A Temporal Social Resilience Framework of Communities to Disasters in Australia

and

Social Network Enabled Social Resilience

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Abstract

The frequency and impact of disasters is on an upward trajectory and, given considerations of climate change and population growth, is projected to continue to increase. There is therefore an imminent need to advance research on factors of disaster resilience and recovery in order to reduce the impacts of these future extreme events on society. This research focuses on identifying social resilience indicators and providing a novel framework for quantifying social resilience with the aim of enhancing the ability of communities to withstand disaster.

Although there has been considerable research interest in various aspects of community resilience to disasters, there have been no studies to the author's knowledge that have gathered all social resilience indicators and constructed a unified holistic framework to cover the three phases of the disaster management cycle (i.e., pre-disaster, response and recovery). Similarly, there have not been any studies that have used social network analysis to explore the impact of the role of social network positionality and structure on social resilience. Therefore, the objectives of this study were to (i) identify the most essential social resilience indicators within communities from previous similar studies in all phases of disaster, (ii) assess these indicators against different case studies, through interviews with subject matter experts within the New South Wales State Emergency Service, then (iii) provide a unified and novel model for social resilience through the addition of (iv) data collected through an online survey within the SES volunteers from which the author (v) propose a framework for the effect of social networks on social resilience. To this effect, the author conducted two phases of research, the first relying on literature review and in-depth interviews and the second relying an online survey for data collection. The results of these were then used to propose the addition of social network analysis. The study seeks not only to advance the state of knowledge on social resilience to disaster, but also to produce actionable knowledge that can improve community preparation for and response to disaster.
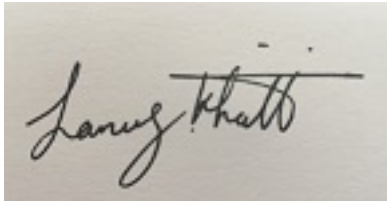
Statement of Originality

This is to certify that to the best of my knowledge, the content of this thesis is my own work. This thesis has not been submitted for any degree or other purposes.

I certify that the intellectual content of this thesis is the product of my own work and that all the assistance received in preparing this thesis and sources have been acknowledged.

This thesis was edited by Elite Editing, and editorial intervention was restricted to Standards D and E of the *Australian Standards for Editing Practice*.

Signed: _Sanaz Khalili_   On: 1/12/2016

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List of Abbreviations

CIO	Chief Information Officer
CRED	Centre for Research on the Epidemiology of Disaster
DROP	Disaster Resilience of Place
EM-DAT	The International Disaster Database
ICA	Insurance Council of Australia
NSW	New South Wales
PTSD	Post-traumatic Stress Disorder
SES	State Emergency Service
SNA	Social Network Analysis
SPSS	Statistical Package for Social Sciences
UNISDR	United Nations International Strategy for Disaster

Chapter 1: Introduction

Since 1995, more than 600,000 people have died from disaster-related injuries and an additional 4.1 billion individuals have been injured (United Nations International Strategy for Disaster Reduction [UNISDR], 2015). Despite the high risk posed by extreme events, both the frequency and severity of disasters have been increasing over the last decade (Newkirk, 2001) and there remains a paucity of research and knowledge on holistic social resilience to and recovery from disasters.

Australian society is particularly vulnerable to the impacts of natural disasters given its geographic location and the proximity of the population to the coast. Thus, further research is needed to determine and holistically measure social resilience within a community—that which addresses multiple determinants collectively—for each phase of a disaster. In an effort to invest in enhancing community and social resilience, this research aims to address this gap by gathering the most essential social resilience indicators and developing a unified framework across the disaster management cycle and, hence, reduce the impact of disasters.

Chapter 1 provides a background of the research topic, an introduction to the research and an overview of the New South Wales (NSW) State Emergency Service (SES). This background will provide contextual knowledge needed to understand this study's approach to assessing how resilient communities are fostered, including how this varies across the phases of disaster and the associated indicators of resilience.

