a very specialised audience, a very interested one, but the million people who read BBC online at lunch every day will always be key to us, but [Twitter] has its place within a mix of channels...[we are] using it where it is appropriate, but also not seeing it as the solution to everything and using it as part of a wider communications mix.” As indicated earlier, interviewees noted that they could not expect certain portions of the population, particularly the older generations, to be using social media and therefore more traditional means such as news articles were viewed as a more appropriate way of capturing this audience. Alternatively, there was the indication that using Twitter may

capture people who are not using traditional mediums: “we know that not everybody watches the news, we know that not everybody reads a newspaper... or they might not care about the news at all. So the advantage of using [Twitter], primarily, is that we can get this information out to an audience that may not access the traditional sources”.

On a related issue, participants stated that the ways in which the public were accessing information was changing. For example, the decline in newspaper sales was mentioned by participants. Participants recognised the “need for the traditional way of providing information to the public and the media through news releases, radio” but also that there was a change in preference and popularity towards social media by the public and they recognised “that we kind of have to make that shift as well and put that information there. We know that people are using social media, for example Twitter, so we need to provide that information there as well”.

A number of differences between Twitter and other channels of communication were identified by the interviewees, specifically they recognised that the format of Twitter was significantly different from other mediums. Firstly, addressing the process of how messages were released. One Nova Scotian interviewee highlighted that traditional styles of media have formal processes supporting their use, whereas Twitter did not have a formal process: “in terms of the message sent out, do these differ from other TV, radio etc? And I would say very much so. There is a formal process for media releases and there’s a different format for media interviews and tweets”. A Scottish interviewee noted that fewer stages of approval were necessary to successfully use Twitter: “it’s not something that has to go through 40 stages of approval before it can be sent out, because if you do that there’s no point.” The interviewee stated that if there was a long approval process, tweets could not be sent out fast enough, noting that the aim of Twitter was to provide up-to-date information. If it could not be used to put information

out quickly due to a long approval process then they would not be using Twitter in the way it was intended. There was a difference in opinion between the approval of messaging on Twitter between Nova Scotian and Scottish interviewees and this will be discussed later.

The second aspect of Twitter which distinguished it from other channels of communication was the limited length of message. This aspect was raised several times along with the question of whether that makes Twitter the most appropriate way to provide information. Many interviewees expressed the concern that due to the lack of characters, details of the message can be lost “if you can’t go beyond the what is it 140 characters? That limitation in itself is a challenge to get that level of detail, and I heard the best expression: ‘sorry I wrote so much I didn’t have time to write less’. It’s very challenging to write less because you want to make sure your message is clearly understood and succinct.” Some interviewees discussed the use of links in tweets which can be used to direct users to further, more detailed information which would be found on the website. However, this was limited by the speed at which the website was updated. Interviewees noted they could only provide links to further information once the website had been updated. Particularly, Nova Scotian interviewees noted that their websites could be slow to be updated. Similarly, another participant was concerned that the limitation on the length of tweet could result in the message losing context: “Trying to get a [message] into the number of characters is difficult, it’s short and we have to be careful we don’t lose context.” Despite the challenges of trying to shorten a message to 140 characters or less, it was noted by interviewees that trying to get a message to fit within the 140 character limitation was “maybe no bad thing”.

The final issue of the use of Twitter and other social media, as part of a mix of communication channels, which emerged was the degree of integration within communication strategies. It was found that the degree of integration

varied between organisations. Some organisations highlighted that Twitter was an important tool and a strong part of the communications strategy and others felt it was not really being used. One interviewee had experience of using Twitter in a crisis event. The interviewee reflected upon the use of Twitter by the organisation and noted that during the event it was not used well. The interviewee, on review of the use stated “in a time of crisis [Twitter] should be the first thing that should be a priority instead of the last thing”. However, others discussed that it was not an established part of the communications strategy and was viewed as more of an add-on or an afterthought.

## Media

*“So our primary focus is media. We were once what would have been called the press office but with the, sort of, widening out of how people access information it’s now much bigger than that... we still primarily lead on media relations, that is still our bread and butter, but we also do things like how can we bypass the media and do direct public engagement?”*

Nova Scotian and Scottish participants discussed the role of the media with respect to their media and their importance to communicating with the public. Issues which emerged in this theme were: 1) the importance of the role of media within communications, 2) the news media’s tendency to focus on negative aspects of stories, 3) decline in newspaper sales, 4) how Twitter is now a source for stories for the media, and 5) the development of relationships with the media. Findings about these issues are presented below.

The importance of the media was evident in both Nova Scotian and Scottish interviews. Despite the increasing channels of communication, the media still remained an important focus for the organisations during a risk event, one Nova Scotian interviewee stated “media is a huge component of the work that we do”.

The interviewee explained that during a risk event certain media stations would be continually monitored. Similarly, Scottish interviewees explained that “we still primarily lead on media relations, that is still our bread and butter”.

Interviewees discussed the way in which the media framed a story. There was a general consensus amongst the interviewees that the media tended to focus on negative aspects of the story, “I mean they will always try and paint a negative”. Another interviewee agreed additionally stating the media will look for the “what-went-wrong, rather than the how-it-was-well-managed” aspect of a story as “that’s what sells newspapers”. Related to this, one interviewee remarked that in the organisation there “is a fear of putting a foot wrong ... the media always wants to criticise health”. The issue that health organisations were easily criticised was discussed in both Nova Scotian and Scottish interviews. One Scottish participant noted “I have to say that the amount of public scrutiny that NHS comes under is phenomenal and the way the media department responds to them and gives full answers, so if I as an individual reporter put [a question] in, they get an individual response.” This interviewee highlighted the demand on staff resources due to the media questioning and the Freedom of Information Act.

Specifically focussing on what the print media published an interviewee distinguished between the way in which the media framed the story and incorrectly reporting it. It was highlighted that the information reported by the media was usually not incorrect, but it was the way in which they would spin the story which was of concern. When discussing the media, the Scottish interviewee explained that “it is actually quite rare for them to publish inaccurate information, we have had some corrections and they may choose to expand on an element of the story that we wish they didn’t expand on, but that is different from it being wrong”. Discussion on the way in which the media would deal with a correction highlighted that it was not proportional to the size or placement of the original story. Therefore, a story could be front page news, but the correction could be a

small paragraph several pages into the newspaper.

In terms of popularity, power and influence, interviewees were in agreement that there had been a decline in the news media. One aspect which was noted was that the number of people buying newspapers had decreased significantly. Several of the interviewees commented on the nature of the print media, one interviewee discussed that the role of the media sources and their power and influence on opinions of the public were declining: “I used to say never underestimate the power of the media in terms of their influence ... I really think that is waning now, the proof of that is in the fact that people don’t seem to be reading newspapers as much now”. The interviewee also highlighted that people were not reliant on a single media site: “Fewer people are reading certain newspapers and fewer people are relying on one news media site for information potentially with the exception of the BBC who are still ... well they are just so well resourced”.

On a related issue, several interviewees highlighted how the media were using social media to find stories. They noted that posts on social media had in a number of cases become the focus of news stories. “So rather than social media following the mainstream media, it’s the other way around now, media follows social media and I found that interesting how it’s all turned on its head.”

It was noted by interviewees that news media in both areas had expanded from the traditional ways of communicating. News organisations traditionally used newspapers, however they also had an online site as well as some form of social media including Twitter and Facebook. Additionally, it was found that the media followed the health organisations on Twitter. During risk events, some health journalists, who had their own Twitter accounts, as well as the media Twitter accounts were retweeting messages from the health organisations to their own followers, this increased the reach of messaging far beyond that of the health organisations’ followers.

Finally, a number of the organisations, in both Scotland and Nova Scotia,

also discussed how their relationship with the news organisations were developing. Although, as expressed above, news media tended to focus on the negative aspects of the story, in some cases organisations were building relationships with the news media, in particular with the health journalists in the news media. Furthermore, several of the organisations had started to write columns in the local newspaper and it was expressed that this was due to the older population in their area. These areas with an ageing population found that releasing information through newspaper articles was still an effective way to communicate with their population. One Nova Scotian participant noted: “we definitely have an older population and definitely younger people are leaving...that’s partly why I think the newspaper ends up still being a really good communication tool because it is a lot of older people who read the paper cover to cover and once it’s in there you know a message will get out.”

### **Managing the Perception of a Health Risk Event**

*“If you aren’t out there quick enough the public will make up their own version [of the event] and you’ll try to recover it...and now you have to change that perception and it’s very difficult to do if you are not in that realm at that time. So that’s what we’ve found, you have to be there to see what’s being said. Or even getting out in front of them at some point, so that your perception of what’s going on is the public’s perception and they don’t make it up on their own, which is often what can happen.”*

Interviewees talked about setting the tone of the event and getting out there first as they believed it was more difficult to change the perception of event. If the organisation released information first, and then the media and other sources released information, the public had to decide what information to believe. In terms of managing the perception of a risk event a number of issues emerged,

these were: 1) media release of information, 2) public providing information, and 3) changing perceptions of event. These are discussed below.

When specifically discussing information released during a risk event the idea of getting out ahead of the media emerged. The interviewees raised the difficulties of trying to change an opinion - therefore they were in favour of releasing information first. However, the media were often quicker releasing information. Additionally there was discussion about not releasing information. One interviewee raised the point that if they do not provide information it has been seen in other risk events that citizens take it upon themselves to become an information source.

Within the interviews there was the general consensus that it was important to be quick with messaging in order to set the tone, and Twitter was used to do that. "I think I mentioned earlier, to get in early to set the tone of how the public are going to see you in that emergency ... the idea is to get out in front and make sure people understand all the dynamics of what's going on and then at least if somebody tries to steer it in the wrong direction people have a choice to make and that can work in your favour". The interviewees specifically focused on the difficulties of trying to change a perception, they noted it was very hard to do so and therefore by getting out in front of the public and the media it allowed them to set the tone of the event. In cases where the media released information first, and as noted earlier they may focus on certain elements of a story that could cause issues as the event then became about managing something unrelated. "I think what I said earlier about getting out in front of these things very early can help to make sure public perception is the correct one and that doesn't go off on its own and create something that isn't there." One interviewee noted that a message from the health organisations carried more weight than that of the media or members of the public. Therefore a message by the organisation could be used to change the perception of an event, but it was noted that this could be

difficult.

A Scottish interviewee spoke of how Twitter had been used during a risk event stating that it was used when the “public needed reassuring, but also reliable information” another interviewee similarly stated that Twitter was used as a way of reassuring the public. In terms of risk events the interviewee stated that Twitter was a way “to get direct messages out and it’s extremely useful in times of crisis in terms of offering reassurance and attempting to calm down an emergency situation”. Finally, one Nova Scotian interviewee similarly stated she had used Twitter during a risk event to reassure the public “I was trying to put out something reassuring and say you know public health are looking after it” in order to calm a situation.

### **Consistent Messaging**

*“[I]t is very important to have consistent messaging ... I would suggest that centralised control would ensure consistent and appropriate messaging”*

Consistent messaging was stressed as highly important during a risk event, as inconsistent messaging could cause panic and confusion. The issues in this theme were: 1) inconsistent messaging, 2) consistent messaging across organisations, 3) consistent messaging at differing levels, and 4) consistent messaging across platforms. The findings of these are detailed below.

The interviewees identified three important aspects of consistent messaging. The first aspect of consistent messaging is shown through examples of inconsistent messaging. The interviewees touched upon past experiences of where inconsistent messaging caused an “utter storm”, where members of the public were travelling hundreds of miles to get a vaccination. One interviewee stated “I would argue having that centralised control point, that is sufficiently resourced with expertise and people, ensured that they even got down to the point of who was going to

release the information first, who was going to release it second, and who was going to release it third and each would contain the exact same information in it.” The interviewees stressed that during an event, they did not want attention to be taken away from the actual event and they specifically referred to inconsistent messaging and lack of messaging by the organisation. They do not want to have to use already limited resources during a time of crisis to deal with issues arising from inconsistent messaging.

When referring to consistent messaging, this extended to not only communications by the organisation but also the organisations who were also involved in the event and were releasing information. It was recognised that different areas of the country may be affected in different ways, Nova Scotian participants stated that they will still try and remain as consistent as possible with the messaging and decisions coming out at a national level; “you have to make sure that your local messages aren’t in direct conflict to messages coming out at the national level”.

Finally, in terms of messaging across all different channels of communication, to ensure consistency one interviewee stated “we’d make sure things kind of happen all at once, so one person would be sending out the news release, one person would be updating our website, one person would be doing internal communications that would all kind of happen at the same time.”

### **Information Source for the Organisation**

*“[T]hen it was about what information does everyone have? What information do we need to put out there?”*

Another aspect of Twitter was the wealth of information which was available. Issues in this theme were: 1) how it can be used to gain information in a risk event, 2) using it to predict questions from the public, and 3) accessing what the public are discussing. The findings are detailed below.

Interviewees talked of how Twitter had been used as an important source to gain information regarding an event: “I use Twitter a lot, on a regular basis, to get a better understanding of what’s going on in a particular event or time to see what the public’s really discussing”. One participant noted that in their organisation “most of the work that we do in our operation centre tends to be around getting feeds of information back from Twitter, from social media to give us a better understanding of what’s happening in the field”. Participants explained that during an event members of the public would be posting information online, including photographs of how the event was unfolding: “but people who are standing by an accident scene are actually tweeting and they are actually telling you what is going on, so if you can get the right sites you can actually gather a lot of information even before that event hits your desk.”

There was also the idea that it can be used to predict questions “[w]hich is another reason for us to be monitoring the social media sites because it at least gives us a sense of where at least a proportion of the public are at but also anticipating where we may get questions or opposition or whatever.”

Through this medium they have been able to find out what is happening in the ‘grapevine’ something that was previously unavailable to them. Participants noted that not only did Twitter allow the organisation to become aware of things, but the organisations are also able to directly respond.

Some organisations had experience using it during health risk events. A number talk about the way in which they were able to gain information through monitoring Twitter using keyword searches. “Ironically, sometimes we got information that was correct that we didn’t know. Maybe once or twice and there was a couple of things that came out and we were like hang on is that a thing and we went and checked it. And, it was, in some ways, an early warning system and we do use it that way in terms of trying to anticipate. In politics when you start to see people starting to tweet about something, actually about this time

on a Thursday, half an hour before first ministers questions. What people talking about on Twitter, what is likely to come up? Obviously today is quite obvious because today it is referendum day so it's fine, but there's days where you do keep an eye on what key people are saying across Twitter just to think what may come up, so it's a very ... it doesn't always provide the answer but it is a useful source of intelligence and certainly one that we keep an eye on."

Finally, related to Twitter as an information source. Many of those interviewed, the participants, used Twitter to follow health stories, and in some cases it was their main news source. Interviewees highlighted how they were able to stay up to date on many health issues just by following certain Twitter accounts.

### **Information Seeking**

*"[W]hen an event happens [and] whether it is a teenage suicide or whether it is a bombing in a marathon ... The number of people subscribing to social media goes through the ceiling. And so you just have to be in the position where you have processes already in place"*

Interviewees noted that during a risk event, information seeking by the public and media increased. This theme addresses the way in which the public actively sought information through Twitter during a health risk event. The issues in this theme were: 1) increase in Twitter followers, 2) changes in information seeking, and 3) media demand for information.

Organisations in Nova Scotia and Scotland stated that during a risk event their number of followers on Twitter increased substantially. One interviewee stated that it was the single greatest way to gain an increase in followers. One Nova Scotian interviewee stated "funnily enough risk events are one of the main spurs for this event and for the "Oh they use Twitter, I will follow them in that"". Similar experiences were noted by a Scottish interviewee: "I was speaking to head of comms at X and he was saying ... in the second really bad winter ...

they couldn't believe the surge of followers that they got when winter hit because people wanted information and then when winter had calmed down their first priority was how do we keep these followers."

Several interviewees noted a change in information demand. They stated that there was a continual round-the-clock demand for information. One interviewee reflected on how the process had changed over time: "It used to be a very structured process in that you used to have the morning to get yourself sorted out, and by 2 o'clock in the afternoon you had to have your press conference so it could be on the 5 o'clock news. And what I hear consistently now is it's a 24 hour type of organisation." This continual demand was found in both Nova Scotian and Scottish interviews.

Finally, during a risk event, interviewees noted the demand by the media for information: "there is a constant barrage of phone calls from the press saying latest update, latest update, latest update." This led to a constant pressure on the phone lines.

### **Misinformation and Rumours**

*"And a lot of the time, it wasn't even so much answering questions but shutting down rumours ... shut it down from a factual point of view, and that was as much as reassuring the public as about making sure the story didn't grow arms and legs with the media even more than it had by that point."*

A previous theme identified that interviewees were able to use Twitter as a means of gaining information about the event and this included misinformation and rumours. This theme specifically focuses on the use of Twitter in relation to misinformation and rumours, issues in this theme were: 1) identifying misinformation and rumours, 2) correcting misinformation and rumours, and 3) credibility of sources. The findings are detailed below.

A number of interviewees highlighted that they were able to gain an understanding of what the public were discussing with respect to a risk event and this was used to formulate messages. One interviewee described experiences of using Twitter to find misinformation and rumours during a risk event and how Twitter was used: “so we were just doing general [keyword] searches, going through all the stuff and if things were getting traction and being picked up we would ...tweet reports of ‘such and such not true, current death toll’. We try not to rubbish things, we try and just factually correct.” Another interviewee highlighted the way in which Twitter can be used to deal with misinformation and rumours: “if there is misinformation then we can kind of enter that conversation and either clarify or direct to information on our website that will provide them with the accurate information”.

A related issue was the way in which sources can easily appear credible on Twitter, therefore official looking sources may not be as official as perceived: “experts can put up information who are not really experts, so there is a function of our social media that we have to provide timely and accurate information and having that centralised control means that all they are doing is the final sign off on the written release of the document”. Some interviewees noted that Twitter accounts can be verified, meaning that Twitter, the organisation, had checked the owner of the account and confirmed the users was who they claimed to be. Therefore, if an account had been verified, it was seen as a way of helping Twitter users verify the authenticity of the account.

## **Engagement**

*“[T]wo way communication is crucial to success”*

The nature of Twitter was found to allow engagement between users as it removed barriers to interaction. The degree of engagement through use of Twitter with the public, other organisations and media varied. The main issues in this

theme were: 1) use of Twitter for direct engagement, 2) removing barriers to interaction, 3) the more you invest the more you will get in terms of engagement, 4) engaging with other organisations, and 5) difficulties of two-way conversations. The findings are detailed below.

A strength of Twitter expressed by both Nova Scotian and Scottish participants was that it allowed direct engagement with the public. Direct engagement was discussed from several different perspectives. Firstly, interviewees discussed how direct interaction allowed them to bypass the media and engage directly with the public and other organisations. One interviewee stated: “the way in which we interact directly is absolutely here to stay; something that none of our forefathers would ever have recognised or even taken into account”. The interviewee also discussed how Twitter had changed his job within communications and how it allowed the organisation to communicate with the public directly “we have to use [Twitter] and for me as a communications professional it’s ideal because it allows you to communicate directly with the audience”. Lastly, the direct engagement meant that they could communicate with the public directly and not through the media: “previously you always [had to] apply a media filter to everything going out, we would put out something that is positive and the media would take that press release and turn it around and say ‘well actually that’s a terrible thing that you are doing’ and we would have no influence on how that appeared in the paper”, it was noted with Twitter the organisation was able to release information without the media altering the message.

The second aspect of direct engagement related to feedback and interaction with the public. Participants highlighted that Twitter removed barriers to interaction and provided a way for the public to ask them questions and contact the organisation in a less formal way. A Scottish participant talked about experiences where the organisation had been receiving questions through Twitter: “So, we’ve got really good examples where there has been that three tweet interaction,

they've asked the question and we've responded and then they've said thanks." However, one participant noted with regard to engaging with Twitter users: "it's a thin line and it's a dangerous world out there. People will say all sorts of crazy things to you, and it's about knowing what should be replied to and what should be ignored. Some of them will be ignored."

One perspective on the use of Twitter, related to issues of inequity and people who may not traditionally have a voice which can change policies. A Nova Scotian interviewee considered that there were those who might not be "accessing the political system, they might not be voting, they might not be reading all their traditional media", so social media can be a way of allowing health organisations to "talk to people who are experiencing the issues". The interviewee recognised that to develop that type of relationship and to support that portion of the population "that means you need to be connected".

Twitter also facilitated a way for members of the public to praise the organisation and give positive feedback. A respondent stated that "to me what Twitter has done in terms of patient opinion is that it is allowing people instantly to say 'staff were fantastic' and we are starting to get compliments through that way now. We're using that to feed back to staff and say." It was noted that typically the organisations would receive formal letters with complaints, but not really receiving praise. The informal nature of Twitter allowed members of the public to say thank-you or express praise towards the organisation.

One interviewee talked about making the dialogue interactive and using Twitter as a direct form of communication. "I think it is what you make it and it's one of those things that you get out what you put in. So the more you engage the more you get back and we will continue to push that and I think from our point of view we would continue to push the level of engagement that we get from the public rather than pushing it beyond staff groups and informed audiences. That would be key for us. And I think just continue to do that. I can't see it going

away any time soon either. It seems to have taken hold quite significantly and I know there is always something emerging and to my mind there is nothing that seems to be a natural rival for it quite yet, or a natural replacement.”

Furthermore, interviewees argued Twitter should not just be used to send out information but the organisation should also be responding and looking to see what other information is out there; “So it’s to make sure that we are not just logging on, sending our stuff out, and logging off, we are checking to see what else is out there that we might be interested in and we want to retweet and respond to” and additionally to also “respond to people as well. So people who are asking us questions and responding to that and whether that is complaints, praise, questions, comments or anything making sure we are interacting with people and I am very, very strong on that making sure that someone doesn’t send us something and it gets ignored.”

Engagement also related to engaging with other organisations and bringing them into conversations on Twitter “because it’s open ... we can engage with other audiences and we can bring other stakeholders into the conversation or our partners’ campaigns”. Additionally, several interviewees highlighted the way Twitter was used to engage other organisations easily and quickly. The nature of Twitter allowed the organisations to mention another organisation in a post, or even to retweet each others messages which then increased the audience exposed to the message. Secondly participants found they were able to connect and engage with people they would not otherwise have met. They explained how it seemed easier to send a tweet than to write an email and from these tweets they were connecting very easily to other individuals and organisations.

One interviewee discussed the differences between Twitter and Facebook use: “what we’ve noticed is we’re getting a lot more engagement on Twitter than Facebook ... Now we post the same information in both places using Hootsuite ... but we are finding that we are getting more interaction through Twitter”.

Finally, several interviewees however raised concerns about how engaged an organisation can be, “I feel like with Twitter, as an organisation, it’s hard to be a two-way conversation. You know you can try, and I’m trying to think of any organisation I really follow, and occasionally you get a reply to something and then you realise ‘oh there’s a person there’ and you’ll have a conversation, but I think it’s hard as an organisation that’s why I really like if I ever use it more say in risk communication I think it would balance each other. I think it would be one source of information, but not necessarily a conversation ... if the organisation had its own Twitter account I think it would be a good thing, but maybe not so much engagement but who knows, we might decide to use it differently, but I feel like it would end up being more information providing.”

## **Trust**

*“I would also suggest that Twitter is also very effective around building confidence and credibility and if managed properly it will enhance people’s trust in the organisation.”*

Trust emerged naturally throughout the interviews. The main issues in this theme were: 1) distrust in politically associated organisations, 2) Twitter as a way to increase trust in the organisation, 3) trust in the Twitter account, and 4) trust in staff to tweet on behalf of the organisation.

There were differing opinions as to whether interviewees thought the public viewed their organisations as a trusted source of information. Some Nova Scotian interviewees questioned whether the public trusted government explaining “the public here has a general distrust of bureaucracy”. Another interviewee stated that the general trust was low: “I think governments in general aren’t really trusted”. It appeared slightly different in Scotland governmental organisation, one participant stated they were a trusted source of information adding “I certainly think the public sees us as a point of reliable information”. A difference

in opinion was found in the local level health authorities, where in their view the organisations were trusted, one Nova Scotian interviewee stated: “in terms of reliable source of information, I’d say yes” another agreed the public, for the most part, do trust the health authority.

On a related issue, a number of interviewees expressed that they perceived Twitter as a way of increasing trust in the organisation. One Nova Scotian interviewee stated “I would also suggest that Twitter is also very effective around building confidence and credibility and if managed properly it will enhance people’s trust in the organisation.” Other interviewees also felt that Twitter could be used to enhance trust and credibility in an organisation, an example of this was discussed. The example discussed by the interviewee was the recent use of Twitter by a Canadian NASA astronaut, Chris Hadfield whilst in space. Through the successful use of social media the interviewee stated “he is being credited with changing the entire perspective of the space program and he did that through Twitter and YouTube” and the successful management of the Twitter account, which was being managed by his son in Europe actually “put a much greater positive reflection on the space program which currently, right now, is in jeopardy of budget cuts”. Another interviewee highlighted that using Twitter as part of their daily communications would help build confidence and credibility in the organisation and therefore this would put an organisation in a better position for the use of Twitter during a risk event: “So I think as we develop perhaps more of an online presence on a day to day basis we get more credibility and it’s easier to flip the switch if there’s a big event.”

A number of interviewees discussed the difficulties of source credibility. It was noted that an individual can very easily set up an ‘official-looking’ Twitter account and not actually be an organisation. Several of the interviewees talked about having a verified Twitter account and how they believed this added credibility to the Twitter account. A verified account is one which has a verified

badge on the Twitter profile. This symbol is used to establish authenticity of the account. Twitter continually works on verifying accounts and some Twitter accounts had been verified and others had not, as yet.

Although participants raised the concern that they cannot expect everybody to use social media, participants also raised the fact that a growing proportion of the population access information solely through social media “I think a lot of people that are really into social media that’s where they get their information, they’re not using anything else. So then it is highly likely that they are being missed.” Building on that the interviewee added the concern “if we are not using the best communication vehicle or media, then that affects our credibility too, because people may say ‘where are they?’, ‘they’re not there’ or ‘they’re late’ or whatever and you just - that affects your credibility as well.” The interviewee viewed this as a driver to increase the use of social media in the organisation.

Finally, there was also an aspect of trust in staff to appropriately use social media. An issue which was raised in several interviews was trusting staff with the Twitter account “Being on call, being on Facebook sitting there. But that’s harder than it looks because you’ve actually got to have somebody you trust, are you really going to let them respond in a timely manner, give them the authority to respond?” However, participants recognised that they trusted their staff to do ‘incredible things everyday’, and questioned why should social media be any different: “staff are trusted to do incredible things everyday so this is just another thing, so why wouldn’t you trust them?” Another interviewee was also confident in staff using social media: “We are a small team, we are busy and I do have to trust them”.

## Organisational Aspects

*“The fact that we have a single Twitter account run by communications for the whole department tells you how cautiously we are approaching this.”*

Interviewees from both Nova Scotia and Scotland raised organisational aspects limiting the development of Twitter. The four main issues were: 1) slowness to change, 2) the risk averse nature of the organisation, 3) ban of social media sites, 4) technology resource issues, and 5) staff resourcing issues. The findings are detailed below.

Interviewees mentioned that their organisation was slow to change and this was highlighted in interviewees in both Nova Scotia and Scotland. One interviewee noted that their organisation had not adapted to the changing preferences of the public in the way they access information. They indicated that the organisation has not responded to that change well enough: “So if a growing percentage of the population is using Facebook, Twitter, other social media stuff and is where they get their information and less and less people are using radio, television, newspaper, then I’m not sure we’ve really adjusted to that world very well yet. So that to me would then say how effective are - is our messaging?” This viewpoint was echoed by other interviewees who noted that their respective organisations were slow to change.

Specifically focussing upon access to social media sites, almost all organisations had a complete ban on social media sites meaning staff could not access sites such as Facebook and Twitter on work computers. The difficulty of getting these bans lifted was noted and instead the bans were only lifted on the computers of certain individuals. There were several reasons cited for the ban which included time wasting, privacy concerns and bandwidth. However, one interviewee talked of how staff should not be asked to work without the proper tools and told employees to be brave and ask to have access. The organisations

were risk averse and did not want to do something which may impact negatively on the organisation in the future. Particularly in the Nova Scotian interviews it was highlighted that gaining approval for Twitter accounts was quite difficult. Extensive approval processes were required in several of the organisations: “we had to fight to get access to social media on Twitter, to get the security settings down”. The approval process involved seniors in the organisation allowing social media profiles to be set up, but also approval by IT to allow access to these sites.

One interviewee highlighted how the IT professional in the organisation did not want to give access to Twitter on the organisation’s network. The interviewee explained: “The IT person here was adamant I couldn’t get access to Twitter on work computers and he was really absolute, and I could have fought for it, I could have said ‘this is really important to my work’ and I could have gone through permission. But then we got these iPads from work but they’re not on the hospital system and I went to get mine and he’d signed me up for Twitter ... So it was weird, he was dealing with the privacy concerns of putting it through our work computer system (which other districts have resolved already), he is still dealing with that, yet he was fully aware it was useful and was excited for me to use it and be able to access it on [my iPad]”.

In many organisations there were also concerns regarding resource limitations in terms of technology. Interviewees reported that Twitter could not be easily accessed through the mobile devices they were given by the organisation. This limited their ability to update Twitter on the go and use it as it is intended.

Finally, there were also organisational aspects related to the number of people required to maintain a Twitter account. One Nova Scotian interviewee considered the use of Twitter in the organisation during a risk event: “To be using Twitter to, sort of, provide live updates that remains to be seen as that can be resource intensive, especially at regional level where we have fewer people to start managing issues like this.” Furthermore “you have to have someone specifically

dedicated to moderating these sites and if you are in the middle of an emergency situation it's a lot of work and how do you capture all of that information so you can make sense of it? And I think what I said earlier about getting out on front of these things very early can help to make sure public perception is the correct one and it doesn't go off on its own and create something that isn't there." The aspect of staff resources being potentially insufficient was noted in many interviews. Interviewees indicated that they were not sure whether they had enough resources to manage the Twitter account sufficiently.

### **Control of Messaging**

*"No I think it's a whole untapped area. How do we actually use social media as a way to really engage; understand public opinion on an issue; engage them in dialogue around the issue around solutions? You know that's pretty scary, I think, for government to kind of open that up because I think the concern of losing control of the process and as you let go. I'm not saying it's right but they are reluctant."*

An issue which emerged from Nova Scotian participants was the theme of control of messaging. It was apparent that in Nova Scotia there was a lot more control over the messaging released through Twitter. This theme did not emerge to the same extent in Scottish interviews. Participants in Nova Scotia highlighted that there was a strong control over messaging in the organisation and there was a reluctance to give staff the power to tweet without an official sign off of the message.

One interviewee reflected on their presence on Twitter "I think we are on Twitter but as a very passive in a very limited way", the interviewee attributed that to the tightly controlled environment. Another Nova Scotian interviewee echoed this opinion "there is a very controlled environment here so I don't think the organisation wants ... lots of people putting lots of things up there and

being attributed [to the organisation]”. Alternatively a Nova Scotian interviewee highlighted their confidence in those handling the Twitter account “when it comes to engaging in it, they do it with our direction and blessing, they are skilled at it, they know what they can say, they know what they can’t say. They are very tuned into saying the right thing at the right time. That’s the only way to describe it and they are well experienced”. Furthermore, a participant explained that the use of Twitter was slowed due to the organisational control, also indicating a very centralised control of messaging: “Well the use of [Twitter], recognition that we need to be using this [is] slow due to the overall government reluctance around losing control, losing you know that responsibility of the message and not having everything centralised, trusting your employees are gonna do the right thing when they are on social media.”

Scottish interviewees did not focus on the control of messaging to the same extent, but they highlighted that there were guidelines in place surrounding the use of Twitter.

### **Individual Staff Knowledge**

*“I think in some way our staff would be our greatest asset”*

Interviewees talked of the importance of staff knowledge and experience in relation to the success of the organisation’s Twitter account. The main issues were: 1) staff recognising and developing the use and success of the Twitter account, 2) how critical staff were to the success of the accounts, and 3) how staff who used Twitter in their personal life are more comfortable in using Twitter in work. These issues are presented below.

In interviews in both Nova Scotia and Scotland, interviewees described how important staff were to the success of the Twitter accounts. Personal knowledge and experience emerged as important to the development of the account. In most cases the use of Twitter was driven by individual staff. Many interviewees

described how the use of social media had been pushed through from the bottom up. A Nova Scotian interviewee highlighted: “A kind of grassroots use of social media is happening and that’s nice to see.” In most of the organisations the use of social media was driven by individuals in the communications teams and therefore there were many examples of how these individuals had developed the use of Twitter and other social media.

One Scottish interviewee talked about how, in his view, Twitter was not really being used effectively when he began. He stated “when I came in I felt it wasn’t being used well at all”. It was explained that Twitter was not being used throughout the week to provide updates, instead “what was happening was nothing was going out for three or four days and then on a Friday or a Thursday you would get like 10 things going out and you could tell that someone was like ‘have you done the social media thing yet?’ and they were like ‘oh no’ and it was all going out at once” and in addition to that it was being used as a one-way communication tool. The interviewee discussed how he had developed the use of Twitter so that tweets were released every day and also he ensured that it was being interactive. The interviewee found that this change had led to a consistent increase of followers.

Several participants explicitly stated that staff in the organisation were critical to the successfulness of the Twitter account. “I think in some way our staff would be our greatest asset if you like ... some have their own accounts already and they are brilliant”. Another interviewee highlighted the importance of staff to the success of the Twitter account “Yeah and I think [that Twitter] it’s really right now [and it] really needs an individual who understands [it] and is passionate about it, as opposed to it being really systematised”. Furthermore, in a number of organisations individuals in various parts of the organisations were setting up their own Twitter accounts: “there are a number of people who have their own personal Twitter accounts and use them. A lot of our program staff do because they ...

have a personal, invested interest in the area that they work”. It appeared that individuals in other areas of the organisation were setting up Twitter accounts as they had also recognised the benefits of Twitter and developed that further.

Another instance which highlighted the importance of staff knowledge was shown through the use of Twitter by a Nova Scotian participant. This participant used Twitter to engage with topical stories from a health perspective. The participant explained how they had retweeted a story and added a health perspective and then the “local CBC picked up on it”. This resulted in an interview with the local news station highlighting how staff who were comfortable with the medium used Twitter, to not only engage communities, but also to build relationships with community partners, media and radio organisations.

Finally, throughout the interviews, it emerged that staff who used social media in their personal life were more comfortable and tended to lead the use of social media in the organisation.

### **Staff Training**

*“I haven’t received any formal training, it’s more general knowledge and information sharing with other colleagues ... I live in an age where social media, Twitter, Facebook ... is becoming very common place ... for myself the learning curve has not been that difficult ... My colleagues who have not been exposed to it or have not ... grown up with this, there is a bit of a learning curve there. So for that I would provide training to my team”*

When interviewees discussed staff training, three issues emerged, these were: 1) a lack of formal training, 2) peer-to-peer training, and 3) learning by using the Twitter account. The findings are discussed below.

Repeatedly interviewees expressed there was a lack of training on social media in their organisation. All organisations had developed guidelines on the use of

social media, however formal training of staff to use social media and to make the best use of social media was very limited. Most participants highlighted that they had only attended conferences which either focused on social media or contained a social media stream. The lack of training meant the organisations were reliant on the personal knowledge of the staff. A Scottish interviewee highlighted the reliance their organisation had on personal knowledge of employees and this type of reliance was seen in most of the organisations: “we are relying on people having a personal knowledge of social media. So I have never been trained in any shape or form except what I use in my personal life, and it’s the same for the rest of the staff. I mean we have all been to a few conferences around it but nobody has been for bespoke training. What I would want to do, and again when we have the new structure in place, is say ‘Who are the people running the social media rota?’ and send them away to do some bespoke training to see how can they use it better”.

One Nova Scotian respondent suggested that staff training was linked to organisational culture. They stated that as social media was not an important aspect in the organisation and “because we haven’t opened up Twitter to any use” therefore “why would there be training for it?”

A number of interviewees discussed informal peer-to-peer training. Respondents talked about how they had shown others in the department how to use Twitter and as they learned new aspects of Twitter use they would then teach their colleagues. Many respondents discussed how they trained other staff from their personal knowledge and experience of it, again highlighting the reliance on personal knowledge. Some interviewees who had learned how to use Twitter through their role suggested that the best way to learn and become comfortable with using Twitter is just to learn by doing: “I came into it not being an expert and I’ve had to learn on the job”.

However, not all staff were confident in using any social media. One interviewee-

wee suggested there needed to be more training as they were worried about the confidence of some of the older staff to promote the social media sites. Older staff who were not familiar with Twitter tended not to use it or promote awareness of the use of social media with patients.

Finally, an interviewee raised a concern related to a lack of training and experience and potential consequences: “but you can sort of quickly see how that could become a slip or a trip, for maybe people who don’t have the experience. So I think getting the tool-kit right for people who do not have that experience is important.” Many interviewees raised the fact that the media followed their Twitter accounts, therefore a message which may be phrased incorrectly could be picked up by the media causing issues for the image of the organisation.

## **Audience**

There were differing opinions on who the audience of the Twitter accounts were. One Scottish interviewee stated: “I think it’s a more informed audience, it’s a more engaged audience I don’t think it captures swathes of the general public, we have some, but even then I think they are people who are actively engaged citizens, maybe an activist in their community a small proportion of our followers would be a general lay person who just wants a chat with the health service. It’s very much staff groups, staff umbrella groups, a lot of nurses, and people like that are a key audience, doctors, charities and the likes of that and I think probably we target with. Technology broadcast is more general public. I do think we get to a new audience.” Another interviewee thought their account was mainly the public, but also acknowledged that there were organisations who also followed the account “I think most of it is just general public and we have a load of organisations that follow us, charities, third sector, other health related bodies”.

Related to audience, one interviewee highlighted that a benefit of Twitter was the ability to reach a wide audience and a wide indirect audience with the

tweets, through the process of retweeting and therefore they were able “to reach a wide audience and a wide indirect audience as well”. As the organisations were followed by other health related organisations i.e. local health authorities, government health departments, these organisations would often retweet messages. Additionally, interviewees talked about news media following the Twitter accounts and they also retweeted messages.

### **Potential Future Issues and Future Concerns of Twitter Usage**

*“I just in the back of my head have a resourcing worry.”*

Finally, participants were asked about potential future issues and concerns of using Twitter within the organisation. The main issues were: 1) resource worries, 2) widening access of the Twitter account to other departments and more staff, 3) user base, and 4) control. This final section presents findings on these issues.

One concern discussed in terms of potential future issues related to resourcing worries, specifically staff resourcing. This concern was raised by both Nova Scotian and Scottish participants. Many interviewees considered the implication of a substantial increase in questions as may occur during a risk event. One interviewee considered that if they were overwhelmed with questions and these questions were not responded to then what impact would that have on the organisation’s reputation and relationship with the public. Many talked of having to find staff to be part of the communications team during an emergency as more people than usual is required. “I just in the back of my head have a resourcing worry. If thousands of people had been asking us questions on [Twitter]...”. A concern raised about the future use, surrounded opening new communication channels and not having the resources to effectively maintain these channels in terms of responding. One interviewee considered this issue: “I think we have to be careful here in terms of the resource that we need to put in to responding to the public and there can be a lot of reputational harm done if we set up a line of commu-

nication and then for whatever reason we don't respond, we have to be careful about that. It would be wrong to invite a public response and then not have the resource to carry that out, so that has to be carefully thought through - I think. And that comes back to the efficiency of the various accounts that we have for making best use of them. And other ones which we aren't getting what we want out of that, or aren't providing a service of the public and we have to be aware of them and focus on what we can do, I think we have to be very careful you know we don't want to open up lines of communication and then not communicate. It will do more harm than good."

On a related issue one interviewee also considered if the organisation was overwhelmed with questions. This interviewee was considering opening up the use of Twitter to more staff in the organisation, particularly outside the communications department. The issue here was staff training and control of the message "the challenge will be opening it up, should we allow access to the corporate feed to other departments?" The interviewee noted that to open the Twitter account up to more departments would require training and that could be a difficulty. A further concern related to this was related to reputational damage. Interviewees raised the worry that a tweet may be taken out of context or interpreted incorrectly and could become picked up by the media and create negative publicity for the organisation.

Several interviewees raised concerns about the user base. The interviewees were concerned that there were small numbers following the accounts. Additionally many interviewees were concerned over whether they were able to capture the 'right' audience by using social media.

There were also organisational aspects such as the tight control of messaging that was suggested may inhibit the development of the use of Twitter in future. Some organisations were reluctant to give up control of the messaging and did not want individuals responding on behalf of the organisation. There was also

the concern surrounding the lack of technological equipment. The majority of staff are unable to access social media sites on work computers and have to “fight” to gain access to it. The control by the organisation surrounding the use of Twitter can prevent them from really engaging and making full use of the Twitter account. Some accounts required more effort with regards to posting more and more frequently.

Finally, a number of interviewees identified that mediums such as Twitter become popular and then decrease in popularity “I think, in today’s age, we can’t rely on one medium. We know that the landscape is constantly changing”. Therefore interviewees considered that at some point in the future, Twitter may no longer be popular. They considered what would be the next big thing. One interviewee commented that he saw no natural replacement to it yet. However, the concern related to keeping up with what mediums are popular and the difficulties of this within these types of organisations. One interviewee questioned “where will we be in five years from now ... and therein lies another challenge. You just get a handle of how to do the tweets and then the next layer of innovation and technology come in to play, and the equipment as well.”

## **6.5 Summary**

To summarise, this chapter firstly provides an analysis of the use of Twitter by health organisations during an outbreak of Legionnaires’ disease in Edinburgh. The pilot study demonstrated that Twitter was being used as a means of communication during this event. Secondly, the chapter presents the findings of the thematic analysis of the interview data.

The interview findings revealed the importance of Twitter in communications strategies in the organisations during a risk event and more widely in the daily running of the organisation. The extent of use of Twitter was found to vary

between organisations. The importance placed on the use of Twitter, within the organisations, appeared to be related to a number of aspects. These included individuals in the organisation driving the use of Twitter; previous experience of use Twitter in past health risk events; organisational support of the use of Twitter; technology and staff resources and finally, degree of control over messaging.

As noted this chapter presents findings of the interview data of the two cases, Nova Scotian and Scotland, within one thematic analysis. The interviewees from Nova Scotia and Scotland were in general in agreement, with the two areas appearing at different stages of development of Twitter within their communications strategies and also the prevalence of use in the two areas. The main difference between the two cases emerged in terms of control of messaging in the organisations. Nova Scotian organisations appeared much more tightly controlled in terms of messaging and this appeared to be due to socio-political attributes within the organisations. Alternatively, in Scotland, there appeared more flexibility and trust in the communications teams to use Twitter effectively. The aspect of control of messaging provided difficulties for the organisations in terms of releasing updates through Twitter due to long approval processes. This issue is discussed in more depth in Chapter 8 where detailed comparisons between organisations and areas are made.

The second empirical chapter, Chapter 7, draws upon the interview data to develop a causal loop diagram. The causal loop diagram is developed as a way to understand the system structure. As identified in the interviews, the use of Twitter was typically driven by individuals in the organisation and there appeared to be a slowness in the organisation to formalise the use of Twitter and develop procedures, guidance, training and investment related to the use of Twitter. The causal loop diagram can help this disjoint as it provides a visual representation of the system. The causal loop diagram provides a tool for structuring discussion and understanding of the use of Twitter and its role during a risk event.

# Chapter 7

## Causal Loop Diagram

### 7.1 Introduction

Chapter 6 presents the findings of the Twitter pilot study and the thematic analysis of interview data. This chapter, alternatively, considers the problem from a systems perspective and presents the development of a causal loop diagram which qualitatively models the use of Twitter during a risk event. Considering the problem from a systems perspective is valuable in that a shift is made from an events cause events perspective to an appreciation of the structure of the system enabling identification of aspects that will improve the entirety of the system as shown in Figure 7.1. Changes made to system structure can provide higher leverage for lasting change. Although not explicitly acknowledged in SARF, the appreciation of the entire system and the way in which elements interact so as to produce amplification and attenuation of risk signals and wider effects in society is implicit.

This chapter presents an explicit representation of the use of Twitter by health organisations and identifies how to better manage the system for more successful use of Twitter as a means of communication during a risk event in the form of a causal loop diagram. Casual loop diagrams are a valuable tool allowing the

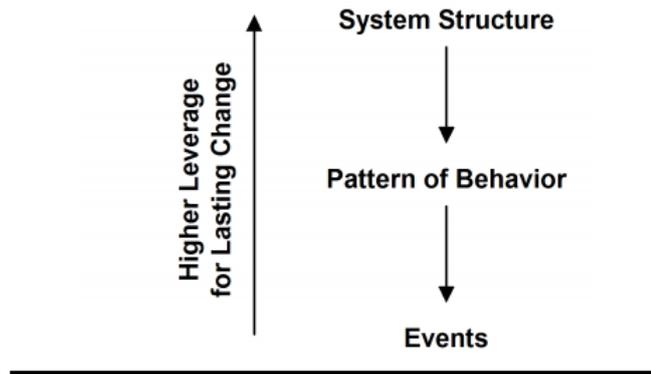


Figure 7.1: Looking for high leverage (Source: Kirkwood, 1998, p.2).

feedback structure of a complex system to be mapped explicitly, an important aspect which is often not included in mental models (Sterman, 2000). The purpose of this model is to make explicit the use of Twitter during a risk event so as to gain a better understanding of the real-world and to support decision making regarding the use of Twitter.