1.1 Background

Over the past few decades, and particularly since the 1970s, the frequency of natural disasters per year has been rising throughout the world (Pollach, 2014). In addition to an increase in the number of potential disasters, there has also been an overall increase in the intensity of the events recorded around the world by the Centre for Research on the Epidemiology of Disaster (CRED) through the International Disaster Database (EM-DAT). EM-DAT also provides information on disaster-related economic damage estimates and the human losses, such as the number of people killed or injured. Although a valuable resource for the study of disasters, it must be noted that there are

two considerable limitations to the use of EM-DAT data. First, to be included in the database, a disaster must have resulted in at least ten deaths, have affected at least 100 people, have been declared a state of emergency and have necessitated a call for international assistance. Second, the data for the second half of the decade can be considered more reliable than that previously reported, as early reporting in remote regions was not as common. Although the data are collected for 1900 to present, the criteria, as provided in the first limitation, cannot as accurately be determined for the earlier years of the data.

Figure 1 and Figure 2 illustrate the number of natural disasters from 1901 to 2015 using EM-DAT data for the world and for each continent separately, respectively. Overall, as presented in the data, the frequency of natural disasters steadily increased from about 1950 to 2000. While the frequency of disasters has decreased since its peak at over 500 disasters in 2000, there were around 350 natural disasters in 2015 compared to less than 50 annually from 1901 to 1965. According to a report issued by CRED and the UNISDR, disasters around the world are likely to continue to increase, particularly climate-related disasters, consuming lives, property and livelihoods. Furthermore, as Figure 2 illustrates, while the frequency of disasters has increased in each of the five geographies depicted, the increase has not been equal across each.

EM-DAT: The OFDA/CRED International Disaster Database - www.emdat.be - Universite Catholique de Louvain, Brussels - Belgium

Figure 1. No. of natural disasters reported 1901–2015, all continents (Guha-Sapir, 2016)

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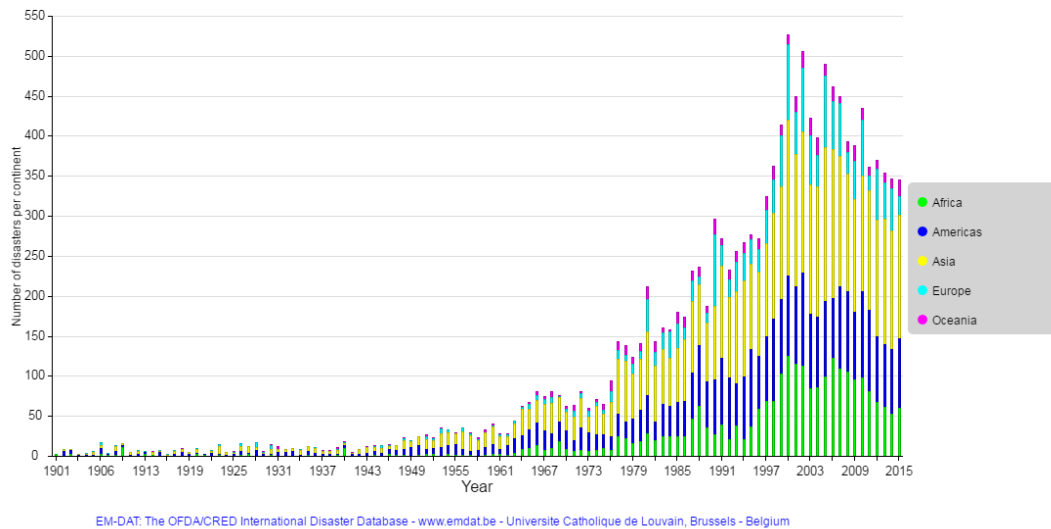
Figure 2. No. of natural disasters reported 1901–2015, each continent (Guha-Sapir, 2016)