The chapter is structured as follows. To begin, the chapter reintroduces the modelling technique; how to analyse a qualitative system dynamics model and explanation of behaviours of feedback loops. The chapter then details the scope and purpose of the model. The causal loop diagram is then presented and the model is systematically analysed considering feedback loops individually in more detail and then the system as a whole. Leverage points within the model are identified and discussed. Details of model verification is then provided as well as feedback from participants. Finally, based on the causal loop diagram applied recommendations on the use of Twitter are given.

## 7.2 Causal Loop Diagramming

A detailed overview of causal loop diagrams is presented in Chapter 5, this section provides a reminder of key aspects of causal loop diagrams, the analysis of causal loop diagrams and a more detailed understanding of behaviour of feedback loops

in the system.

### **7.2.1 Components of Causal Loop Diagrams**

As noted in Chapter 5 causal loop diagrams are simple models, essentially they consist of variables connected by causal links (shown by arrows). Arrows represent the causal influences between variables. An arrow drawn from variable 'A' to variable 'B' is taken to mean that A causally influences B (Richardson, 1999). Causal links are denoted with a '+' or '-' sign indicating the type of link polarity. It is these polarities that "describe the structure of the system" (Sterman, 2000, p.139). The overall polarity of a loop is defined as either positive (reinforcing change) or negative (counteracting change) (Richardson, 1999).

### **7.2.2 Analysis of Causal Loop Diagram**

The following six steps are put forth for model analysis for qualitative system dynamics:

1. "Isolate the major feedback loops in the model, whether arising intuitively or from the modular approach to model construction.
2. Assess the general mode of behaviour of the individual loops and the whole model over time arising from the strategies contained within them. This can be achieved in simple cases by determining the polarity of each feedback loop or in more complex cases, by tracing round each loop the effect of a change in one of its constituent rate variables. Check if this mode of behaviour is consistent with any reference mode available for the system.
3. Identify the rate variables within each loop which are available to be controlled, that is, those which are within the boundaries of the organisation trying to implement the system control.

4. Identify, possible ways to control these variables. For example, by defining target states for them or by linking them to information sources (levels) elsewhere in the model and specifying appropriate strategies by which to use the information.
5. Assess, as in 2, the general model of behaviour of the model arising from any new feedback loops created in step 4.
6. Reiterate from step 3, if necessary.”

(Wolstenholme, 1990, p.30).

These steps provide a means of structuring the analysis of the causal loop diagram developed in this chapter.

### 7.2.3 Loop Behaviour

Loop behaviour is an important aspect of a causal loop diagram identified in Step 2 above. To determine the behaviour of a loop, the modeller must first assign polarities to each of the causal links in the model. Once causal link polarities have been assigned the modeller can examine the patterns of behaviour of the variables. Individual loops produce three different patterns of behaviour, furthermore when different feedback loops combine they result in more patterns of behaviour. Kirkwood (1998) identifies four main types of behaviour seen in systems; exponential growth, goal-seeking, S-shaped and oscillation. The four patterns of behaviour are shown in Figure 7.2.

**Patterns of Behaviour Type 1: Exponential Growth.** Exponential growth refers to a pattern when the incremental increases get bigger and bigger. This means that in the beginning growth can appear slow, however over time the growth will increase quicker. This pattern of behaviour is shown in Figure 7.2(a). This type of behaviour is found in a reinforcing loop where a loop has an even number of negative causal links.

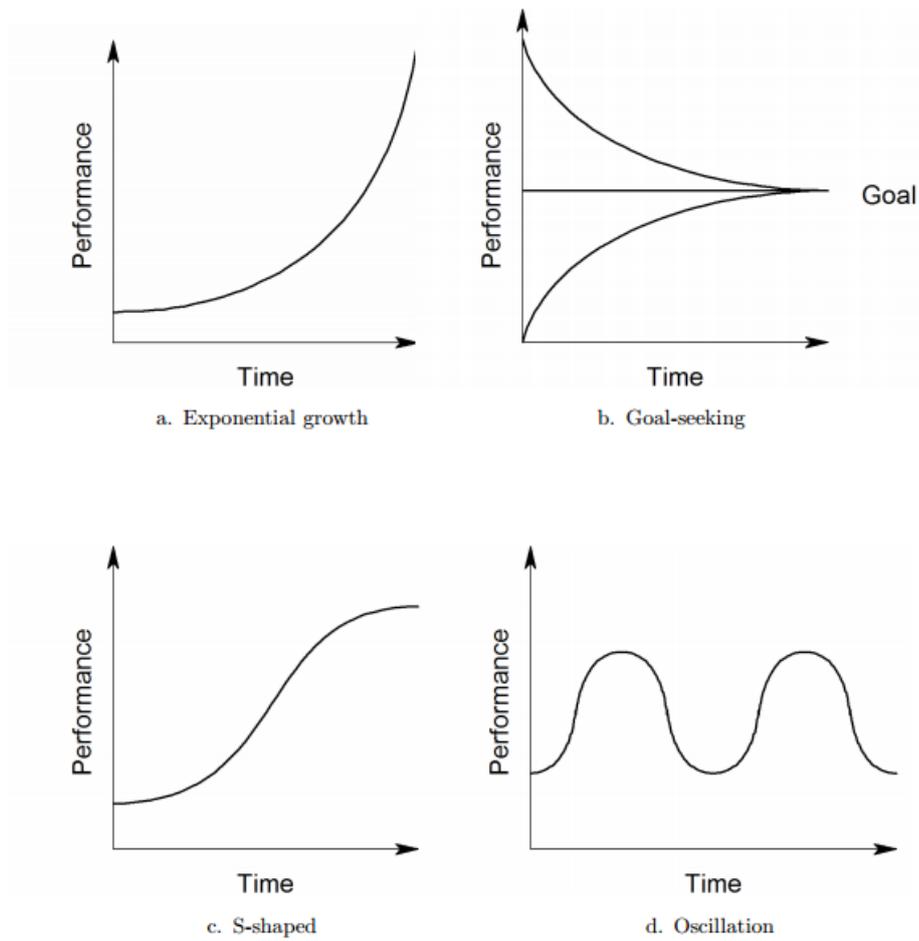


Figure 7.2: Characteristic patterns of system behaviour (Source: Kirkwood, 1998, p.4).

**Patterns of Behaviour Type 2: Goal Seeking.** Goal seeking behaviour refers to a pattern of growth/decline which over time tends to a given value the 'goal'. Initially growth/decline may appear fast, however growth/decline will decrease as it nears the 'goal'. This type of behaviour is seen in a balancing or negative loop where a loop has an odd number of negative causal links. This pattern of behaviour is shown in Figure 7.2(b). Negative feedback loops provide stability in systems, but they can also resist change.

**Patterns of Behaviour Type 3: S-shape.** In this type of behaviour the quantity of interest begins with exponential growth, but this becomes goal seeking behaviour and the curve will flatten out, thus creating the S-shape. This is shown in Figure 7.2(c). This occurs when multiple feedback loops interact.

**Patterns of Behaviour Type 4: Oscillation.** In this pattern of behaviour the variable of interest oscillates around a given value. This behaviour is shown in Figure 7.2(d). Oscillation occurs in a negative loop where a delay is present.

Individual loops will either be exponential growth, goal-seeking or oscillation. The combination of positive and negative loops (with or without delays) can combine to produce many different types of behaviour such as S-shape. By identifying a pattern of behaviour in a variable that is an issue, the system structure causing this behaviour can be identified and through modifying the structure of the system the issue can potentially be removed (Kirkwood, 1998).

### **Virtuous and Vicious Loops**

A further classification of loops with reinforcing behaviour as shown in Patterns of Behaviour Type 1: Exponential Growth i.e. a positive loop are defined as vicious loops or virtuous loops. The classification depends on whether this reinforcing behaviour is desirable or undesirable. An undesirable positive feedback loop is known as a vicious loop, where a situation is worsening (Richardson, 1999). A desirable positive feedback loop is known as a virtuous loop (Wolstenholme, 1990).

## 7.3 Causal Loop Diagram

The causal loop diagram developed is shown in Figure 7.3. To summarise, the causal loop diagram brings together a number of issues and comprises of both short-term and long-term aspects related to the use of Twitter during a health risk event by a health organisation. A list of the variables in the causal loop diagram, with an accompanying short description of each, are shown in Table 7.1 and Table 7.2.

### 7.3.1 Scope and Purpose of Model

The causal loop diagram qualitatively models the use of Twitter by health organisations. The purpose of the model is to provide an explicit, visual representation of the system structure to represent the interdependencies of factors during a risk event. The model highlights the importance of organisational attitude towards using Twitter and the relationship with organisational training and ultimately Twitter usage. The model demonstrates the causal relationships between Twitter usage and wider impacts of its use including trust in the organisation, understanding of public perception of event and volume of misinformation and rumours.

This type of modelling is also recognised as being extremely effective with respect to the communication of findings as they allow communication of complex system structure in a nontechnical way (Sterman, 2000). A final purpose and benefit of developing this model is to provide decision makers within health organisations with a tool to guide thinking, discussion and understanding on the issue and ultimately to help improve decision making regarding the use of Twitter in health risk events.

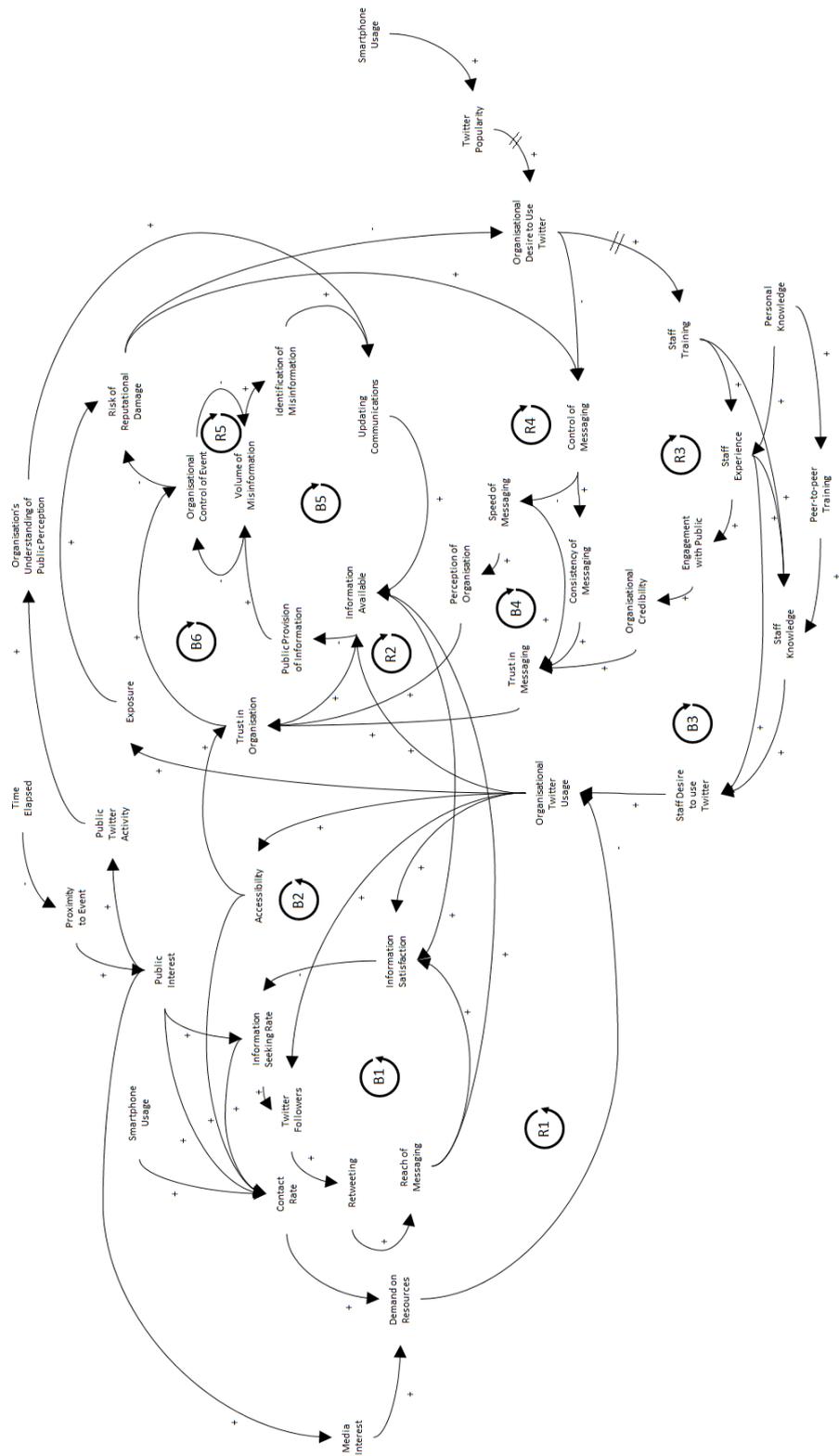


Figure 7.3: Causal loop diagram modelling Twitter usage during a health risk event.

<b>Variable</b>	<b>Description</b>
Accessibility	Perceived accessibility, by the public, to contact the organisation through Twitter.
Consistency of Messaging	Agreement of messaging within organisation's messaging and if part of a multi-agency response, consistency between sources.
Contact Rate	The rate at which the organisation is contacted regarding issues related to the risk event.
Control of Messaging	Control within the organisation of the messages released by the organisation, including degree of regulations and processes in place as well as organisational culture on releasing messages on behalf of the organisation.
Demand on Resources	Demand on work load of members of the communications team.
Engagement with Public	Interaction on Twitter with the public.
Identification of Misinformation	The number of instances where incorrect information about the event is identified in Twitter.
Information Satisfaction	Information satisfaction of the public.
Information Seeking Rate	The rate at which the public seek new information.
Media Interest	Interest in the event by the media in terms of the number of inquiries to the organisation.
Organisational Control of Event	How well organisation is managing the event.
Organisational Credibility	Credibility of organisation as perceived by the public.
Organisational Desire to Use Twitter	The stance within the organisation to incorporate Twitter within the communications strategy.
Organisational Twitter Usage	The use of Twitter by the organisation.
Organisation's Understanding of Public Perception	Organisation's understanding of public perception on the event based on information gained from Twitter.
Peer-to-peer Training	The amount of peer-to-peer training in the organisation regarding the use of Twitter.

Table 7.1: Description of variables in causal loop diagram (part 1).

<b>Variable</b>	<b>Description</b>
Perception of Organisation	Perception of the organisation by the public in terms of the way they are dealing with the event.
Personal Knowledge	Personal knowledge of staff of Twitter through use in their personal life.
Proximity to Event	Time proximity to the event.
Public Interest	The public interest in the event.
Public Knowledge	Public knowledge of the risk event.
Public Provision of Information	The amount of information provided by the public from personal experience or assumptions about the event (i.e. unofficial information).
Public Twitter Activity	The volume of tweets related to the event by the public.
Reach of Messaging	The number of people who potentially see the message, including followers and retweeters' followers.
Retweeting	The number of times a tweet is retweeted by other Twitter users.
Smartphone Usage	Prevalence of smartphones in society.
Speed of Messaging	Time between event occurring, or sub-event and the messaging related to that event.
Staff Desire to Use Twitter	The desire of staff to use Twitter.
Staff Experience	The amount of experience of staff members in the use of Twitter.
Staff Knowledge	Staff knowledge of Twitter.
Staff Training	The amount of training a staff member is given on the use of Twitter in the organisation.
Time Elapsed	Time elapsed since event started.
Trust in Messaging	The degree of trust in messaging of official organisation by the public.
Trust in Organisation	Trust in the organisation by the public.
Twitter Followers	The number of followers to the Twitter account.
Updating Communications	Number of times updating communications.
Volume of Misinformation	How much misinformation there is on Twitter.

Table 7.2: Description of variables in causal loop diagram (part 2).

### 7.3.2 Exploration of Feedback Loops

As noted earlier, the most interesting aspect of causal loop diagrams are the feedback loops which cause dynamic behaviour in a system. The following analysis and discussion of the causal loop diagram is structured around the feedback loops identified in the model. In order to facilitate understanding and to better structure discussion of the model it will be shown in three parts.

#### **The Model: Part 1**

This first part of the analysis looks at the variables shown in Figure 7.4, it includes loops B1, B2 and R1 and a number of exogenous variables.

Loop B1 is a balancing loop. The variables in this loop are ‘Twitter Followers’, ‘Retweeting’, ‘Reach of Messaging’, ‘Information Satisfaction’ and ‘Information Seeking Rate’. The goal of this loop is the variable ‘Twitter Followers’ which will reach a level. An increase in ‘Information Seeking Rate’ causes an increase in ‘Twitter Followers’. The number of Twitter followers to the official account increases as the public want information and identify appropriate sources on Twitter and begin following. As ‘Twitter Followers’ increases this leads to an increase in retweeting as the number of followers increase. The more a tweet is retweeted the more the increase in the ‘Reach of Messaging’ as Twitter users share the tweet with their own followers. As the increased reach of the messaging occurs, it causes an increase in ‘Information Satisfaction’. An increase in this variable causes a decrease in ‘Information Seeking Rate’, hence the loop balances. The loop shows that as more people seek information the number of people following the Twitter account increases. The loop is a balancing loop and the number of Twitter followers steadies based on information seeking rate. Driving the information seeking rate are a number of causal links stemming from an exogenous input and this is discussed next as this has an important relationship in the information seeking rate and therefore the number of Twitter followers.

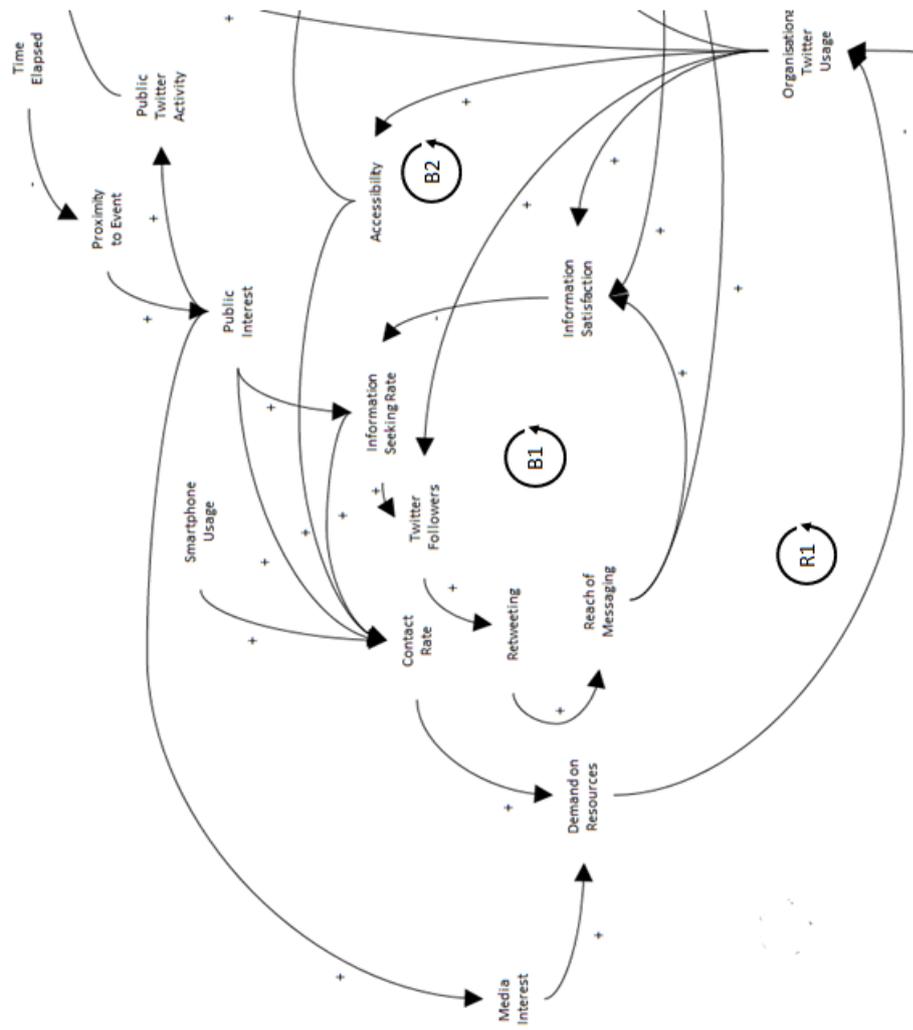


Figure 7.4: Causal Loop Diagram Part 1.

Driving this loop are a number of variables with an exogenous input. The exogenous variable 'Time Elapsed Since Event' is the time since the event occurred. The model shows that an increase in the time elapsed since the event occurring causes an decrease to the variable 'Proximity to Event'. As the proximity to the event decreases 'Public Interest' decreases. Therefore the longer since the event (and sub-events) occurred the less the public interest in the event. The model shows that as public interest in the event increases, the information seeking rate will also increase. It is therefore expected that after an event the information seeking rate will be high to begin with and then decrease over time. There is a positive relationship between information seeking rate and Twitter followers. As the information seeking rate is high it drives the number of people subscribing to following the official Twitter account. As time elapsed since the event, the number of new Twitter followers decreases. Therefore, it is not expected to see a continual sustained increase in growth over time, instead there will be surges in the Twitter followers as events occur. Looking over the course of numerous risk events, it is expected to see fluctuations in the rate at which new followers begin to follow the organisation and this also occurs as sub-events occur as there are changes to the event itself. This aspect of the model highlights how surges in followers increase as Twitter users want information about an event they identify appropriate sources on Twitter and will follow them throughout the event. The model shows that the public identify relevant sources of information on Twitter and begin following to gain information at critical times with respect to the risk event. 'Time Elapsed' since event is an exogenous variable, and although it is not controllable, there are expected impacts on the variable 'Public Interest' and these have significant impacts on the behaviour of variables elsewhere in the model. The impacts of this are predictable in the system and can therefore be managed.

Loop B2 is a balancing loop. The variables in this loop are 'Contact Rate',

‘Demand on Resources’, ‘Organisational Twitter Usage’ and ‘Accessibility’. The goal of this loop is ‘Organisational Twitter Usage’. The use of Twitter will reach a steady level. As the ‘Organisational Twitter Usage’ increases, it leads to the organisation being more accessible. An increase in ‘Accessibility’ causes an increase in ‘Contact Rate’. The increase in ‘Contact Rate’ increases the ‘Demand on Resources’. This causes a decrease in ‘Organisational Twitter Usage’. This loop highlights that as the organisation increases its usage of Twitter the organisation will be perceived as more accessible. Accessibility means that Twitter users will direct more questions at the organisation. This increase causes a demand on resources in the communications team as they are required to answer the questions. This demand causes a decrease in usage. The more the organisation uses Twitter the more this becomes perceived as a way to contact the organisation, with the potential to be overwhelmed with questions such that there are not enough resources to respond to the questions. Participants highlighted that in general there will be themes that emerge from the questions and this assists in managing the questions posed through Twitter. Importantly, the loop highlights that as the Twitter usage increases there will be a change in perception by the Twitter users and their identification of this as a means of contacting the organisation will increase questions and engagement through this communication channel.

As the organisation increases its Twitter usage, the accessibility of the organisation increases as Twitter users can contact the organisation through this means. The informal nature of the medium means it facilitates more messaging between the public and the organisation. With this increased accessibility the contact rate increases and this places demand on staff resources as mentioned earlier. It is this point at which a decision needs to be made on how many resources to dedicate to different parts of the communication process. The organisational Twitter usage is limited by the staff resources and therefore it is a balancing loop.

From the above, it is clear that the variable ‘Demand on Resources’ is a key

variable in the system. This variable denotes the demand on staff resources within the communications team in the organisation. There are two important demands on this resource, that by the media (Media Interest) which occurs through both telephone and Twitter requests and those made by the public through Twitter (Contact Rate). As these two variables increase it causes an increase on the variable 'Demand on Resources'. Increased demand on finite resources in the communications team causes a decrease in Twitter usage. There is a clear decision to be made in this case: the organisation can either respond to the media requests or those made by the public. This aspect of the model highlights that the organisation could give too much attention to the media and allocate too much of the resources to dealing with their information requests and this, as shown in the model, occurs at the starvation of other aspects including the variable 'Organisational Twitter Usage'. The model clearly identifies that it is an important consideration of how to allocate resources within the communications team as feeding one of the demands, Media Interest or Contact Rate, starves the other. Instead the organisation should aim to improve the entirety of the system and allocate resources such that both can be maintained to an appropriate standard with respect to the limited resources of those in the communications teams. Identification of this aspect allows the organisation to identify how to allocate resources in the case of a risk event and maintain different lines of communication to a desired standard.

Loop R1, is a reinforcing loop it contains the following variables: 'Demand on Resources', 'Organisational Twitter Usage', 'Twitter Followers', 'Retweeting', 'Reach of Messaging', 'Information Satisfaction', 'Information Seeking Rate' and 'Contact Rate'. As a reinforcing loop the behaviour can either be defined as vicious cycle or a virtuous cycle. Starting at 'Demand on Resources' an increase in this variable causes a decrease in 'Organisational Twitter Usage'. This decrease causes a decrease in 'Twitter Followers', 'Retweeting', 'Reach of Messaging' and

‘Information Satisfaction’. As ‘Information Satisfaction’ decreases ‘Information Seeking Rate’ increases. An increase in ‘Information Seeking Rate’ causes an increase in ‘Contact Rate’, finally also causing an increase in ‘Demand on Resources’. This loop shows that an increase in ‘Organisational Twitter Usage’ decreases ‘Demand on Resources’ which highlights the benefits of using Twitter in the organisation.

Finally, an important exogenous variable is ‘Smartphone Usage’ as the use of smartphones in society increases it causes an increase in contact rate to the organisation as individuals access Twitter through their smartphones and can ask a question in that moment.

## **The Model: Part 2**

The second part of the model, focuses on long-term aspects within the organisation. This part of the model contains Loops B3, B4, R2, R3 and R4, and also a number of exogenous variables. This part of the model is shown in Figure 7.5.

Loop B3 is a balancing loop. It consists of the following variables: ‘Organisational Twitter Usage’, ‘Exposure’, ‘Risk of Reputational Damage’, ‘Organisational Desire to Use Twitter’, ‘Staff Training’, ‘Staff Experience’, ‘Staff Knowledge’, ‘Staff Desire to Use Twitter’. An increase in the variable ‘Organisational Twitter Usage’ causes an increase in ‘Exposure’ of the organisation to criticism of tweets. An increase in ‘Exposure’ causes an increase to the variable ‘Risk of Reputational Damage’, an increase in this variable causes a decrease to ‘Organisational Desire to Use Twitter’. A decrease in ‘Organisational Desire to Use Twitter’ causes a decrease in ‘Staff Training’ with a delay. A decrease in ‘Staff Training’ causes a decrease in ‘Staff Experience’ which causes a decrease in ‘Staff Knowledge’ and this causes a decrease in the variable ‘Staff Desire to Use Twitter’. A decrease in this variable causes a decrease in ‘Organisational Twitter Usage’. The loop identifies that the more the organisation uses Twitter to release



information, this increases risk of reputational damage as tweets for example may be taken out of context, phrased incorrectly etc. The loop balances at a level of Twitter use which the organisation influences. Although, there is a risk of reputational damage the more Twitter is used, it is identified this is a critical point in the system as potential reputational damage can be mitigated by improving training within the organisation for staff. It is important for the organisation to support the use of Twitter and put in place training to ensure that it is carried out properly thus reducing the reputational damage.

Loop B4 is a balancing loop. The loop consists of the variables ‘Trust in Organisation’, ‘Organisational Control of Event’, ‘Risk of Reputational Damage’, ‘Organisational Desire to Use Twitter’, ‘Control of Messaging’, ‘Consistency of Messaging’ and ‘Trust in Messaging’. An increase in the variable ‘Control of Messaging’ causes an increase in ‘Consistency of Messaging’ as more processes are in place to check the messages being released. An increase in ‘Consistency of Messaging’ causes an increase in ‘Trust of Messaging’ and then also an increase in ‘Trust in Organisation’. An increase in ‘Trust in Organisation’ causes an increase in ‘Organisational Control of Event’. An increase in this variable causes a decrease in ‘Risk of Reputational Damage’. As this decreases the variable ‘Organisational Desire to Use Twitter’ increases. An increase in ‘Organisational Desire to Use Twitter’ causes a decrease to the variable ‘Control of Messaging’. This balancing loop highlights that the control of messaging will reach a certain level as the organisation begins to use Twitter. There is a trade-off between consistency of messaging and speed of messaging and this is discussed next.

Loop R2 is a reinforcing loop. The loop consists of the following variables ‘Trust in Organisation’, ‘Organisational Control of Event’, ‘Risk of Reputational Damage’, ‘Control of Messaging’, ‘Speed of Messaging’ and ‘Perception of Organisation’. An increase in the variable ‘Control of Messaging’ causes a decrease in ‘Speed of Messaging’. This occurs as higher control of messaging on the more

time it takes to approve tweets, meaning the speed at which the Twitter account is updated decreases. A decrease in the speed of updating Twitter and releasing messages causes a decrease in the perception of the organisation and this also decreases trust in the organisation. As trust in the organisation decreases there is an increase in risk of reputational damage. An increase in risk of reputational damage causes an increase in the control of messaging in the organisation. This loop highlights that a high degree of control over messaging causes messaging to be slower through Twitter.

Considering Loop R2 and Loop B4 there is a trade-off between 'Speed of Messaging' and 'Consistency of Messaging'. 'Control of Messaging' influences two variables 'Speed of Messaging' and 'Consistency of Messaging'. The more controls and regulations in place in the organisation elongates the time before a tweet can be released by the organisation. If the organisation is consistently releasing messages after other sources it can cause issues in the management of the event. Consistency of messaging was also raised as an important point, therefore there requires to be a trade-off between the two.

The speed of messaging is a key aspect, especially in the context of Twitter. This is a fast medium, where information is available almost instantly. The use of Twitter by the organisation can be slow and this means that they become one of the later sources to message and this leads to a lack of trust in the organisation as they fail to update communications quickly. The issues are that the organisations, as highlighted above, try to ensure the messaging however no messaging or delayed messaging causes issues and ultimately impacts on the organisation's ability to manage an event. It is necessary to communicate with the public, ensuring the messages are released as quickly as possible and if the information is not available to provide notice of when information will be given. This also helps manage expectations of the Twitter account as it clearly provides information on when it will be updated.

Loop R3 is a reinforcing loop. It consists of the following variables: 'Trust in Organisation', 'Organisational Control of Event', 'Risk of Reputational Damage', 'Organisational Desire to Use Twitter', 'Staff Training', 'Staff Experience', 'Engagement with Public', 'Organisational Credibility' and 'Trust in Messaging'. This loop highlights that as the organisational desire to use Twitter increases it causes an increase in 'Staff Training' and 'Staff Experience' through positive causal links. An increase in staff experience of using Twitter causes an increase in 'Engagement with Public' as the staff become more experienced in how to use Twitter. The increased engagement through Twitter causes an increase in the 'Organisational Credibility' and 'Trust in Messaging'. These positive causal links cause an increase in the control of the event by the organisation therefore decreasing the risk of reputational damage which subsequently causes an increase in organisational desire to use Twitter.

Loop R4 is the final loop in this part of the model. This reinforcing loop contains the following variables 'Trust in Organisation', 'Organisational Control of Event', 'Risk of Reputational Damage', 'Organisational Desire to Use Twitter', 'Control of Messaging', 'Speed of Messaging' and 'Perception of Organisation'. As 'Speed of Messaging' increases it causes an increase in 'Perception of Organisation'. An increase in this variable causes an increase in 'Trust in Organisation' and then through another positive causal link also 'Organisational Control of Event'. As the organisational control of event increases it causes a decrease in 'Risk of Reputational Damage'. Subsequently this causes an increase in 'Organisational Desire to Use Twitter'. As organisational desire to use Twitter increases, the control over messaging decreases and this causes an increase in the 'Speed of Messaging', thus reinforcing the original change.

Related to these loops are a number of important causal links which are shown in the bottom right of the causal loop diagram. To begin, the variable, 'Personal Knowledge' is an important exogenous variable in the system. This

variable highlights the amount of personal knowledge that individuals in the team have from personal use of Twitter out with their professional role. An increase in personal knowledge of Twitter causes an increase in peer-to-peer training as individuals in the team with knowledge of Twitter train others in the team. An increase in 'Personal Knowledge' causes increases in 'Staff Experience', 'Staff Knowledge' and 'Staff Desire to Use Twitter', increases in these variables cause an increase in 'Organisational Twitter Usage'. These links, although exogenous, importantly show the importance of individuals within the communications teams and their influence on Twitter use in the organisation.

These variables and causal links highlight the importance of individuals in the organisation driving the use of Twitter. The use of Twitter is shown to be closely tied to the individuals in the organisation. The knowledge of individuals can either be from their personal knowledge of Twitter, through use in their personal lives, which increases the knowledge of others through peer-to-peer training. Individuals in the organisation may also gain knowledge through training which stems from the organisational desire to use Twitter. There is a positive link between 'Organisational Desire to Use Twitter' and the variable 'Staff Training'. In an organisation which does not support the use of Twitter, as there is not the desire to use Twitter, there is less, if any, formal training within the organisation. Alternatively, organisations who do encourage the use of Twitter there is a increase in training of staff on the use of Twitter. However, there is a delay in the system, highlighting that although organisations may increase their organisational desire to use Twitter, but despite this establishing training is delayed.

The variable 'Organisational Desire to Use Twitter' is influenced by 'Twitter Popularity', the more Twitter becomes popular in society and it becomes more established as a means on communication the more the organisation will start to want to use Twitter as they respond to the changing way in which their public preferences change. There is a delay between this these two variables. It may

mean that Twitter will continue to be used after it loses popularity. The exogenous variable 'Smartphone Usage' causes an increase in 'Twitter Popularity', the role of technology is extremely important for this technology as it encourages live updating. Increased use of smartphones facilitate the use of Twitter and causes an increase its popularity.

### **The Model: Part 3**

The final part of the model focuses on provision of information. Loops in this part of the model are B5, B6 and R5. This part of the model is shown in Figure 7.6.

Loop B5 is a balancing loop. The loop consists of the variables 'Information Available', 'Public Provision of Information', 'Volume of Misinformation Information', 'Identification of Misinformation' and 'Updating Communications'. As 'Information Available' increases, there is a decrease in the variable 'Public Provision of Information'. As this variable decreases there is a decrease in 'Volume of Misinformation' which causes a decrease in the 'Identification of Misinformation' and a decrease in 'Updating Communications'. Importantly, this part of the model highlights as official information available by the organisation decreases, which may occur in the early stages of the event when the organisation is beginning to deal with the event, the public provision of information increases. The public try to provide information when there is an absence and as such it is unofficial and unverified information which is released on Twitter. The more the public provide information based on personal knowledge opposed to official information released by official bodies it causes an increase in 'Volume of Misinformation and Rumours', as this increases it becomes difficult for the organisation to manage the event. This loop highlights the importance of the organisation releasing information early on to prevent misinformation and rumours occurring which can then lead to confusion around the event and panic.



Loop B6 is a balancing loop. It consists of the variables ‘Trust in Organisation’, ‘Organisational Control of Event’, ‘Volume of Misinformation’, ‘Identification of Misinformation’, ‘Updating Communications’ and ‘Information Available’. An increase in the variable ‘Information Available’ causes an increase in ‘Trust in Organisation’ as the public are being given information about the event, creating the perception that the organisation is open and honest about the risk event. As this increases the ‘Organisational Control of Event’ also increases. An increase in this variable causes a decrease in ‘Volume of Misinformation’ as the organisation is able to better manage the event and prevent misinformation and rumours as they are identified as managing the event. As ‘Volume of Misinformation’ decreases this causes a decrease in ‘Identification of Misinformation’. A decrease in ‘Identification of Misinformation’ causes a decrease in ‘Updating Communications’.

Related to these loops are a number of important causal links. Moving to the top of the causal loop diagram to the variable ‘Public Interest’, an increase in this variable causes an increase in ‘Public Twitter Activity’. Again, as previously noted, public interest is linked to time elapsed since event, thus it is expected that in the early stages of the event for public interest to be high and then decrease over time. This also results in high Twitter activity to begin with and then it will decrease over time. An increase in ‘Public Interest’ causes an increase in ‘Public Twitter Activity’. The ‘Public Twitter Activity’ is limited by the number of people interested in the event and this is dictated by features of the event. As more people become interested in the event it causes an increase in the number of tweets related to the event. As tweets relating to the event increases the information available to the organisation of what the public are concerned about, questions, information sharing this increases the organisation’s understanding of the public’s perception. The use of Twitter is limited by the organisational perspective on Twitter to gain information. Therefore, an increase in

Twitter activity causes an increase to the variable ‘Organisation’s Understanding of Public Perception’. As this increases it increases ‘Updating Communications’ to reflect the learnings from the public Twitter activity. An increase in ‘Updating Communications’ causes an increase in ‘Information Available’. These links show that the public Twitter activity causes updating in communications as the organisations learn what information is out there and what needs to be out there. They identify the gap in knowledge and are able to fill this gap by releasing more relevant information.

Finally, Loop R5 is a reinforcing loop. The loop contains two variables ‘Organisational Control of Event’ and ‘Volume of Misinformation’. An increase in ‘Volume of Misinformation’ causes a decrease in ‘Organisational Control of Event’. A decrease in ‘Organisational Control of Event’ causes an increase to ‘Volume of Misinformation’. This is an important loop in the management of the amplification and attenuation of risk events. The greater the misinformation and rumours, the less control the organisation has. This can cause large issues where the attention of the event can be diverted to some other, apparently unrelated aspect of the event.

### **7.3.3 Leverage Points**

A leverage point within a causal loop diagram is an area within the model where a change made will produce desired outcomes in the system. This section reviews the model to identify areas in which this is possible.

The first leverage point identified is ‘Organisational Desire to Use Twitter’, changes to this variable can produce a number of desired outcomes in the system. ‘Organisational Desire to use Twitter’ is the stance within the organisation to use Twitter as a form of communication. This is a variable in which the organisation does have power to change. An increase in ‘Organisational Desire to use Twitter’ will support staff to use it more as a channel of communication as it becomes a

more formal means of communication and is integrated into the organisation. As the organisation recognises this channel of communication and invests in training staff and providing resources to support its usage it will be used more by communications professionals. The model shows that to successfully use Twitter the organisation needs to support and invest in training of technology and develop guidelines on its usage. Without the support of the organisation, the model identifies that the use of Twitter is driven by individual members in the communications teams. Although this can be successful it poses issues in that only one person in the communications team is managing the use of Twitter, and others in the team may not be confident in using it through lack of training and experience. With training, individuals in the communication team can use it to release information, but also as a way of engaging with Twitter users and beginning to build a rapport with the audience which leads to trust in the organisation. Furthermore, staff training mitigates risks of reputational damage as staff are trained to use the medium. As the organisation becomes more comfortable in the use of Twitter and training and experience of the communications teams increase, relaxation of control over messaging occurs allowing Twitter to be a means of quickly communicating during an event.

Secondly, the variable 'Organisational Twitter Usage' is a key variable in the diagram. Again, organisations also have control over this variable. It links different aspects of the causal loop diagram highlighting that it is a key variable in the system structure. Twitter usage represents the use of Twitter by the organisation in terms of releasing tweets. The more the organisation uses Twitter the more official information that will be available on Twitter. This results in less provision of public information and subsequently misinformation and rumours. Therefore, assisting the organisation in managing the event. Additionally, the model highlights that the more the organisation uses Twitter the more Twitter followers the account will gain as it is identified as a source of information. Twitter

usage also increases accessibility of the organisation, and therefore increases the engagement from the public.

Thirdly, 'Demand on Resources' is the final leverage point. An increase in this variable causes a decrease in 'Organisational Twitter Usage'. Potentially the demand on resources could be such that they are not able to satisfy both demands, that of the media through information requests and that of the public. Therefore it is necessary to ensure there are both sufficient resources, but also to ensure that different channels of communication are being executed to the standard desired in the organisation. It is important that the organisation recognises the time required to use the Twitter account appropriately and allocating resources as required. Previous literature (see Hughes and Palen, 2012) finds that the use of Twitter causes a decrease in the number of media requests as shown in the feedback loop in Figure 7.7. If this relationship holds also in the context of health organisations, then it suggests an increased use of Twitter is favourable to the organisation as it provides a way to satisfy demands of the media and also to use Twitter as a way to provide updates.

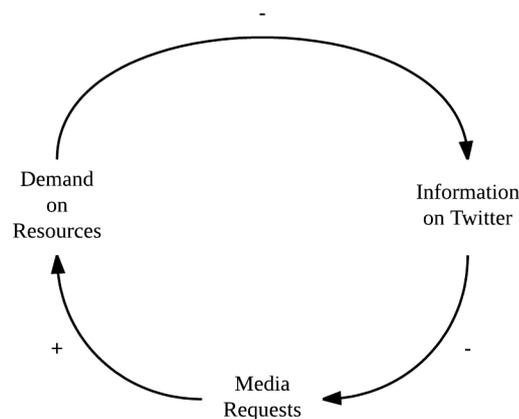


Figure 7.7: Media demands feedback loop.

## 7.4 Model Verification

The verification process resulted in small changes to the model developed, these changes are reflected in the model presented above. There are additional aspects which emerged from the second session with participants which also contribute to the verification of the model. The presentation of the model prompted an interesting and rich discussion of the use of Twitter in the organisation. The session clearly provoked thought, realisation and understanding of the complex system of Twitter usage during a risk event. The first part of this section details the main points of discussion which emerged as a result of the presentation. The second part of this section specifically focuses on aspects indicating the usefulness of the model to the participants.

### Discussion on Model

The presentation of the causal loop diagram sparked interesting discussions. These discussions provide additional insight into the use of Twitter in the organisations. Aspects of these discussions are outlined below.

First, participants identified a number of variables which they had control over, and thus could act upon to increase the successfulness of their Twitter account as a communication tool in the management of a health risk event. The two variables were ‘Organisational Desire to Use Twitter’ and ‘Twitter Usage’. Participants noted that the causal loop diagram allowed them to identify where they could focus effort. Additionally, the causal loop diagram was recognised as a means of facilitating understanding on where to invest and also understanding the return on investment in terms of spending within the organisation.

Another consideration that emerged during discussion related to “who” was tweeting and the perception of the source by the public. Participants identified that a health professional may be better suited to tweet in terms of perception of source as opposed to the communications teams. It was suggested that the

credibility of the message may be dependent on the source within the organisation. The interviewees discussed that as the credibility of the information sources increases, the greater the impact a single message can have at stopping rumours as they are seen as the credible source. Therefore, as a source on Twitter, the organisation will have a greater impact on stopping misinformation and rumours.

Related to credibility of messaging, it was noted that part of the difficulty of Twitter is that a source can sound official even when it is not. The participants noted that their organisation had to be able to be identified as the trusted source of information during a risk event, and that they were easy to find on Twitter. Discussion noted the concept of branding and the use of the organisations logo was one way to do this. They noted that they want to be easily identified and this branding should mean that their message has more influence during a risk event as they are a trusted source of information.

From the diagram participants identified there required to be a balance between speed and consistency of messaging. There was discussion on inconsistent messaging and it was identified that if there were lots of conflicting messaging then it was found that “people lost faith” because of inconsistent messaging. One participant noted: “There’s a balance to be struck throughout all of this between proactivity in terms of getting good messages out there and reacting to the bad stuff ... but it’s a difficult balance”. Participants also highlighted the key role of public reassurance during a risk event and that would be a key role of Twitter messaging throughout the event: “One of the big things for us is public reassurance when we are dealing with anything, and it’s part of our statutory responsibilities of warning and informing the public ... it’s certainly public reassurance: we’ve got this under control, we’re allocating the correct resources, we’ve got our plans.” The interviewees confirmed that Twitter could be used as a way to gain insight into how the event was unfolding and being able to intercept issues quicker than previously in order to prevent escalation of rumours. Twit-

ter was also identified as an excellent tool for dissemination of context specific information.

Participants noted on the speed of messaging, that the delay in messaging caused the perception that they “were looking like they were having to be provoked for it, or asked for it” when in fact the organisations were not “trying to hide something when you’re just not, you’re just trying to get organised usually”. The role of the media was once again returned to, identifying their role in the event and speed of messaging. The press were identified as being quicker than the official organisations, part of the reasoning of this was highlighted as “they focus on one part of what you are saying...they focus on the bit that supports whatever point they’re wanting to make at a particular time” and it was observed that “[the media] can speculate as well, talking heads, just spouting off whatever they like but you’ve got to get all your ducks in a row and have your facts absolutely right” and this causes a delay between the media messaging and these official organisations messaging. It was identified that it looked as though the organisations were slow and following the media when in fact they are bound by different regulations.