Natural disasters have many different forms; they can be geophysical, such as earthquakes or climate-related disasters, or they can include hydrological and meteorological events, such as floods, storms, drought and wildfires. Figure 3 shows the number of disasters and the types of disaster that took place from 1901 to 2015. This figure demonstrates that since 2000, floods have accounted for the greatest percentage of natural disasters, followed by storms. The frequency of earthquakes and droughts, however, has remained relatively steady since the 1980s.
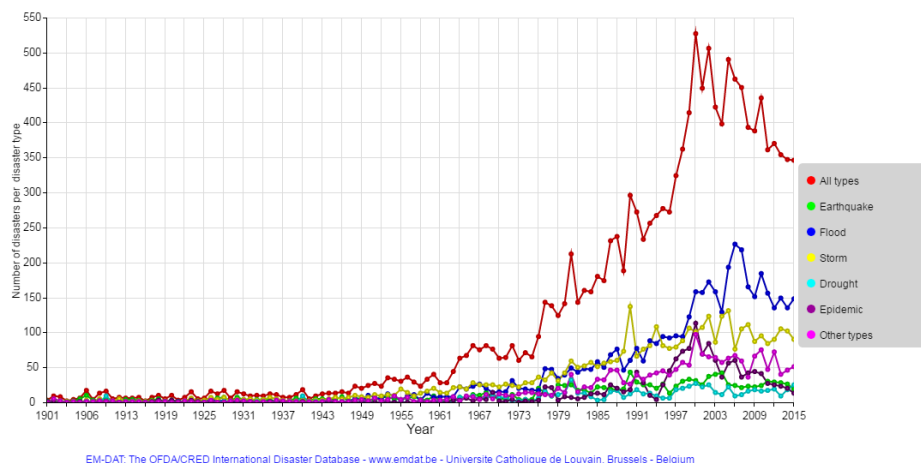
Figure 3. No. of natural disasters and disaster types 1901–2015 (Guha-Sapir, 2016)

Figure 4 shows the total deaths of people in disasters from 1901 to 2015. This figure reveals that the death toll from disasters does not correlate to the frequency of disasters.

While figures 1 through 3 demonstrate an increased frequency in disasters since the 1950s and, in particular, an increase in storms and floods, Figure 4 adds that not all types of natural disasters are equally deadly and that the number of disasters does not equate to the death toll impact. As presented here, epidemics, droughts and floods are the deadliest of disasters but, despite their frequency, these events were deadlier in the first half of the twentieth century because of the lack of early communication technology, medical technology and the ability to mobilise the resources needed for recovery at both the national and international level.
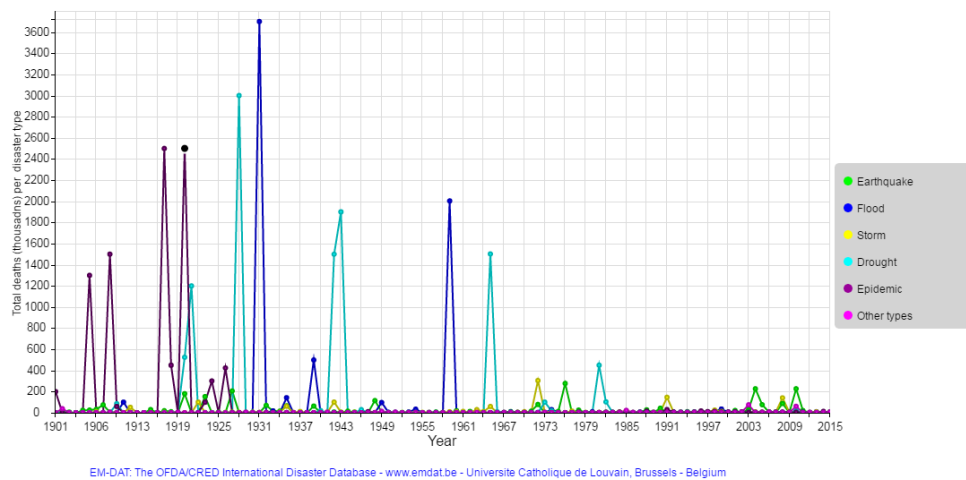
Figure 4. Total deaths by disaster 1901–2015, per disaster type (Guha-Sapir, 2016)