Related to the variable ‘Media Interest’ it was noted: “I can’t believe the amount of direct media contact there is ... you’re feeding them almost to an exclusion of all the other things aren’t you? Because they were seen as the primary way of getting a message across, but no longer ... Do they deserve the amount of attention that hitherto they’ve attracted? They are players, certainly, within the communications scheme but they are not *the* player any more”. Despite the media’s important role, on reflection of the causal loop diagram participants noted that they need to consider other elements and decide whether the allocation of resources to the media is fair.

The model facilitated conversations of how to build the use of Twitter, particularly transitioning between daily use and that during a risk event. Participants

identified that if the organisation aims to use Twitter during a risk event they decided they had to be using it consistently within communications prior to an event. It was seen as necessary to have Twitter integrated into the communications strategy. Interviewees noted there is Twitter usage before, during and post event. The use of Twitter during an event should be an expansion of the daily use of Twitter. Consideration, therefore, should be made on the daily use of Twitter and what the expansion of it will be. Interviewees raised that if they invest in the use of Twitter pre-event this is a key aspect in the use of Twitter, particularly staff and staff training.

It was identified that the use of Twitter may differ depending on the event. It was noted that some events can be planned for such as influenza pandemic, whereas other cannot be planned for. Risk events are different and the organisation needs to be able to respond accordingly. The adaptive capacity of the organisation was viewed as an important element during a risk event. There were challenges in terms of approval of messages and an aspect raised was that there required to be rules and regulations in place such that the communications staff were able to respond without requiring lengthy approval. Thus allowing communications professionals to be able to use Twitter as needs be in terms of the event. Through discussion of the map it emerged that the use of Twitter was “not going to come from the top down” instead it was the “enthusiasts embedded within the organisation driving it forward”.

There were still concerns over the resources required to maintain the use of Twitter during a risk event, one participant noted: “we’re adding all these methods of communication and do we have the support underneath it?” One participant identified: “We know we should be doing it but can we release anyone to do it? And that’s a change of mindset to be quite honest.” There were concerns noted on the resources available to deal with the multiple communication channels in the organisation. A participant noted that within communications

it appeared to be that they would increasingly add channels of communication, but asked: “Do you think there will ever come a time when we can get rid of one communication channel? Because you add, and you add, and you add”. This question supports findings in the previous chapter and raises concerns over the proliferation of ways in which communications occur. This again relates back to organisational capacity to manage these multiple channels and resources required. It was noted that there were certain events which attracted a lot of media attention, and particularly attention on social media and so “having a plan in place ... to actually set that resource aside [for Twitter] as part of the communications strategy for it, it would be key, absolutely key.”

Finally, discussing the changing preferences of information sources of the public and the way in which they were accessing information it was noted: “[a] portion of the public relies solely on social media. I think that portion will get bigger over time”. “And I think you’ve put in here a couple of things about smartphones and tablets, and I think because of the nature of it this is what people are doing now it’s not their PCs, it’s not their laptops, so something quick and dirty in the way people getting their information.” This aspect meant that the engagement between organisations and the public is greater than through other means. “I think just from the nature of it you get more back from the Twitter account, because somebody thinks oh I want to ask a quick question” and tweets the organisation.

### **Feedback on Model**

The presentation of the model clearly provoked thought around the use of Twitter within the organisation during a risk event. The model was able to, communicate clearly, the complexities of the use of Twitter by the organisation. The model also assisted in understanding of the extent of the role of Twitter during a risk event. The model had a number of potential uses in the organisations, ranging from supporting development of communications strategies to helping communicate

the complexities of Twitter use to seniors in the organisation. The following is a summary of comments which emerged through discussion after the presentation of the model. These aspects contribute to the verification process of the model.

To begin, an important benefit of the model was that it was able to provide a more holistic understanding of the problem. The participants identified how they were able to trace round the relationships in the model to identify the wider effects. Participants also highlighted that users of the model, depending on their role in the organisation, may identify different areas of interest to focus on. During the discussion one participant identified variables which were of “particular interest, like organisational desire, understanding, demand on resources” whereas another participant alternatively highlighted “from our team, the speed of message, the consistency of the message, building the trust you know all of that communications side things” were of key interest. Participants identified that depending on their role “you’d hone in on some areas”.

Secondly, participants identified that the model could be used to bridge the gap between different levels in the organisation to highlight the importance of Twitter in the communications to improve understanding of seniors. One participant identified that there were key points of the model that needed to be communicated to seniors such as the relationship between demand on staff and the use of Twitter in the organisation. The participant stated: “That minus there [indicating to a causal link in the model] that’s where we need to win the hearts and minds of seniors. Giving them a look at this and a quick talk through might get their heads round the complexities; and it’s not just a question of opening up a [Twitter] account and saying we’ll use that. No, this is a living thing which we have to monitor, which we have to resource. We can’t just leave it to its own devices otherwise we end up here with misinformation ... I think we have to get the hierarchy on board with this”.

The model aided participants in the identification of key aspects within the

model that required further consideration by the organisation and which areas required an investment of resources. The participants were able to identify variables which were key to the system. For example one participant identified the variable 'Demand on Resources': "And that's a key one. That's what we were talking about, that's the weak point in I would suspect most organisations, certainly organisations such as our own where we don't have a dedicated resource for that by any stretch of the imagination ... so that's a biggie. That insignificant little blip is a biggie for us as an organisation. And in terms of developing the use of that further we need to win senior hearts and minds surrounding this. I would suspect that is a key part of the model here."

One participant noted: "in terms of developing a communications strategy, I think that [*indicating to the causal loop diagram*] would be really useful." It was identified that the model could almost be used as a point of reference. A participant described how they could potentially use it in response to the current communications or situations which have occurred. The model can be used to understand "right what are we missing here? Or why is that going wrong in this?" The participant proposed that with "reference to this [*indicating to the causal loop diagram*]" they could identify "right there might be too much misinformation out there, how is that happening, let's study this a wee bit more". By studying the diagram they would be able to answer "what can we do here?" and then identify "this is where we need to" make a change. "You could hone in on particular areas" to resolve an issue. Another participant also identified the use of the model in helping to develop communications strategies. The participant identified that there was an intention in the organisation to use Twitter: "Well I mean there was the desire for us to have the [Twitter] account, but I don't think we'd figured out what we wanted to do with it really ... But I think this [*indicating to the causal loop diagram*] assists us in showing us the complexity of the thing and how we can develop it further." The participant identified, the organisation needs to "be more

proactive in our day to day business and then in terms of response mode, I think it's another thing which we need to consider ... I think we definitely need to think about, not just the major incidents but the little ones. I know we put out press releases when there's been a C. difficile outbreak, or something like that. But there could be cleverer ways to ... to handle that, I guess, and so then if you're handling the little small things, then heaven forbid anything happened you know you're more ready, more prepared." Additionally, one participant identified how the communications strategy required to be extended beyond day to day events: "I now think we need to look beyond [day to day use] for specific incidents and yes for prominence but I think for public health incidents. I think we would be wrong not to take this forward in terms of that because we are identifying the importance of social media and Twitter and the great assistance it could be to us during say we had a Legionella or Norovirus or whatever and just incorporate it within our communications strategy in general terms and then perhaps more specifically at the individual plans, incorporate it into it."

Causal loop diagramming was new to all the participants. "I haven't come across [a causal loop diagram] before, but once you talked through it I understand it more." Furthermore, it was noted by participants that they had not previously seen a visual representation of the use of Twitter showing the relationships and implications of its use. Interviewees noted that one benefit of the diagram was its clarity, despite the complexities within the diagram; "this is actually quite sophisticated the amount of detail that's in it". A related aspect of feedback on the model was that it was able to solidify thoughts of participants. One participant noted that she'd had inclinations of some of the aspects presented in the causal loop diagram: "I think ... we've had feelings about these things. This is the first time I've seen anything written down about what the impacts are and what the relationships were. And, you know how it sort of links in with things. You know we maybe have the idea that it's a good idea to do this, but

this shows us why, a bit, I think. And also, maybe we need to take it a bit more seriously than we do. I think that we're not taking advantage of it as we should be really. We could be doing more with it I guess we could be doing more if we had the resources".

One participant identified that the causal loop diagram would be of particular use to her to support the review of the Twitter account of which she was in charge of. The participant stated: "I really do think this will be very useful for us, to be thinking about our, sort of, planning and how ... we don't not take it seriously because obviously we do but we're not utilising it to the best of its ability and we need to take some decisions about what we're using the different accounts for. It's very much at the forefront of my mind because we're reviewing the account that I, sort of, run. So this is very useful to me at this point in time because all this stuff about well, you know getting information out there, building up trust in the organisation that kind of links in with the account that I run ... building up desire for us to use it, but I need to sort of see where it's linking in to, what are we actually building up in terms of?"

Shortly after the presentation of the causal loop diagram to participants in Nova Scotia an updated social media policy was put in place. Participants shared this policy as soon as it was created. This outcome highlights the impact of the meeting and presentation of the causal loop diagram in the organisation. The changes made to the social media policy also acts as a verification of the model developed.

Finally, the model clearly provoked thought around the use of Twitter. The visualisation of the causal relationships and the complexity of the use of Twitter with far reaching impacts coupled with the discussion of the model can be attributed to this. The presentation of the model alone was valuable to the participants, one participant noted: "So you've helped us a lot, thank you very much". Additionally another participant highlighted again the benefit of the model and

also the thought that it provoked around the use of Twitter “I’m not sure we’ve helped you but that’s got us thinking - my goodness”. Furthermore, participants asked if they could keep copies of the map, but also if they could be sent electronic versions of the causal loop diagram to use within their roles.

## **7.5 Applied Recommendations**

Based on the findings presented in Chapter 6 and Chapter 7 a number of practical recommendations and points for consideration for the use of Twitter by health organisations were developed, these are detailed below.

### **Recommendation 1: Integration of Twitter**

The first recommendation regarding the use of Twitter during a risk event is to integrate it into the daily activities of the organisation and to do this the organisational attitude towards the use of Twitter is key. There are challenges of establishing a Twitter account during a risk event where demand on resources is already high. Failing to develop a strategy of the use, as well as understanding of the organisational position, could potentially lead to difficulties and potential for damaging reputation. Using Twitter in daily activities allows the staff in the communications department to become familiar with Twitter, understand the audience and develop a general policy and strategy for its usage. The use of Twitter should be stepped up during a risk event opposed to beginning the use of Twitter during a risk event.

Training in the organisation is a critical factor in the use of Twitter. Training on the use of Twitter helps encourage the use of Twitter by communications professionals who do not have experience of Twitter from their personal lives. The organisation has a number of choices to ensure the team has adequate experience of social media. Firstly, the organisation can implement training and a stronger

focus on the use of Twitter. Secondly, when hiring individuals or redistributing staff between communications teams consideration should be made to their social media skills.

The nature of Twitter means that certain technologies can aid the use of Twitter. Smartphones allow the updating of the account on the go. Tablets available in the communications team allow different members to use the Twitter account as responsibility changes over the course of the day. Tablets also mean that Twitter does not need to be on the health organisations computer network systems if there are security concerns. Furthermore, there are a number of free social media dashboards which can be used to help manage the organisation's Twitter account as well as monitor the discussion on Twitter about certain topics, these include TweetDeck and Hootsuite.

## **Recommendation 2: Twitter as an Information Source**

The second recommendation is to recognise that Twitter itself can be an important source of information for the organisation. During a risk event, the organisation can gain information on a number of aspects. Firstly, the organisation can gain information about how the event is unfolding as individuals tweet 'from the ground'. Secondly, the organisation can gain understanding of concerns and questions of the public. Thirdly, it can provide insight into what information is circulating, and by default what information needs to be out there. Finally, it can be used as a way to identify misinformation and rumours.

An important aspect to note is the speed at which information is available. Information is available far quicker than through other means, thus the organisations have the potential to gain information quicker than alternative channels. Importantly, this allows the organisation to intercept issues quicker than before helping the management of the event.

### **Recommendation 3: Reputational Issues**

Reputational issues are a key concern regarding the use of Twitter. There are a number of aspects related to this. Firstly, organisations should implement social media policies early on to clearly identify the intended use of Twitter for the organisation. The policy should support adaptive capacity in the organisation to allow the use of Twitter to change over the course of the event, as and when necessary. Secondly, there is also the aspect of managing expectations of the public in relation to the use of Twitter. Clearly linking social media policies from the Twitter account allows Twitter users to understand the purpose of the account and how it will be monitored.

Use of Twitter can cause reputational damage as noted above, but also consideration must also be made by to reputational damage of organisations through absence of Twitter usage. Health organisations have a duty to communicate effectively with the public and if an increasing number of people are using Twitter and the organisation is not using that channel of communication it may cause reputational issues for the organisation. Not being an active member of Twitter prevents the organisations ability to enter conversations on a particular topic leaving it to other Twitter users to self-police the medium.

Furthermore, on a practical note, within the organisation a social media rota is recommended where particular individuals have responsibility for managing social media channels to ensure that the Twitter account is managed continually.

### **Recommendation 4: Account Authenticity**

Issues exist in confirming the identity of Twitter accounts, in that the account belongs to the person/organisation they claim to be. It is important for Twitter users to be able to easily identify an organisation's account is authentic. There are two ways for users to do so. The first way a user can identify if an account is authentic is to check whether the account is verified. Twitter is actively working

to verify accounts of persons and organisations of interest. A verified account means that Twitter, the organisation, has determined that the account is who it claims to be. A verified account can be easily identified by checking for a small symbol (a white tick in a blue cloud) appearing next to the user's name. This symbol indicates that the account is a verified one and represents the authenticity of the account, i.e. that it is who it claims to be. A verified account is slightly different from an unverified account as it has a number of additional features. These features include: 1) additional options on notifications, 2) two different options for users to view their timeline: 'tweets' and 'tweets and replies', 3) options to change who they can receive direct messages from, and 4) access to analytic features. Currently verification is carried out by Twitter therefore, if the account has not yet been verified there is greater need to provide account authenticity. The second way to do so, and this is recommended even if the account is verified, is to clearly link the Twitter account from the website. This ensures that users are able to easily confirm that the Twitter account is authentic.

### **Recommendation 5: Use of Multiple Accounts**

It is advised that there is one Twitter account which is the main corporate account and this will serve as the main channel for posting updates during a risk event. However, it is noted that additional Twitter accounts may be created for other purposes. Typically, the main account will have the largest following and is likely to be followed by other organisations. Other Twitter accounts for different aspects of the organisation will be typically managed by staff out with the communications department. Policies should be in place to ensure that these accounts are managed to the same standard as the corporate account. It is recognised that this is also an account for the organisation, and again it is essential that it fits with the overall social media policy in the organisation. Training may be required to manage these accounts. The management of accounts can be time consuming

to maintain and it is recommended that this be considered prior to setting up an account, as failure to respond would reflect on the organisation. Finally, a list of the accounts linked to the organisation should be listed somewhere on the website.

### **Recommendation 6: Directing to Further Information**

Due to the nature of Twitter it can serve as an excellent directional tool to further information. Twitter statuses are limited to 140 characters, this means that messages need to be concise. By using shortened URLs organisations can provide key points of information and direct users to further, more detailed information in a tweet. To do so relies on detailed information being available online and this therefore means that the organisations website must be updated in a timely manner. Furthermore, it can be used to direct users to more appropriate sources of information, for example another health organisation.

### **Recommendation 7: Tweeting with Partner Organisations**

Twitter can be used to increase consistency of messaging across multiple organisations. During a risk event it may involve multiple health organisations. Retweeting messages of partner organisations during a risk event can be done thus ensuring consistency in messaging and also extending the reach of the message. Therefore it is recommended to follow the Twitter accounts of other health organisations and retweet messages when appropriate.

## **7.6 Summary**

This chapter presents the development of a causal loop diagram. The causal loop diagram models in detail an aspect of the communication process during a risk event. It shows that this type of modelling is suitable for representing the

interdependencies among factors during a risk event. Participants verified the model and found it useful in thinking about planning the use of Twitter and understanding the impacts of the medium.

The model was developed based on interviews with participants in Nova Scotia and Scotland. The generalisability of the model is of course considered. Based on the interviews it is argued that the model is generalisable to organisations within each of these two areas. Furthermore, the model is also perhaps generalisable to other official public organisations such as fire and police services. In order to make this model more generalisable of the role of Twitter in a risk event it is unable to do so due to a lack of data. The model has indications of how some elements occur, but it is unable to highlight the role of the public and their use of Twitter. The system structure was developed based on the interviews. It indicates the structure of the system is similar for the two areas.

In terms of practical implications, the model has had many. As highlighted by Wolstenholme (1990) the development of the model from multiple perspectives the causal loop diagram can then be used to broaden understanding of individual actors, this was found during the process of verification. Secondly, the explicit visual representation effectively communicated the complexity of the use of Twitter during risk events, explicitly highlighting the wider effects of its use and importantly the feedback in the system which is often omitted from mental models. Participants stated that the model provoked thought of the use of Twitter and this can be attributed to the explicit visualisation of it. The model can be used to have conversations, to understand which variables they have control over, to make decisions about future use of Twitter. The next chapter discusses the findings of Chapter 6 and Chapter 7.

# Chapter 8

## Discussion

### 8.1 Introduction

This chapter is the penultimate chapter of the thesis, it presents the discussion of the research. The two empirical chapters of this thesis are Chapter 6 and Chapter 7. Chapter 6 presents the findings of the pilot study and the thematic analysis of the interview data. Chapter 7 presents the development and analysis of the causal loop diagram. This chapter concentrates on discussing the findings of these two chapters, firstly, with respect to the research questions posed at the beginning of the study, secondly, in light of the existing literature in the field and, finally, in terms of practical implications. The chapter concludes by revisiting the conceptual framework, presented in Chapter 4, to review the framework based on the findings of this study.

### 8.2 Current Role of Twitter in Communications

Twitter was established in 2006 and, as such, was a relatively new channel of communication used by the health organisations in Nova Scotia and Scotland. The first research question posed in this study is:

*What is the current role of Twitter in health organisations in Nova Scotia and Scotland?*

This question seeks to explore and understand the use of Twitter in health organisations in the two areas, with a specific focus of identifying how it was used during a health risk event. This section of the discussion focuses on the following aspects: the role of Twitter within the overall communications strategy of the organisation; the role of Twitter during a risk event and organisational aspects shaping the role of Twitter.

### **8.2.1 Channels of Communication**

To begin, it was clear that the interviewees were aware of the changing nature of communications. The use of Twitter, in the organisations, was, in part, a response to the changing preferences of the public but also due to the identification of the potential benefits of Twitter usage to the organisation, in both the daily running of the organisation and during a risk event.

The research found Twitter was used by health organisations as an additional channel for communication. There was recognition by participants that this channel of communication would not replace other means of communication. Instead, it had a unique role within the daily communications serving as an informal communication channel. It was leveraged as a means of building the reputation and credibility of the organisation as they used it to release positive stories about the organisation and in some cases a way to engage with other Twitter users. Its role as a communication channel during a risk event served largely as another channel through which to disseminate information to the public. It had a secondary role as a means of identifying information from the public pertaining to the risk event. In general, Twitter was being used to support existing, more traditional, channels of communication. It was recognised that this, newer, channel of communication would not capture the entire population, however it was still viewed as an impor-

tant means of communication. These findings support those of Merchant, Elmer and Lurie (2011) who state that although social media will not replace traditional means of communication, it is used to “bolster current systems” (p.291). It was clear that participants understood that they would not be able to reach the entire population through any one channel of communication, therefore they had to be using multiple channels of communication in the attempt to reach as many people as possible.

Participants noted the changing preferences of the public for accessing information. Essentially, it was noted that if the population was changing the way in which they chose to access and share information then the health organisations should also be identifying and embracing new platforms to provide information. Some interviewees linked this decision, to use new platforms or not use new platforms, with issues of credibility and trust in the organisation. Participants questioned that if their organisation was not communicating using the channels which are popular with the public then does that impact on the perception of the organisation. Renn and Levine (1991) note that credibility is a ‘scarce’ resource. They identify one of the elements necessary for an information source to have credibility is that the source needs to be flexible and respond to new demands of the public. Clearly, in the context of this research, the adoption of Twitter related to credibility of the information source. Adopting platforms such as Twitter, which are popular with the public, assists in building the credibility of the health organisations as they respond to the changing preferences of the public. However, as identified there were organisational aspects which provided issues in the adoption and use of Twitter within these organisations. These are discussed further in Section 8.2.3.

The findings identified that the shift in preference and popularity of social media such as Twitter was causing a change in the hierarchy of communication. It was found that the traditional hierarchy of communication, in which the media

was a key source of information, was undergoing change. The findings revealed that Twitter allowed the provision of information by a variety of sources and, as the medium is searchable, this information is accessible to all. Importantly, the role of the media was perceived, by the participants, to be lessening, particularly in their ability to shape perceptions of the public. Interviewees identified that Twitter allowed them to directly communicate with the public meaning they had greater control over the messaging. On a related note, the findings highlighted that the media were also drawing upon Twitter as an information source. Additionally, the media organisations also followed the Twitter accounts of the health organisations. In some cases the media used Twitter as a means of contacting the health organisations to ask questions.

The interviewees noted how easy it was to send a tweet to a user, noting that barriers to interaction were reduced. This was found to facilitate interaction between different types of users. For the organisations, it meant that Twitter was used as a means for other Twitter users to contact the organisation. This created a new demand on organisations to respond to interaction. The organisations had differing perspectives on whether to respond to other Twitter users and how to respond. These reduced barriers to interaction related to interaction with the public, media and other official organisations. This research found that Twitter facilitated direct communication between the public and organisations. The response through Twitter, by the organisation, was limited by policies in place and also demand on resources in the organisation. Some organisations were strong in their belief that incoming messages should not be ignored. Responding to each and every message was an important part of using Twitter. However, other organisations purely used Twitter as a one-way tool for communication.

Murdock, Petts and Horlick-Jones (2003) propose that an important aim of communications should be placed on becoming a more 'user-centred' approach. It is suggested that Twitter is a platform through which the organisation can be

more user-centred, however, it is limited by the organisational perspective. Furthermore, Pidgeon and Henwood (2010) note that health organisations should participate in two-way communication with the public and this two way engagement is viewed as increasingly important. Again, Twitter is a platform which supports engagement between different users.

For health organisations, as a communication channel, the speed at which information was available on Twitter far outpaced other means. This appeared to create a new demand on communications teams to respond quicker as there was a continual demand on individuals opposed to the traditional set news times. This agrees with findings of Latonero and Shklovski (2011) who state that there has been a shift from appointment media to real time media, recognising this has brought demands and opportunities. Issues existed in the management of an event, particularly if the organisation had a tight control over messaging the Twitter account would not be used to release messages quick enough. It was noted that the media updated their Twitter accounts faster than that of the health organisations. The expectation for information faster than before, presented issues for organisations as there required to be correct information being released by the organisation, but also it needed to be quick. As the media were bound by different regulations they were able to release information faster.

The interview findings demonstrated that the interviewees and their respective organisations were recognising the changing preferences of the population in terms of how they chose to access information and responding to these changes. The use of Twitter appeared to be, in part, a way to respond to these preferences in order to fulfil duties to communicate effectively with their respective publics. However, the use of Twitter appeared to be driven largely by individuals in the organisations who recognised the importance of Twitter and then developed it. This finding is similar to that by Latonero and Shklovski (2011). This reliance on individuals in the organisation suggested that the organisations often lacked an

appreciation of the use of Twitter and the benefits of the platform, again agreeing with findings of Latonero and Shklovski (2011).

Therefore, as an additional channel, Twitter enhanced and strengthened existing means of communication and provided a number of benefits unavailable through more traditional channels of communication, including direct communication with the public; faster feedback of information from the ground and a means to build trust and credibility in the organisation.

### **8.2.2 Role in Risk Event**

Twitter was found to have an increasingly important role during a health risk event, however this was limited by the organisational culture and approach to Twitter and individuals within the organisations. The role of Twitter in the organisation was found to be tied to individuals in the communications teams who recognised the potential importance of Twitter and initiated its use in the organisation. In general, there was little training available for any type of social media and instead individuals trained others. There were limited formalised strategies in place for the use of Twitter by the organisations during risk events.

Analysis of tweets by the health organisations during the outbreak of Legionnaires' disease highlighted that Twitter was used as a way of releasing reassuring messages to the public. Additionally, Twitter was used as a directional tool identifying where users could go for further information. The use of shortened URL links allowed the organisations to release a tweet with a short update, where the tweet also directed users to additional further information, typically on an official website. Analysis of the tweets released during the outbreak of Legionnaires' disease revealed that Twitter was also used to manage expectations. Tweets announced when the next update would be available and this helped manage expectations of the public and the media. Finally, Twitter was used to correct misinformation as well as respond directly to Twitter users' questions.

In general, the findings revealed that during a risk event Twitter would be used as another way to disseminate information. Consistency of messaging was viewed as important as inconsistent messaging was identified as a potential cause of panic. Interviewees were careful not to release conflicting messaging as it could cause panic in the public and this could lead to issues and significant impacts of the manageability of the event. These issues were viewed as avoidable. However, it was recognised that during a risk event, messaging may change daily as the organisation gains more knowledge about the event. This was seen as unavoidable, but it did lead to concerns of trust in messaging.

Twitter was also identified as an important source of information to the organisation during a risk event. It acted as an early warning system and through keyword searches the organisations were able to gain information about the event; identify misinformation and rumours; identify concerns of the public and learn of questions being asked by the public. This allowed the organisations to take appropriate actions. It was noted that this information was available to the organisation quicker than through other means and this served as an important aspect during a risk event.

The findings revealed that during a risk event, the number of followers to the official accounts increased. This highlights how Twitter users identified relevant sources of information during the time period and actively began following these sources.

The importance placed on Twitter varied across organisations and appeared to be due to previous experience using Twitter during a risk event and also due to individuals in the organisation. The experience of using Twitter during a risk event had a significant impact in shaping the role of Twitter in the organisation. Those organisations which had used Twitter during a risk event identified the benefits of Twitter and this experience informed plans of the future role of Twitter in the organisation. These organisations recognised the importance of Twitter

and identified in another similar situation Twitter would be a priority.

### **8.2.3 Organisational Aspects**

A number of organisational aspects were raised in the interviews and the research finds that these aspects had a significant role on the use of Twitter. Organisational aspects included: issues of staff training; technological resources and staff resources; trust in staff and the risk averse nature of the organisations.

First, there were few formalised processes related to the use of Twitter in the organisation. Of particular importance was the limited staff training for social media. Individuals in the organisation had not received any formal training related to social media and instead had personal knowledge and experience of it; had learned as part of their role; been taught by others in the organisation and in some cases had attended presentations at conferences related to social media. The lack of training stemmed from the organisational desire to use Twitter. It was observed that these organisations were risk averse and Twitter was viewed as risk to the organisation, therefore they had not put formal training in place for staff to use Twitter. The lack of staff training resulted in those who use Twitter and other social media in their personal lives to develop the use of it, while those not as comfortable with social media would not use it.

Related to the above, the role of Twitter was significantly influenced by key individuals in the organisation. In the majority of cases Twitter was driven by individuals in the organisation. A number of participants recognised the important role of members in the communication teams to drive and shape the use of Twitter. These findings agree with Latonero and Shklovski (2011) who identified that the success of an emergency services Twitter account was attributable to one key individual in the organisation. The findings of this study highlighted that key individuals identified the way in which Twitter should be used, to provide updates, to engage, to respond, and they drove the development of the Twitter

accounts with great success. This does lead to consideration of organisations where these types of individuals do not exist and with the lack of training in the organisation it can be difficult for organisations to establish a successful Twitter account.

Within the organisation there were concerns over the use of Twitter in terms of reputation. Twitter was viewed as another means of communication and as such this must be carried out to a given standard, in line with other forms of communication used by the organisation. Again, in terms of credibility of information source, Renn and Levine (1991) note that an information source must be consistent in its communication. Therefore, the use of Twitter, in terms of monitoring and maintaining this channel of communication, is important to maintain credibility in the organisation. There were concerns of the use of Twitter in that it could cause reputational damage, particularly if something was missed or misinterpreted. It was identified that in the organisations there were limited resources and it was questioned whether the organisation could dedicate resources to managing Twitter. The dedication of a resource to Twitter relied on the organisational perspective with respect to Twitter.

On a related topic, the findings revealed that expectations of the public was another key aspect relating to reputation. As Twitter was a fast form of communication, organisations can, potentially, respond within minutes. However, it was noted that by doing these types of quick responses it also builds an expectation from the public for a fast response. Therefore, if the organisation was tweeting and replying to users, then an expectation may be developed over speed of replies. Participants considered whether they could, in future, be overwhelmed with questions and what impact that would have on their reputation and trust in the organisation if they were not responding. Interviewees were very strong on only setting up lines of communication which they could manage effectively. The management of expectation agrees with findings of Latonero and Shklovski

(2011) who identify the quick response enabled by Twitter as a double edged sword, in that although it does mean quick responses, it does also build expectations of the organisations. Therefore, managing expectations of what the public can expect from the accounts is necessary.

In some organisations there were issues of trusting staff members with the Twitter account to release information. There was a divide in opinion as some trusted staff completely and felt very competent in their ability, highlighting the skill of individuals to manage the Twitter account. However, the findings identified that in some cases, particularly from Nova Scotian respondents, there was the opinion that regulations were needed and control of messaging was important. These organisations did not want to allow individuals to speak on behalf of the organisation. The role of trust in individuals is an important one as regulations and processes in the organisation means that Twitter cannot be used as intended. Instead it was argued by many participants that there required to be a flexibility in the use of Twitter to use it as intended.

The degree of flexibility of Twitter appeared to be a contrast to the way in which these organisations were organised. The degree of flexibility and updating quickly contrasted sharply to regulations in place by the organisations and provides difficulties for the organisations attempting to successfully implement the use of Twitter.

There was some resistance in the organisation due to their risk averse nature and in some cases there was a disparity between the communications teams and senior members of the organisation again this agrees with findings by Latonero and Shklovski (2011). Without the support of seniors in the organisation there was a number of aspects which slowed the use of Twitter. First, technology in place was not of the standard required. In some cases, professionals in the communications teams identified that they were unable to update the Twitter account through their mobile phones. Participants in organisations which were investing

in technology, such as tablets, to monitor Twitter identified the technology helped maintain the use of Twitter. Furthermore, without the support of seniors there was no formalised training or policies in place around the use of social media. It is crucial for the disparity between levels in the organisation to be resolved and for the organisation to incorporate the use of Twitter into communication strategies.

### 8.3 Amplification of Risk Signals

To date limited research has considered SARF and Twitter. However, findings in this study demonstrated that Twitter was changing the way in which communication occurs and its important role in risk events. According to Kasperson *et al.* (2003) unless communicated a risk will have little impact in society. Due to its structure Twitter facilitates communication of information to a wide indirect audience and this includes information relating to risk events. The medium allows a range of users to post information, and as most accounts are ‘public’, in that anyone can view them, most tweets are publicly available and are therefore retrievable in a search to anyone (with or without a Twitter account). Twitter also removes barriers to interaction as organisations and individuals alike use the same platform which allows communication between individuals and organisations with or without prior connections. The searchable nature of the platform means information on a topic to be easily found which is of particular importance during a risk event. Due to the retweeting function tweets from both individuals and organisations potentially have a global reach. The second research question posed in this study is:

*What is the role of Twitter in the amplification and attenuation of risk signals by health organisations?*

There are a number of aspects of Twitter impacting on the amplification and attenuation of risks. Aspects which are relevant to this study and are discussed in this section are stations of amplification; credibility and trust in organisation; Twitter as an information source and changing hierarchy of communication.

### 8.3.1 Stations of Amplification

Kasperson *et al.* (1988) propose that a signal passes between multiple stations before reaching its final end receiver. As the signal passes between stations it undergoes transformation as it is decoded by the intermediate stations and then encoded as it is passed to the next station. This research suggests Twitter changes this process in a number of ways. Firstly, it is put forth that Twitter is changing the dynamics of communication. Twitter allows health organisations to communicate directly with the public. As messages from organisations no longer require to pass through a media station to reach the public, with respect to SARF this means that the risk signal passes through less stations, between health organisations and final receiver meaning that the message is not decoded and encoded as it passes between intermediate stations. Therefore the message undergoes less changes. Thus, the organisation had more control over the message.

Importantly, Kasperson *et al.* (1988) recognise that “many risks are not experienced directly. When direct personal experience is lacking or minimal, individuals learn about risk from other persons and from the media. Information flow becomes a key ingredient in public response and acts as a major agent of amplification” (p.184). Twitter allows individuals to learn about risks through users with no previous relationship. It facilitated information flow between users with no previous relationship and this relates to public, official organisations as well as media. Twitter also facilitates communication of risks to a wide audience. By organisations using Twitter to communicate about events allows members of the public to gain information for the official information source. It facilitates

information flow as Twitter users are able to follow events in a way that is convenient for themselves. Thus, by using Twitter, health organisations are able to establish an information flow directly with the public.

The research indicated that partner organisations, such as governments, other health boards, authorities, supporting health organisations were also retweeting messages of one another. Retweeting allows a user to share another users tweet with their followers. As found, the health organisations do gain a lot of retweets from partner organisations, media and public. Considering retweeting in the context of SARF Kasperson *et al.* (1988) recognise that a “factual statement repeated several times, especially if by different sources, tends to elicit greater belief in the accuracy of the information” (p.180). Retweeting is the repetition of the same statement, therefore by the message being retweeted by different sources it lends credibility to the statement. By using Twitter to release messages about the event, the organisation allows others to repeat their messages. Retweeting by partner organisations increases consistency of messaging across organisations involved, increasing consistency of messaging. Additionally, retweeting appears to be a way to increase reach as it is expected those retweeting will have different followers. Relating to amplification and attenuation, first as it is exact repetition of a message it means that there is no change to the message as it passes between stations. However, the repetition of the tweet means that the frequency increases of the message as it propagates easily through Twitter and volume is identified in research as an aspect of amplification and attenuation of risks. Frewer (2003) also notes that the perception of the source also contributes to the amplification and attenuation of messaging. Therefore, if tweets are retweeted by official organisations they will have a greater impact of the amplification or attenuation based on the message tweeted. Additionally, if the health organisations messages are retweeted by a person’s personal network, the message may also carry more weight in terms of the effect of amplification and attenuation.

Related to the retweeting aspect, it is interesting to consider the concept of two-way communication. Retweeting is aligned with the passing on information opposed to a back and forward interaction. There is a limit on the two-way communication. Instead, as the lead information source in an event, these health organisations were found to be providing information as the primary focus of the account. As users identify, or are concerned about the event they will identify the relevant Twitter account for the organisation managing the event and begin following. These users have the ability to share information through the retweeting function. If the users decide to retweet health organisations credible messages will dominate the communication. It means that on Twitter there is a credible source of information. An increased consistency in messaging is important within the social amplification and attenuation of risk signals. More trust is placed in messages of official organisations helping to manage the situation. Still focussing on retweeting, users can simply retweet the message as it is. This means that the same message will be shared with the users' followers, verbatim. Drawing upon the social amplification of risk framework, Kaspersen *et al.* (1988) highlight that risk signals undergo changes and this can lead to the amplification and attenuation as symbols are added/removed, the volume is increased/decreased. If the same message is retweeted is actually prevents the transformation of the message as it is not decoded and encoded as it passes between transmitters and receivers. Those retweeting also included media organisations.

Previously, as identified, the media had a strong hold on public opinion and they were a key station in SARF that directly influenced public opinion. This research identified the changing role of the media in the amplification and attenuation of risk signals. As shown in this research the role of the media is changing with the rise of Web 2.0 and social media which allows a more participation in discussion from organisations, public and the media. The media are now following social media for information. The media also follow official organisations and

will retweet official organisations during risk events.

Despite the media's power decreasing, as noted by participants, the communications professionals noted they do still have an important role in risk events. Particularly, they can choose to focus on aspects of an event and from this a different aspect becomes the focus of attention. The findings revealed that the media were typically quicker in releasing tweets related to an event and this was in part due to differing regulations of the organisations. Participants noted that it was of critical importance to be one of the first to release messages so as to set the tone of the event. Participants noted that trying to change the perception is much more difficult than setting the perception in the first place. However, there are difficulties in being able to release information quick enough.

The public, as Twitter users, also have a role in amplification and attenuation as they choose who to follow, what to tweet about and what to retweet. They have a clear role in amplification and attenuation and this role is more observable and open to measurement than in previous means. It was identified in the absence of information the public will take it upon themselves to provide information, therefore it is important for official organisations to be in the realm of Twitter to be a reliable source of information. It is important for organisations to recognise this fact and to be updating their Twitter account understanding that they are the organisation that the public will seek to gain information from.

Twitter facilitates direct engagement between different users on Twitter. It was found that the use of Twitter allowed direct engagement between health organisations and the public. Engagement with the public was found to be highly important to some organisations. The organisations were able to directly engage with Twitter users, it was found that the responses were well received with Twitter users thanking organisations for the response. Furthermore, Twitter appeared to also facilitate positive feedback from the public and although positive feedback could be given through other means, participants identified they were

getting more positive feedback through Twitter as it is easy to send a tweet praising the organisation. In some cases the positive feedback was shared by the organisation through retweeting.

### **8.3.2 Trust in Organisation as an Information Source**

Trust in the organisation emerged as a key theme and was of high importance to the organisations. Previous research related to SARF highlights the important role of trust, particularly the role of social trust in social amplification (Cvetkovich and Lofstedt, 1999 cited by Kaspersen *et al.*, 2003).

Interestingly, participants identified effective use of Twitter could build trust and confidence in the organisation. Twitter allowed the organisations to post messages daily to provide an insight into the organisation, almost to humanise the organisation. The Twitter account provided access to the information source and by the organisation replying and interacting with users it helped build a relationship with the public. The importance of trust in the information source is critical to the way in which the message is received. It is proposed that the amplification and attenuation effects of a trusted source will be greater than those experienced of a source in which there is mistrust (Frewer, 2003). Health organisations identified themselves to be trusted sources of information and, as such, carrying more weight in the role of their messaging. Within communication in Twitter this means that their role is potentially to have greater influence. For example, their ability to shut down rumours through a message, or to calm public through releasing reassuring messages. Alternatively, the media, a source which was identified as a less trusted source of information by participants will have less impact in their messaging (Frewer, 2003). Murdock, Petts and Horlick-Jones (2003) identify that a goal of risk communication should be to become a more ‘user-centred’ focus on communication, clearly Twitter is allowing these official information sources to become more user-centred as they shift to using platforms

which are more popular with the public. Furthermore, as they use these platforms to engage in a dialogue with the public.

Slovic (2000b) puts forth the asymmetry principle, which argues that the process of creating trust takes longer than it does to destroy. The findings revealed that the use of Twitter over time builds trust and credibility with Twitter users, and this aspect is supported by other literature (see Latonero and Shklovski, 2011). Based on the findings of the research, it takes time to build followings. The asymmetry principle of trust was identified by numerous participants and this identifies with the cautious approach of the organisation to Twitter. Participants identified the potential global reach of messaging as a risk. The lack of character length in the messaging meant that messages could lose context and be interpreted incorrectly. Concerns were raised at potential damage to reputation through a tweet being misinterpreted simply through the wording of the messaging. Trust in the organisation was of high importance and explains the caution of organisations in their use of Twitter.

Previous literature identifies that “risk control efforts have frequently gone awry due to a lack of openness and “transparency” a failure to consult or involve so called “interested” and “affected” persons, a loss of social trust in managers, inadequacies in due process, a lack of responsiveness to public concerns, or an insensitivity to questions of environmental justice” (Kasperson *et al.*, 2003, p.31). The findings of this research revealed that Twitter had the potential to address some of these aspects, it also allowed the organisation to demonstrate that it was listening to public concerns in a transparent manner. The channel of communication facilitated openness. The channel was able to manage expectations of the public as the informal nature of the channel allowed the organisation to identify when information was expected to be available. This management of expectations is particularly necessary due to the speed at which the media update their Twitter accounts due to the different regulations in place. In addition to this,

the platform allowed the organisation direct control over their messaging. It was found that the media could often put a spin on a story. However, using Twitter allowed the health organisation to release a message over which they had direct control, thus without the media changing the message.

As identified there were a number of health organisations that worked together to deliver health services to the public. By retweeting messages from partner organisations it increases the reach of messaging beyond the original number of followers. Not only does this increase messaging, but it also meant that there was a consistency in messages being released. Consistency in messaging is recognised as a way of building trust in the messaging. Furthermore, consistency across information sources also assisted in preventing panic by the public.

Renn and Levine (1991) list five attributes of trust, these are 1) competence, 2) objectivity, 3) fairness, 4) consistency, and 5) faith. The research finds that releasing consistent messages, the fourth attribute of trust, can be difficult in risk events impacting on the entire country such as a pandemic. This type of event will have different impacts on different areas in the country. Therefore there is a question of how messaging can reflect this. Previous research noted that members of the public preferred local information as information at a national level was not relevant to them (Starbird and Palen, 2010). However, in the interviews consideration was made to alignment of national and local level messaging. If the messaging was in direct conflict to one another then it could cause confusion and mistrust in the organisations as the public receive inconsistent messaging.

### **8.3.3 Twitter as an Information Source**

The research found that health organisations, during a risk event, were also using Twitter to gain information about the event. By monitoring Twitter during a risk event, the organisations were able to gain an insight into what the public were tweeting about. Regardless of the fact that Twitter was used only by a

portion of the population keyword Twitter searches and monitoring of hashtags provided an indication of worries, concerns, questions, misconceptions as well as identification of what information was in the public realm. This information was then used to help shape future decisions on communication.

One important aspect related to this was that of misinformation and rumours. Organisations were able to use Twitter to identify what misinformation and rumours were circulating. They could then use Twitter to prevent the spread of the rumour by releasing a tweet addressing the rumour. In SARF the framework clearly identifies feedback and iteration between the sub-processes. The feedback and iteration was clear from this research and the research found that organisations were gaining information quicker through monitoring Twitter than was available to them through other means. Prior to Twitter there would be a delay between public providing information and the organisation receiving the information, but by monitoring Twitter it removes the delay in the feedback loop allowing the organisation to respond quicker. The findings highlighted that Twitter was an important source of information to these health organisations in the management of the event. Twitter allowed organisations to gain an insight into the public and this transparency allowed identification of issues quicker.

Additionally, the findings highlighted that the use of Twitter as an information source also extended to a political context. Using Twitter the organisations were able to identify when key individuals were trying to make something an issue.

By following Twitter activity, information can reach the organisation far quicker than other means. If issues are identified quickly, the organisation can then take action. However, if the issues are not picked up they can escalate making it difficult to manage the effects. One interviewee noted that you could not previously gain access to the grapevine until it escalated so far that the media published it. Now, by monitoring Twitter health organisations can potentially identify issues at an earlier stage and make appropriate responses to help manage

the event. Chew and Eysenbach (2010) highlight that it is essential for health organisations to create a feedback loop, where public responses are monitored. This research confirms that health organisations are beginning to develop this feedback loop in which they are identifying the concerns of the public and feeding this back in to their strategies for handling the event. Murdock, Petts and Horlick-Jones (2003) note that information sources should be asking the question: “do we know what lay public know and want to know rather than what we want to tell them?” (p.177). This research has found that Twitter was used as a means of gaining understanding of the public’s knowledge as well as their concerns, thus it was found that Twitter was a way of addressing this question.

## 8.4 Comparison of Role of Twitter

Empirical data was collected from participants in Nova Scotia and Scotland. As highlighted in Chapter 6 the two areas are similar in a number of aspects and therefore are suitable for comparison. The third research question posed is:

*What are the differences and similarities of Twitter use between organisations?*

This section discusses a number of differences and similarities related to the use of Twitter in health organisation in the two areas. Comparison of the two areas is made at a number of different levels, first, the interview findings revealed generic similarities and differences between Nova Scotia and Scotland. Secondly, due to the nature of the participants, comparison can also be made into governmental and regional health organisations and this provides a second dimension for comparison. Finally, comparison can also be made between the use of Twitter by organisations located in urbanised areas and between organisations located in rural locations.

First, considering the prevalence of Twitter usage in the two areas, as noted earlier there was a significant difference in the number of District Health Authorities (Nova Scotia) and Regional Health Boards (Scotland) with corporate Twitter accounts. In Scotland all Regional Health Boards except one had a Twitter account, whereas in Nova Scotia only three District Health Authority had a corporate Twitter account. It must be noted although Scotland had more Regional Health Boards using Twitter, this number has steadily increased throughout the research period. This is a contrast to that observed in Nova Scotia, where the use of Twitter has been mainly confined to the main cosmopolitan area in Halifax. Interestingly, in the cosmopolitan region, which was in the remit of Capital Health, the Twitter account was well established and it was created in 2009 during H1N1 pandemic. Comparing the use of this Twitter account and a similar account in Scotland, that of NHS Lothian, which was established at approximately the same time and also serves a predominantly urbanised population. It was found that the two were comparable in terms of the number of followers and the use of Twitter in day-to-day usage of the account. Furthermore, the research identified in both cases the use of Twitter was driven by key individuals in the organisations.