Disaster death tolls, however, do not equate to the impact of, or number of people adversely affected by, an event. An analysis by CRED shows the number of people affected by disaster type from 1901 to 2015 (see Figure 5). For example, in 1997, floods affected about 300 million people. This information demonstrates that while the death toll from disasters was higher in the first half of the twentieth century, the number of individuals negatively affected by disasters was higher in the second half of the century. Thus, while modern technologies have lessened the death toll of many disasters, there are in fact more people now affected by disasters, but to a lesser degree. Moreover, the figure also demonstrates that floods and droughts disproportionately affect populations relative to the other forms of natural disaster.
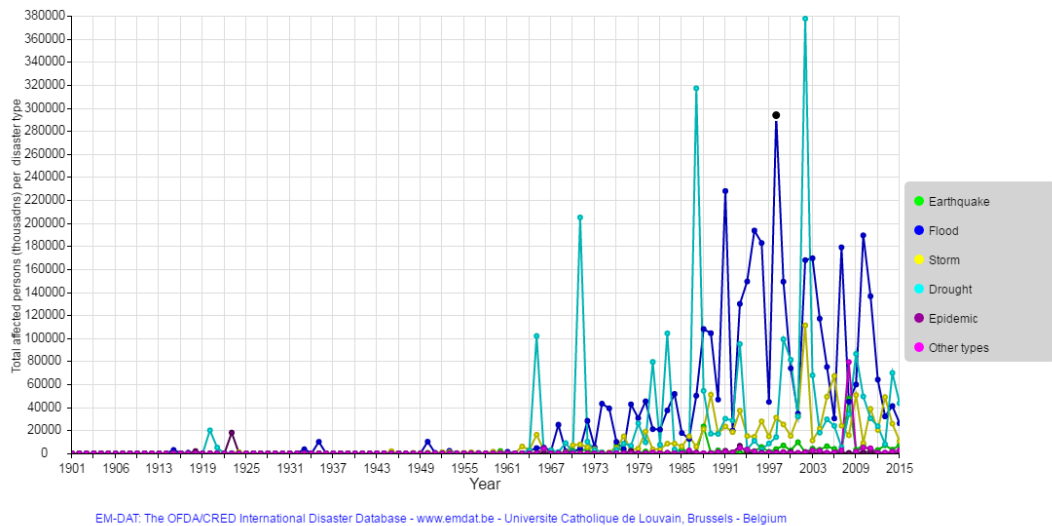
Figure 5. Total people affected 1901–2015, per disaster type (Guha-Sapir, 2016)