The interviews revealed that Twitter was more regulated in Nova Scotia than Scotland. First, notable differences in the process of approval between Nova Scotia and Scotland were identified. Nova Scotian approval processes were more rigorous and lengthy than that seen in Scottish organisations. Secondly, with respect to control of messaging Nova Scotian organisations were far more controlled, particularly in governmental organisations. A concern which emerged from Nova Scotian participants was that pertaining to the idea of one individual speaking on behalf of the organisation. There was a strong focus in Nova Scotian interviews, within the use of Twitter by governmental accounts, of who was speaking on behalf of the organisation. It emerged that the organisations did not want individuals to be speaking on behalf of the organisation and as

such there was a tightly controlled communications. The use of Twitter in these organisations was predominantly used as a one-way communication tool opposed to engaging in dialogue. Through discussion of the model there appeared tension within the organisations in Nova Scotia as members of the communications teams did not feel they could use the Twitter account without guidelines in place for the use of Twitter which highlights organisational issues. There were clear impacts of centralisation and decentralisation within these organisations. Organisations where staff had more autonomy over the use of the Twitter account, were more interesting and engaging and the accounts had higher followings. Alternatively, organisations which were more centralised in their approach towards communications used the Twitter account as a means of providing information as a one-way channel of communication and not using Twitter as way of engaging. In the remainder of organisations in Nova Scotia and also Scotland there was the general opinion that staff were competent and there is no difference in them using Twitter or creating a press release. They appeared to be given more freedom to respond. Giving freedom to respond meant that they could reply quickly. Replying and engaging with the public was viewed as a way to gain confidence and credibility, aspects which are important to become an identifiable source of information in which the public have trust and confidence in. This impacts on the way in which Twitter was used by the organisation.

Organisations in the two areas were risk averse and Twitter was used with caution. Organisations had a strong focus on maintaining the reputation of the organisation. Concerns were also raised by IT professionals who were concerned with use of Twitter on the computer systems. This risk averse culture appeared to slow the development and use of Twitter. Integration of the use of Twitter was difficult in all organisations and no formalised training was available. It was found that the organisations were reliant on the personal knowledge of staff. It emerged those using it in the personal life recognised the potential benefits of the medium

for the organisation and drove the use of it. Social media policies emerged as a response to the Twitter usage in the organisations opposed to being put in place first reflecting the way in which the use was developed. It was found those not using it in their personal life shied away from the use of Twitter. This agrees with previous research which highlighted that the adoption and use of new means of communication by the organisation may be difficult (Renn and Levine, 1991). As identified there were issues in its usage within these types of organisation who tend to display a cautious approach to its use but this research also revealed that there were difference in the organisational culture of Nova Scotian and Scottish organisations.

Different organisations had different opinions on whether it could be used to engage with the public. This again related to the control of messaging within the organisations. Organisations with a high degree of control of messaging were using their Twitter accounts primarily as a one-way communication tool through which to provide information. For these organisations, Twitter was not perceived as a suitable means for engaging with the public as they considered they had insufficient resources to do so. This was in contrast to regional level health organisations where alternatively there was a strong focus that Twitter should be used to engage, interact and to become part of discussions. Again, this was driven by key individuals in the organisations that the account should be used as a tool for two-way interaction and using it to engage and to respond to questions. Despite this, there was also the concern of resources available to answer all questions should there be a substantial increase in engagement.

From the above, the findings clearly showed organisational culture was a critical aspect of the role of Twitter during a risk event. Particularly in Nova Scotia there was a need to develop a culture which allows flexibility and to have an adaptive capacity in the organisation for the use of Twitter during a risk. There appeared to be an argument that regulations were required to use Twitter appro-

priately, but regulations does not lead to innovation. The identification of literacy levels was raised by participants in Nova Scotia, this issue is an interesting one as Twitter potentially facilitates communication as the short style posts effectively communicate the message. The nature of Twitter provided a challenge for these types of organisations where it demand fast real-time updating, engagement and discussion. It required a change of mindset in the organisation, but the change in mindset and seizing the opportunity of Twitter had many potential benefits for the organisation in the management of risk events.

## **8.5 Causal Loop Diagramming and Risk Events**

The literature review presented in Chapter 3 highlights the need to provide decision makers in health organisations with a comprehensive understanding of the dynamics of the use of Twitter by the organisation during a health risk event. The system dynamics tool causal loop diagrams were chosen as a means of explicitly showing the system structure, with the aim to provide a tool to help understanding. The final research question is:

*To what extent can causal loop diagrams adequately represent inter-dependency among factors during a risk event?*

To answer this question the following aspects are considered in more depth: suitability of causal loop diagrams; causal loop diagramming and SARF and limitations of causal loop diagrams.

### **8.5.1 Suitability of Causal Loop Diagramming**

Richmond (1993) positions system dynamics as a subset of systems thinking and argues that “[t]he systems thinkers’ forte is interdependence. Their speciality is understanding the dynamics generated by systems composed of closed-loop

relations” (p.113). As a qualitative tool used within system dynamics to provide a visualisation of the system structure, with particular focus on the feedback within these systems (Richmond, 1993) causal loop diagramming is positioned as an appropriate tool for representing interdependencies between factors during a risk event.

The interdependencies among factors during a risk event is a complex system. Therefore to model this system a type of modelling is required which can deal with complex systems such as system dynamics. This research found that causal loop diagrams were able to successfully represent the interdependencies among factors in a risk event. The causal loop diagram provided a visualisation of the dependencies (causal links) between factors (variables). The explicit representation of the system structure was a key strength of causal loop diagramming.

Causal loop diagramming was an excellent tool for capturing the factors of interest in a risk event. Due to the qualitative nature of the model, it was able to incorporate variables which were difficult to quantify. The consideration of a system and the causal relationships between variables allowed a holistic appreciation of the system. The system is of course limited by the boundaries set in the model.

Finally, a key strength of using causal loop diagrams to model interdependencies between factors is that the modelling forces a shift in perspective from an events cause events perspective to a systems perspective. It facilitates appreciation of feedback in the system, an element which is often omitted from mental models but is an important aspect to consider as it causes dynamic behaviour. It highlighted elements for consideration and can be used to help decision making and guide discussion on the use of Twitter. In the case here, it identifies the absolute necessity for the organisation culture in the use of Twitter during a risk event. As the causal loop diagram is developed based on multiple perspective it helps broaden the perspective of individuals.

### 8.5.2 Casual Loop Diagrams and SARF

SARF as proposed by Kaspersen *et al.* (1988) is a complex framework. It is argued that the type of modelling chosen here, causal loop diagrams, and also the wider system dynamics modelling provide highly suitable types of modelling with respect to SARF. This type of modelling is able to capture the structure of system to identify how factors in a risk event produce behaviours that cause amplification and attenuation as depicted in feedback loops.

Secondly, the dynamic element of causal loop diagrams are also necessary when relating to SARF as these behaviours occur over time. “Dynamic thinking is the ability to see and deduce behavior patterns rather than focusing, and seeking to predict, events. It’s thinking about phenomena as resulting from ongoing circular processes unfolding through time rather than as belonging to a set of factors” (Richmond, 1993, p.122). This links well to the dynamic processes within SARF over the course of a risk event and is a necessary consideration which can be omitted from other types of modelling.

Finally, the focus of this type of modelling shifts the perspective from events orientated to a systems perspective. As noted earlier, within SARF there is an implicit assumption that the entirety of the system is important in the consideration of the way in which risks become amplified and attenuated. Thus, this systems perspective as seen in system dynamics modelling is aligned with the purpose and aim of SARF as it looks to understand how aspects interact together to produce amplification or attenuation of risk events to produce certain behaviours over time. The explicit feedback structure identifies how changes in the system feedback on themselves to reinforce or oppose the original change. These models allow identification of key aspects which allow leverage of the system to produce desired lasting change.

### 8.5.3 Limitations of Causal Loop Diagrams

There are a number of limitations of causal loop diagrams and these limitations provide a boundary to which they are able to represent interdependency among factors during a risk event.

As the model is qualitative, a user is only able to understand the causal relationships between variables and the feedback structure in the system. There is no indication of the strength of relationships. Additionally, another limitation of causal loop diagrams is that while understanding the behaviour of one loop is simple, appreciation of the entire structure is difficult as multiple loops interact. Appreciation of the behaviour of the entire system is difficult to assess without computer assisted simulation and is therefore out with the remit of this type of modelling. To understand the complex behaviour of the system requires quantification of causal relationships and the use of specialised simulation software is necessary. This purpose is aligned with the second phase of system dynamics modelling as identified by Wolstenholme (1990) and this aspect of model quantification is discussed further in Chapter 9.

Secondly, causal loop diagrams are limited by the boundaries established and the level of aggregation within the model. The model boundaries identify which variables are included in the model and by default what is omitted. Naturally, boundaries mean that infinite number of variables are omitted from the causal loop diagram. However, the level of aggregation and boundaries of the model are to some extent defined by the modeller and can therefore be changed to suit the purpose of the model including level of detail required.

Thirdly, causal loop diagrams are never final, but always provisional. The model aims to provide insight into the system and therefore revisions of the model are encouraged as more information becomes available. Therefore, the model can be used to gain insight into the system opposed to relying on the model for predictions.

### 8.5.4 Summary

The literature review presented in Chapter 3 revealed a need to provide decision makers in emergency organisations with a comprehensive understanding of the dynamics of the use of Twitter in the organisation during a risk event (see Latonero and Shklovski, 2011; Kavanaugh *et al.*, 2012). The model has shown to be a successful way to communicate the complex structure relating to Twitter usage during a health risk event to individuals in the organisation. The presentation of the causal loop diagram facilitated understanding, discussion and thought on the use of Twitter and the extent of its role to the organisation. Interviewees stated that they found the diagram very helpful as it provided a visualisation of the causal relationships between variables and identified it as a means of helping discussions with seniors in the organisation to establish the role of Twitter in communication strategies. Participants were also able to use the causal loop diagram to identify key variables in the system which they could focus upon in future communication strategies.

The causal loop diagram extends SARF research as it presents the dynamics within the use of Twitter by health organisations. This highlights aspects presented in SARF which have a role in the amplification and attenuation of risk signals including trust and credibility of the information source; repetition of messages by official organisations; engagement; misinformation and rumours. There are limitations of the causal loop diagram, in that it is focused on the use of Twitter by health organisations. It is noted that the use of Twitter is part of a wider communications mix and there are others which have not been explored in detail in this study such as the public and media. This limitation is discussed further in Chapter 9. With respect to SARF, the type of modelling was suitable and provided an excellent tool for exploring system structure.

## 8.6 Conceptual Framework: Review

At this stage it is appropriate to return to the conceptual framework (shown in Figure 8.1) and to consider it in light of the findings detailed above and also to use it to structure theoretical contributions the research makes to SARF.

This research focuses upon the use of Twitter during health risk events from the perspective of official health organisations. It is clear from the findings in the previous chapters that Twitter is becoming an increasingly important channel in the communication of risk events. Therefore, it is argued that the selection of Twitter as a communication channel explicitly within a modified SARF is justified. The research shows that this information channel is different from others and is changing the way in which communication occurs. Therefore based on this research it is argued that changes are required in SARF to reflect this.

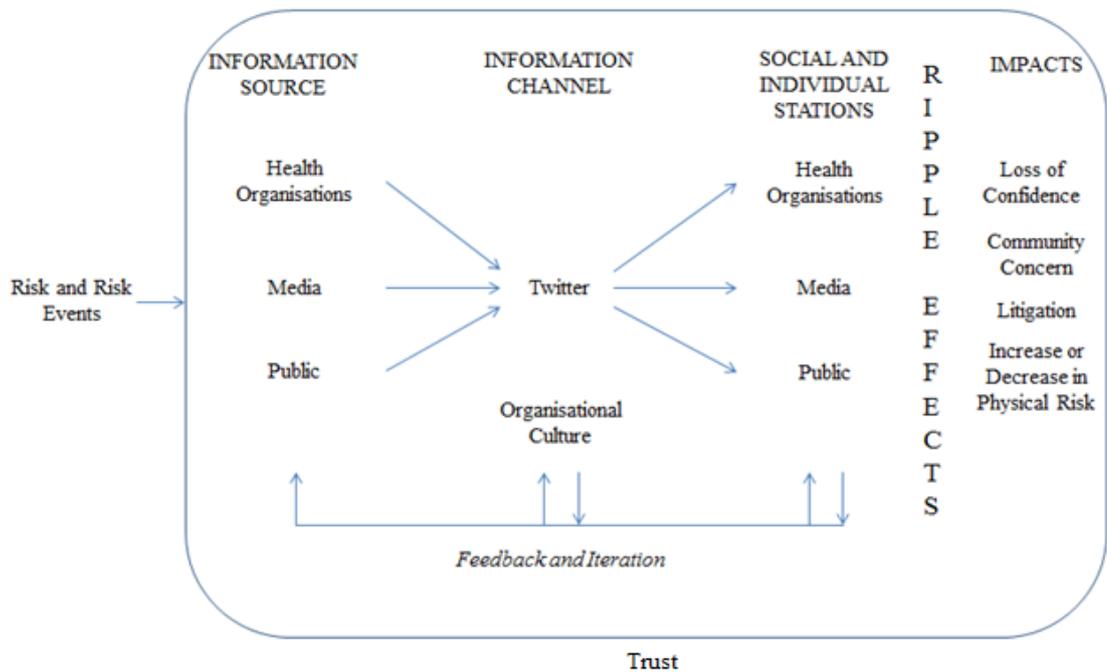


Figure 8.1: Conceptual framework

Previous research on SARF argues and positions the media as the main station for amplification and attenuation of risk signals. However, this research indicates

that this role may be undergoing change; it suggests the power of the media as the most important station for shaping public perception of a risk event is lessening. This is attributable to the structure of Twitter which is a platform through which anyone (public, media, official organisations etc.) can provide, search and gain information. The searchable nature of the site means that this information is available to any other user who looks for it including those with and without a Twitter account. This appears to shift dynamics of communication in a number of ways. First official organisations dealing with risk events are able to communicate directly with the public meaning that there are fewer stations through which information passes before reaching the end receiver. The news media are not required to distribute the information. This provides a contrast to previous research which assumes the news media are the key station in the transfer of information. It was identified that official organisations were recognising this and using Twitter as a means of bypassing the news media to interact directly with the public. The public were also found to have an important role in risk events. Individuals were reporting 'live' from events providing information faster than traditional means. The searchable nature of Twitter allowed organisations to identify the information quicker than before. Therefore there appears to be a change in the hierarchy of communications with the role of the news media not dominating the means in which information is received.

SARF also indicates that there is feedback and iteration between the sub-processes. Twitter was found to make this process quicker and more efficient. The searchable nature of Twitter means that information is available to all actors in the system. For health organisations searching Twitter during an event meant they were able to gain information quicker allowing a faster response in updating communications as well as other actions. In terms of amplification and attenuation of risk signals, the organisations were able to respond to the information on Twitter quicker. They are able to intercept misinformation and correct

it preventing the escalation of issues, an important aspect of the management of risk events.

Furthermore, Twitter facilitated the direct interaction between the public and organisations. The use of the platform facilitated communication between the organisations, the public and media organisations. Direct engagement with the public was found to build rapport with their followers and helped build trust and confidence in the organisation. Instances were also found where the organisations were correcting information by media stations through Twitter. The site facilitates direct interaction between users with no previous relationship. This can cause a demand on organisations to be able to fulfil expectations of the public.

Twitter is a popular platform which is gaining weight as an information source. Although previous research finds that Twitter is self policing consideration must be made to the lack of use of Twitter by official organisations. If these organisations are not in the realm, then it is difficult to guide conversations. Furthermore, there are concerns regarding the perception of the organisation and their ability to provide information. If a growing portion of the population are using social media as their main means of information source, then the official organisations should be recognising the change in information preferences and responding to these preferences. The rise in followers indicates that the public look to these organisations for information identifying key sources of information during a risk event.

## **8.7 Summary**

Sterman (2000) states: “The greatest constant of modern times is change. Accelerating changes in technology, population, and economic activity are transforming our world, from the prosaic - the effect of information technology on the way we use the telephone - to the profound - the effect of greenhouse gasses on the global

climate. Some of the changes are wonderful; others defile the planet, impoverish the human spirit, and threaten our survival. All challenge traditional institutions, practices, and beliefs” (p.3). This statement by Sterman has resounding similarities to the findings of this research. The advent of Twitter has brought changes which are challenging traditional hierarchical institutions. The findings of this research demonstrated that the use of Twitter had brought difficulties in the organisation on the integration of this new platform. Struggles emerge in terms of control; allowing one person to speak on behalf of the organisation; balancing quick responses and correct information; engagement with the public and managing expectations of the public to communicate quickly through Twitter.

Considering Twitter with respect to SARF there are a number of interesting aspects to note. The way in which Twitter is structured facilitates a number of aspects related to amplification and attenuation of risks. There are a number of aspects of this research related to the processes defined in SARF. The research highlighted that the use of Twitter had the potential to decrease the number of stations through which a message passes before reaching the final receiver. Health organisations were using Twitter as a means of communicating directly with the public meaning the organisations had more control over the messaging. Thus, there is less opportunity for the message to undergo changes that the organisation could not anticipate before reaching the public. The use of Twitter can build trust and credibility in the organisation. It was a point to engage with the public. Twitter was also being used to identify a sense of what the public’s opinion of an event was and were able to use this knowledge to inform their decision making improving the feedback loop between the public and themselves as an information source.

The two areas of study were highly similar in their use of Twitter, however there were some notable differences. Firstly, there appeared to be a far more controlled environment in Nova Scotia. Within the organisations there were more

regulations in place related to the establishment of Twitter accounts making it a difficult process to be allowed to use Twitter; there were more regulations on the messaging and there was a concern about individuals being able to speak on behalf of the organisation. Related to this, aspects such as engagement were embraced by Scottish organisations but concerns were raised in Nova Scotian organisations about their ability to engage through this channel and instead used it more as a one-way channel for communication. Secondly, the use of Twitter in health organisation in Nova Scotia was not as widespread as seen in Scotland and they appeared to be at a less developed stage than Scotland.

Finally, causal loop diagrams were found to be suitable for representing the interdependencies among factors during a risk event. The causal loop diagram developed was able to capture interdependencies among factors during a risk event, combining both short and long term aspects within the organisation. There were issues in assessing the behaviour of the entire system as the model is qualitative and this presents a limitation of the modelling. However for understanding the feedback structure, the model was highly successful. It provided a tool which successfully provoked thought, discussion and understanding of the role of Twitter during a risk event.

# Chapter 9

## Conclusions

### 9.1 Introduction

This is the concluding chapter of the thesis where the research is reviewed and considerations to future work is presented. To begin this chapter a summary of the research and research findings is provided. The chapter next presents the contributions of the research which are classified as theoretical and methodological contributions. The chapter then addresses limitations of the study. Finally, to conclude this chapter and the thesis, potential future research is considered.

### 9.2 Summary of Research

To summarise, the research adopts SARF as the theoretical basis. This comprehensive framework provides an excellent basis for the research study as it encompasses aspects of both risk communication and risk perception fields of knowledge. Recognising the increasing importance of Twitter and the way it is changing communication, this study extends the extant body of SARF research by exploring the role of Twitter. To focus the study, the research concentrates on the use of Twitter by health organisations during a health risk event. The research focuses on modelling the perceptions of professionals in health organisations in

Nova Scotia and Scotland regarding the role of Twitter within amplification and attenuation of risks using the system dynamics technique, causal loop diagrams.

This research adopts a philosophical position of hierarchical epistemology and ontological realism as set out by Rosa (1998; 2003). This research takes an exploratory qualitative approach. To begin, a pilot study was conducted where initial data from a health risk event, an outbreak of Legionnaires' disease in Edinburgh, Scotland, was collected from Twitter. This Twitter data was analysed using basic quantitative and qualitative analyses to gain a general understanding of use of Twitter by health organisations during a risk event. This pilot study, along with the literature informed the development of semi-structured interview questions. Semi-structured interviews were conducted in Nova Scotia and Scotland with participants from a number of health related organisations. This rich interview data was analysed using a thematic analysis. The research then developed a causal loop diagram to model the system structure of Twitter usage during a risk event by health organisations. The research questions for this study are as follows:

1. What is the current role of Twitter in health organisations in Nova Scotia and Scotland?
2. What is the role of Twitter in the amplification and attenuation of risk signals by health organisations?
3. What are the differences and similarities of Twitter use between organisations?
4. To what extent can causal loop diagrams adequately represent interdependency among factors during a risk event?

The following is a summary of the research findings. To begin, participants recognised the changing news arena. Twitter was viewed as a way of bypassing

the media to directly reach their public. With respect to SARF there is indication that the framework needs to take into account the shifting dynamics within communications. The use of Twitter provides a platform for anyone to share information, including public, emergency organisations and media. The research indicates that the media no longer have full control as Twitter provides a platform for any user to share and find information. This means that organisations' messages no longer require to pass through the media and instead users can gain information directly from the organisations managing the event. The research, furthermore, indicates that the media can also gain information through Twitter indicating the changing nature of communications during a risk event. Participants highlighted that an important aspect of the medium was that it allowed direct control of messaging, meaning it passes through one less station before reaching the final receiver. The result being that there was less opportunity for amplification and attenuation of messaging. Furthermore, the use of retweeting meant that the same message was retweeted. Kasperson *et al.* (1988) highlight that the amplification and attenuation of risk signals are impacted upon by the addition/deletion of symbols. Twitter restricts this as, instead, retweeting replicates a message. This increases the impact of the organisations' messages. Previous research highlights that sources such as local news media and emergency organisations are the most likely to be retweeted. Twitter provides a platform through which members of the public and official organisations are both using. This means that Twitter straddles two of the sub-processes identified in SARF.

The searchable nature of Twitter meant that information could be found easily by health organisations. This allowed communications by the organisation to be updated far quicker than before as information through this channel was received faster than through other means. This has both benefits and limitations. In terms of benefits organisations can identify issues earlier on. With respect to amplification and attenuation of risk events, and this has been seen both in

the empirical findings of this research and of other previous research, this meant that organisations using Twitter can identify issues sooner and correct and help manage these situations at an earlier stage. Furthermore, official organisations have greater leverage in terms of their messaging. It was proposed in the research that the public do trust the organisations and their messaging. Therefore their messaging carries greater weight than that of others, meaning that if they correct information it will be viewed as more credible than other sources and therefore they have a better capacity to correct information. Difficulties existed in organisations in terms of the speed at which they were able to update Twitter. There were two notable elements limiting this. Firstly, organisations placed importance in the information they released with a strong focus on whether the information was correct. Secondly, organisational approval of messaging was in some cases lengthy meaning that the account could not be updated as quickly.

Organisations had experience using Twitter during a risk event. Twitter was used during these times to gain an understanding of public knowledge. Through keyword searches Twitter was able to identify misinformation, questions and concerns of the public. The medium was viewed as a way to access the ‘grapevine’, to identify what the public were concerned with during the risk event. This could then be fed back into updating communications to reflect the findings. In terms of considering the use of Twitter within communications by health organisations it is important for it to be considered as it has many benefits. Twitter was not seen to replace other means of communications, but was instead used to strengthen communications.

Whilst the two areas were similar in many aspects, differences were identified in the use of Twitter. To begin the use of Twitter appeared far less prevalent throughout the province of Nova Scotia when compared to Scotland. Within the main metropolitan area of Halifax, a number of organisations had successful Twitter accounts, some of which had been established and used during the

outbreak of H1N1 in 2009. However, out with the Halifax Municipal Region, Twitter accounts were being used in few District Health Authorities. From the interviews it was apparent that there were lengthy approval processes for the use of Twitter in Nova Scotian organisations. Lack of support of the use of Twitter and other social media limited the development of it as a means of communication. There appeared to be a more controlled environment in terms of what can be said on behalf of the organisation in Nova Scotia than in Scotland, although this control varied between organisations in Nova Scotia. However, this difference impacted on the use of Twitter as the messages released required more approval and therefore it took longer to post the information which contradicts the purpose of Twitter which is to provide real-time updates. Similarities of the two areas included the development of the use of Twitter. It was found that the use of Twitter was mainly driven by individuals in the organisation as opposed to a top down approach. This meant that Twitter was being used and then guidelines were put in place after its establishment.

Lastly, the causal loop diagram was found to be a successful tool for identifying and explicitly representing the underlying structure of the system. The qualitative nature facilitated the communication of findings with participants and it meant the model was usable for participants. The model was well received in that participants found the explicit visualisation of the structure highly useful. The meetings and discussion with participants resulted in updating plans of social media use in the organisation, supported reviews of existing Twitter accounts in the organisation and structure discussions.

### **9.3 Contributions to Knowledge**

This research presents a number of original contributions to knowledge. This study is distinctive from previous research studies providing both theoretical and

methodological contributions to the work on SARF and use of causal loop diagrams, respectively. This section outlines these contributions to knowledge.

### 9.3.1 Theoretical Contributions

This first section outlines the theoretical contributions of this research. There are a number of theoretical contributions including theoretical contributions to SARF, as well as to the wider field of risk communication and also contributions to the field of crisis informatics.

#### Twitter and SARF

This research makes an important contribution to the extant body of research relating to SARF. The research focuses on the use of Twitter by health organisations during a health risk event. The research considers the use of Twitter in the context of aspects identified by Kaspersen *et al.* (1988) within SARF. Importantly, this research identifies a number of interesting aspects relating to the use of Twitter and the way in which risks are amplified and attenuated.

This study extends the extant body of research relating to SARF by addressing the role of Twitter by health organisations. The review of the literature presented in Chapter 2 and Chapter 3 identified the limited previous work on SARF and Twitter. However, Twitter, despite being a relatively new medium, due to its nature, is creating significant changes in the communication process and thus the dynamics of risk communication. Twitter is becoming an increasingly important platform for communication which was not in existence when SARF was developed. It is changing the way in which communication occurs and also the hierarchy of communication. It is observed that the media no longer have the sole control of information. Instead organisations are clearly identifying Twitter as a means of communicating directly with the public, and the public too are able to post information publicly. Organisations interact directly through

Twitter with members of the public. Both health organisations and the media alike are now gaining information through Twitter.

By addressing SARF in relation to Twitter it is shown that Twitter requires to be considered in the amplification and attenuation of risk signals. It is proposed that the information channel, Twitter, needs to be considered in the model. It is clear from the above research that Twitter is an important channel for communication and it has a number of distinctive features meaning that SARF requires the addition of such channels to its framework.

This research indicates that Twitter does have a role in the amplification and attenuation of risk events. The research found that organisations were using Twitter as a means of communication during risk event, the degree of which depended on the stage of development of usage of Twitter in the organisation. Fundamentally the use of Twitter was driven by individuals in the organisation and the majority of organisations were highly dependent on the personal knowledge and experience of staff. However, this medium was being used as a means of managing an event. Twitter was used on numerous occasions, as shown in the pilot study and also identified in the interviews, as a way of reassuring the public and it was used to manage information in the realm of Twitter.

In previous research SARF identified the media as the main means of amplification and attenuation of risk signals as they provided the major station for information transmission about an event to the public. The research highlights that Twitter is now becoming an arena on which media, official organisations and public interact. It allows the provision of information by any user and furthermore its searchable nature means that it can be found by those who seek it. The research identifies that Twitter is an additional means of communication and is not intended to replace any other traditional means of communication. It is recognised that the type of individuals using Twitter may be limited and it may attract a certain type of person. It is therefore used to strengthen communications

strategies.

The research highlights that Twitter can be used to build trust and confidence in the organisation which is important in terms of consideration of the weight of a users' message in Twitter. The ease of use of Twitter allows it to be a platform for interaction with official organisations and the public, media and partner organisations and again, this helps build trust and confidence in the organisation.

The research shows that Twitter can be used by organisations to identify aspects of amplification and attenuation of risk events and this knowledge is available faster than through other means. It means that the organisations managing the event are able to gain understanding of the public's perception of a risk event and respond appropriately. Specifically, it is the removal of the delay of information being gained by the organisation from the public which is important in the management of the amplification and attenuation of risk events as organisations can intercept issues quicker.

### **Risk Communication**

In addition to contributing to research on SARF, the research also makes a theoretical contribution to the wider field of risk communication. The study, through its focus upon Twitter, identifies a number of interesting aspects. Firstly, the research identifies the changing pace of risk communication and the new expectations of the public on the speed at which information should be available. The research revealed that there are new demands on risk communication in which the demand is continual and not confined to traditional set news times, putting pressure on these organisations. Secondly, through Twitter there is now the ability for two-way engagement. This allows the organisation to communicate directly with the public. It also allows the organisations to listen and respond to the public developing trust and credibility between the public and organisations managing

the event. Previous research has not investigated the use of Twitter as a means of communication by health organisations. This research highlights that the use of Twitter can provide a means for the organisation to gain information from the public which can inform future risk communication by the organisation. The information from the public is available quicker than by other means allowing the updating of communications quicker.

### **Organisational Trust**

The research highlighted an important finding that the use and lack of use of Twitter are linked to trust in the organisation. It was recognised that Twitter can be used to effectively build trust and confidence in the organisation as it is used consistently in both day-to-day activities of the organisation as well as during a risk event. However, there were concerns raised of using Twitter as sustained usage builds an expectation by the public of the organisation to be using Twitter to respond in a certain way, in a certain time. Managing this expectation was recognised as essential to maintain the public's trust in the organisation. Alternatively, eschewing from using the medium entirely, also carries with it issues of potential lack of trust as the organisations are perceived as failing to set up lines of communication which are popular with the public. Organisational trust was of importance in the management of a risk event and the weight of the messaging released by the organisation. Importantly this research has provided rich insights into the use of Twitter by health organisations extending previous research. The research confirms that in general these organisations are also risk averse to developing Twitter accounts as a means of communication.

### **Organisational Culture**

Importantly this research has shown that the use of the medium Twitter is highly dependent on the organisational culture. Organisations involved in this research

appeared risk averse, however differences were found between organisations in Nova Scotia and Scotland. The research found that particularly in Nova Scotia organisations were concerned with individuals speaking on behalf of the organisation. There was a much more controlled environment with respect to who was allowed to speak on behalf of the organisation. The degree of regulations in place impacts on the use of Twitter in time critical situations and also on the use of Twitter in the organisation.

Similar to the research carried out by Latonero and Shklovski (2011) there appeared to exist a disparity between those in the communications teams and higher levels within the organisation. There appeared a lack of support in many organisations for the use of Twitter. As a result there was little training in place in the organisations, difficulties in gaining approval for Twitter accounts and limited resources (staff and technological). It is identified that it is necessary for there to be a reconciliation between the different levels within the organisation. The causal loop diagram presented in Chapter 7 provides a means of explaining the use of Twitter in the organisation to more senior members. It can be used to highlight some of the wider consequences of Twitter usage and help discussion and decision making around Twitter usage. With more support in the organisations, the Twitter accounts could be developed further.

### **Crisis Informatics and Twitter**

The final theoretical contribution of the research is to the field of crisis informatics. Previous research investigates the use of Twitter during an emergency event, but as identified in Chapter 3 much of the research focuses upon the use of Twitter by the public and analysis of the information available from the Twitter. It was highlighted there is limited research investigating the use of Twitter by official organisations. One of the studies which focus upon the use of Twitter by an emergency organisation is that by Latonero and Shklovski (2011) who focused

on the use of Twitter by one organisation. This research agrees with findings of Latonero and Shklovski (2011) in that the same finding of the importance of key individuals in the use of Twitter. As this study has drawn upon participants in multiple organisations across Scotland and Nova Scotia this study extends their work to the context of health, as well as two new areas out with the United States of America. This strongly suggests that this finding is generalisable to public organisations. Importantly, this research makes a contribution by extending the research to multiple locations and organisations. Previous research typically focuses on single organisations or one area. Instead this study collects empirical data from two regions and multiple organisations across the two areas. Furthermore, this research investigates the use of Twitter during health risk events by health organisations. Previous research typically focused on the use of Twitter by police and fire and this contributes to the knowledge. The research makes an important contribution to understanding of Twitter usage of health organisations.

### **9.3.2 Methodological Contributions**

This study also makes a methodological contribution to knowledge. This is, to the author's knowledge, the first study which brings together SARF, Twitter and system dynamics technique causal loop diagrams. Therefore, it is identified that two methodological contributions are made. Firstly, there is a methodological contribution to research on SARF by exploring the use of Twitter through causal loop diagrams. Secondly, the research also makes a contribution to the emerging field of crisis informatics by using causal loop diagrams to map the system structure of Twitter usage from an organisational perspective during a health risk event.

The research makes a methodological contribution to knowledge through the application of causal loop diagrams to SARF. The modelling is appropriate as SARF is a comprehensive, dynamic framework attempting to model both macro

and micro aspects of the process in which risk signals are amplified and attenuated. Therefore, system dynamics techniques, where the focus is upon the system opposed to an events orientated perspective, compliments the underlying ideas of SARF. It is demonstrated that causal loop diagramming facilitates identification of aspects of the system which can be changed to provide desired lasting changes. Causal loop diagrams are also able to capture the dynamics and dynamic complexity of a system another aspect required by SARF. This research shows causal loop diagrams were found to be an effective way of capturing system structure and reflecting the interdependencies among factors in a risk event. The qualitative nature of the tool lends itself well to modelling variables which are difficult to measure.

A further benefit of using causal loop diagrams relates to the communication of results to professionals in the organisations. Causal loop diagrams are highly appropriate, in this context, as their qualitative nature makes them easily understandable to professionals in the health organisations. It allows understanding of the complex feedback structure within communications with the public and aspects within the organisation.

Secondly, the field of crisis informatics is a relatively new one. Here, causal loop diagrams are demonstrated to be an effective way of modelling the dynamics of the use of Twitter by health organisations. This field is in the early stages of development and it is argued that the use of causal loop diagrams is able to provide a better understanding of the system structure. Previous research focuses upon collecting data from tweets, but has not yet considered the wider dynamics of Twitter use. Causal loop diagrams provide a way to structure thinking about the interdependencies among factors during a risk event. The explicit system structure helps identify the feedback within the system which can be used to help explain observed patterns of behaviour.

## 9.4 Applied Recommendations

A final contribution of this research is a number of applied recommendation which emerged from the empirical data collection and analysis. These applied recommendations are aimed toward public health organisations and their use of Twitter, more specifically during a risk event, but also some more broadly, which will help develop a more successful use of Twitter during a risk event.

The first recommendation is for organisations to integrate the use of Twitter into the daily activities of the organisation to build a user base. By using it and incorporating it into daily processes, staff are expected to become familiar and proficient with its use. It also allows the organisation to start to build a relationship with Twitter users. The use of Twitter in a risk event would then be increased as necessary to communicate about the event. Establishing a Twitter account during a risk event has its challenges and as highlighted in this research may not be used effectively as possible. Planning prior to an event allows the full benefits of the use of Twitter to the organisation.

Secondly, related to the above, health organisations should be aware of Twitter and the vast wealth of information that Twitter can provide. Many public health organisations were recognised to be slow at adopting new technologies and new methods of communication as a whole. During a risk event Twitter is able to provide the organisation with a range of information regarding what information the public are sharing; concerns of the public; questions of the public and misinformation and rumours circulating about the event. It is recommended that the organisations identify the potential benefits of Twitter as an information source and develop strategies to leverage this information to improve risk communication throughout events. Twitter has the potential to act as an early warning system so for dealing with a risk event it could potentially provide information quicker than through other means.

## 9.5 Limitations

As with any research there are limitations and it is now appropriate to consider the limitations of this research. The research is limited in two main ways, firstly, the research is inherently limited by the focus of health organisations. Clearly health organisations are just one of many stations within the system meaning that this research only addresses, in detail, one aspect. Secondly, the type of modelling used, causal loop diagramming, is qualitative in nature. These limitations are discussed in more detail below.

### 9.5.1 Limitations of Focus

This research takes a specific focus on the use of Twitter by health organisations. With this focus in place there is of course limitations in that investigation has not been made into the use of Twitter by other relevant groups including the public and the news media.

First, the research conducted interviews with health organisations. Of course this means that there is a limitation in the empirical data source. Two other groups clearly identify themselves for investigation: the public and the media. The public and the media have clear roles in the amplification and attenuation of risk signals during a health risk event. This research does not collect empirical evidence from either group and therefore it is viewed as a limitation of the study. The media were noted in a number of interviews as an important factor in the management of a risk event. This study has not investigated the use of Twitter by the media, but it is clearly an aspect relevant to the study. Furthermore, the public, a much more heterogeneous group, has also not been involved in the empirical data collection and this group is of clear importance to the health organisations who have a duty to communicate effectively with the public.

The collection of Twitter and interview data was solely from health organi-

sations. It would also be of interest to understand the way in which Twitter is being used by the media and the public throughout a risk event. However the collection of Twitter data is opportunistic, meaning that collecting Twitter data generated by the public was difficult during the outbreak of Legionnaires' disease. The collection of such data would provide insight into the way in which Twitter was used by the public during the risk event.

## 9.5.2 Limitations of Modelling

Although it is argued strongly that system dynamics modelling is highly suitable for the problem presented in this research there are a number of limitations of the type of modelling chosen.

Firstly, as with any type of model, the boundaries of the model are a limitation in itself. It is noted above that the research takes a specific focus on the use of Twitter by health organisations during a risk event, however other parties such as the public and media have not been investigated to understand their role in the system. Sterman (2000) highlights that causal loop diagrams cannot ever be comprehensive, like all modelling it is a simplification and as such many variables are missing. Therefore, it is argued that the model presented in this thesis is a successful representation of the structure of the system, but it cannot be argued that the model includes every possible variable.

Secondly, the model is a qualitative one, and as such there is no way to understand the strength of the relationships. Additionally, a further limitation lies in understanding the overall behaviour of the system. This is difficult as there are a number of loops to consider in the causal loop diagram developed and while understanding the behaviour of one loop is relatively straightforward, understanding the overall behaviour of a number of different loops can be difficult. Furthermore, trying to understand the behaviour of the system is difficult due to the lack of quantitative information and without quantitative information it

is difficult to determine the dominant loops in the system. Sterman (2001) notes “when multiple loops interact, it is generally impossible to determine what the dynamics will be by intuition. When intuition fails, we must turn to computer simulation” (p.20). The next section considers some of these limitations in terms of future research.

## 9.6 Future Research Considerations

This is the concluding section of the thesis. This chapter, earlier, presents a summary of the research and research findings; details the contributions to knowledge which the research makes and highlights the limitations of the study. This section now focuses on future research considerations as a way of concluding this thesis.

Twitter was launched in 2006, meaning that research focusing on Twitter and research collecting empirical data from Twitter in the context of risk events is relatively new thus, scope for future research in this area is vast. Since beginning this research study, there has been a proliferation of studies relating to Twitter and it is expected for work in this area to continue to develop in a rich manner, with researchers from increasing numbers of disciplines focussing on the use of Twitter, using Twitter data as a method of empirical data collection and developing methods for analysing Twitter data. It is observed that the nature and attributes of Twitter data lends itself to analysis from a wide range of disciplines from highly quantitative approaches to rich qualitative approaches. It exciting to consider the future prospect of the development. Therefore, as the final section of the thesis it is fitting to consider potential future research which emerges from this study. This section first considers some wider questions which arise from the research. Secondly, the section takes a more specific focus on two potential areas for future research and these conclude the section and thesis.

The research identifies a number of broad areas for future research. To be-

gin, as identified by participants the information which they are providing to the public can change each day. This poses an issue for trust in the organisation as their advice and messaging undergoes change in a short period of time. Therefore, it is interesting to consider dynamic trust in health organisation throughout an event and how to manage and maintain trust throughout the course of an event. Furthermore, it raises questions of how can organisations build trust when communicating uncertain information?

To date, there are few studies investigating the social amplification of risk through Twitter. The first potential research consideration is to focus upon Twitter data to explore amplification and attenuation of risk signals. As acknowledged in Section 9.5 the present study is limited in that it solely focuses upon health organisations and their role in communications. Clearly, this is a narrow consideration. As identified within the framework the amplification and attenuation of risk signals is shaped by more than just official organisations responsible for the management of the event. Therefore, it is proposed that a future study would monitor the amplification and attenuation of risk signals during a health risk event over the course of its duration. A number of aspects are identified as interesting for investigation, these are as follows 1) tweets of official organisations, 2) tweets of local and national media, 3) retweeting behaviour of public, 4) public tweets related to event, 5) dynamics of communication throughout event, 6) influence of Twitter users, and 7) spread of misinformation and rumours.

Empirical data would be collected directly from Twitter. There are three sources for collection: official organisations responsible for the management of the event Twitter accounts; news media Twitter accounts (local and national); the general Twitter feed from various Twitter users whose tweets relate to the event. The tweets by official organisations and news media organisations can be collected as is done so in this research, using NVivo. The third type relies on searching Twitter to collect tweets containing specified keywords. It is proposed

that collecting tweets from these three source will allow analysis of the three. Collecting these three concurrently allows analysis of the differences in messaging between them. The use of Twitter data allows the messages of various sources to be captured. Importantly, the posts of the public are unprompted meaning that it is a much more realistic data. These sources provide a wealth of data to investigate the social amplification and attenuation of risk signals. Previous studies investigate tone of newspaper articles, however this study indicates that the hierarchy of communication is shifting and as Twitter allows various types of users to post information which is publicly searchable means that it is interesting to harness this wealth of information to extend the body of research relating to SARF.

Particularly, from the research conducted in this study, health organisations highlighted that they were using Twitter in some cases to provide reassurance to the public. It would be interesting to examine the wider effects of the messaging. Previous research focuses upon the role of the media in the amplification and attenuation of risk signals. Tweets collected from news media could be compared to tweets in the public feed to identify if there is a relationship between the two.

Previous research studies have used sentiment analysis to understand the degree of concern. This could be an effective way to track the concern level of the public over an event and understand how it changes over time. Recent research has developed techniques which allow the visualisation of the relationships between users on Twitter. It would be interesting to investigate the nature of relationships, particularly the media and the official organisations with the public. A final analysis of the Twitter data relates to the influence of Twitter users and to understand the connections between users. Research can now identify Twitter users which are the centre of conversations and discussions within Twitter. It would be interesting to do this type of modelling to determine influence in conversations and knowledge sharing, particularly to identify the role of official

organisations and news media. This would provide a network analysis providing insight into the complex network of communications during a risk event and the influence of key stations in influencing tweets.

A related research consideration could look to analyse Twitter data (i.e. tweets) to understand the amplification and attenuation of risk signals. As identified in Chapter 3, through sentiment analysis, Twitter can offer real time analysis of the mood of Twitter posts related to an event. This could be used as a means of approximating the amplification and attenuation of the risk event. Research related to SARF lacks quantification despite the framework being positioned as a structured way of understanding the amplification and attenuation of risk signals. Sentiment analysis would allow the changing mood to be tracked over throughout the event. The research could collect the tweets of the official organisations responsible for managing the event as well as tweets of local and national media. Finally, Twitter data for the public could be collected using keyword searches.

The second avenue for relates to the causal loop diagram. As noted, the causal loop diagram is a qualitative model, clearly there is opportunity to quantify the model. This research demonstrates that system dynamics is highly suitable for modelling aspects of SARF. The model presented in this research would be used as a basis for structuring the development of a quantitative system dynamics model. This avenue of research would contribute in two significant ways, firstly it would provide a quantitative model of the use of Twitter during risk events and secondly, it contributes to previous work on SARF which, traditionally, is dominated by qualitative approaches.

Certainly, it is clear that there are plenty of research opportunities for risk communication and Twitter. This concludes the chapter and the thesis.

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# Appendix 1: Interview Questions

## Background - 1

- What is your role and responsibilities within the organisation?
- How much experience have you had with social media?
- What is the purpose of the organisation's Twitter account?

## Risk Communication Strategy - 2

- How is risk communication structured within the organisation?
- What mediums are used for risk communication and how are these different mediums coordinated?
- How successful are the current risk communication strategies?
- How do you measure the success of risk communication strategies?
- Do you feel the organisation is a trusted source of information?

## Social Media - 3

- How is social media used within the organisation?
- Who/what is driving the use of social media?
- How much is known about using social media in the organisation?
- In terms of structure, how and where does social media fit within risk communication?
- In terms of the messages sent out, do the messages differ for this medium compared to that of radio, TV etc?

- Do you feel the audience which uses social media is missed in other forms of communication?
- How is social media promoted by the organisation?

#### Twitter - 4

- How is Twitter used within the risk communication strategy?
- What are the benefits of using Twitter and other social media?
- How could Twitter and other social media be used during a risk event?
- Is there any type of monitoring of Twitter during risk events to understand what the public are tweeting about and if so is that taken into consideration?
- What type of regulations are in place surrounding the use of Twitter, in terms of who is allowed to post messages and what messages can be posted?
- What type of role do the people have who are releasing tweets on behalf of the organisation and how do they work within the team to update the Twitter account?
- How does the organisation decide how to present itself on Twitter?
- How can the organisation develop the use of Twitter so that it is an effective medium for transferring information?
- Why is there the need for Twitter and other social media?
- Is there anything which is limiting the development of the use of Twitter?
- Will Twitter and other social media be used to engage with the public?
- What do you feel the restrictions and limitations of the use of Twitter are?

- How can Twitter be used in future, what concerns and potential obstacles can we anticipate?