This unprecedented frequency of natural disasters poses significant challenges in economics and society, as well as new risks for vulnerable populations. Figure 6 shows the economic losses caused by natural disasters from 1960 to 2015. This figure demonstrates that high risk, low probability disasters are capable of having a severe negative economic impact. Among these, Hurricane Katrina of 2005, with an economic impact estimated in excess of $200 billion (USD) (Dolfman, Wasser, & Bergman, 2007), largely due to the costs associated with the levee failure in New Orleans and associated flooding, stands out for storms. Meanwhile the Japanese earthquake and tsunami of 2011, with an estimated economic impact in excess of $240 billion (USD) (Cooper, Donnelly, & Johnson, 2011), stands out for earthquakes. Moreover, EM-DAT shows 30 earthquakes in 2011 that together resulted in 21,000 deaths, affected 1,747,000 individuals and cost $230 billion (USD) in damage (EM-DAT).
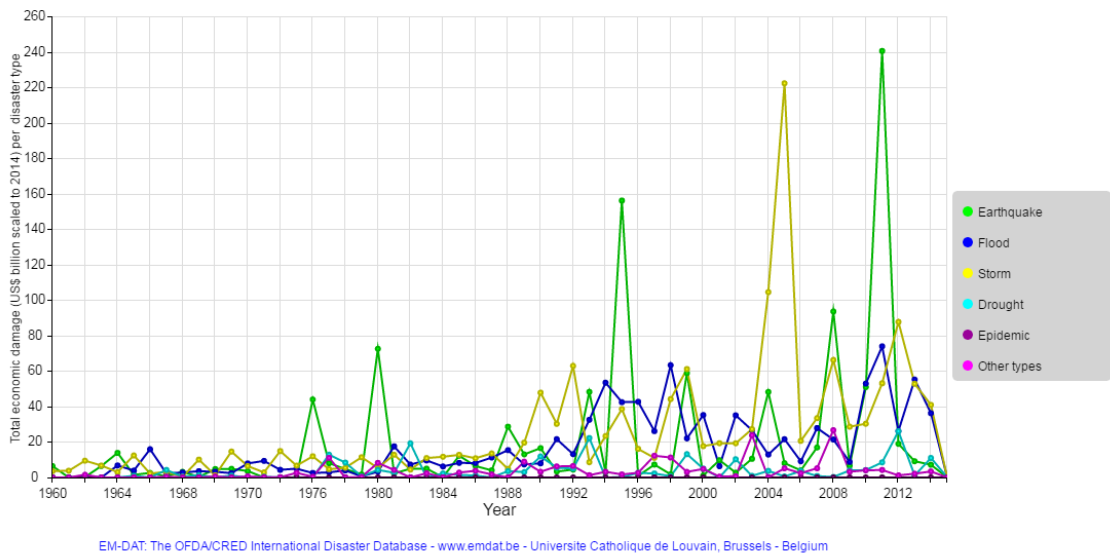
Figure 6. Total economic damage (US$ billion) per disaster type 1960–2015 (Guha-Sapir, 2016)

Among the increase of natural disasters, the incidences of climate-related disasters have also progressively increased over this period (Leaning & Guha-Sapir, 2013) (see Figure 7). Nellemann et al. (2008) predict that this percentage of climate-related natural disasters will only continue to increase, while the number of geophysical disasters has remained stable. The data presented in Figure 7 demonstrates that while the frequency of earthquakes has remained relatively consistent between 1980 and 2000, the number of floods and cyclones, which are bi-products of climate, has dramatically increased in this period, which is consistent with the data presented in Figure 3.

Figure 7. Trends in natural disasters (Bournay, 2007)

With a growing population, the world's exposure to climate disasters is certainly increasing. In addition, population growth and rural-to-urban migration causes coastal populations to increase relative to inland populations, thereby presenting a higher percentage and overall number of individuals at risk to climate disaster impact. Moreover, coastal populations are in general growing at a higher rate than inland populations. As coastal populations are at greater risk of natural disasters (floods and storms in particular), this increased world population and greater percentage of the world living by the coast only compounds the risk in these areas. Exposure is expressed as human lives, properties and places that can potentially be affected by disasters (Pelling et al., 2004).

Australia is particularly vulnerable to natural disasters, specifically those related to climate change such as floods and storms. Moreover, in Australia, growing coastal populations increase the risk posed by disasters according to Australian Bureau of Statistics (ABS, 2011). Australian communities live with a variety of climate disasters, like floods and storms, and many parts of Australia are prone to flooding at different times of year. A vast majority of Australian disasters between 1990 and 2014 were due to climate-related events (see Figure 8). Storms and floods, with disproportionately affected coastal populations, accounted for 74.8% of Australian disasters in this period.

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Between 1990 and 2014, EM-DAT shows 41 floods (which affected 292,939 individuals) and 60 storms (which affected 4,034,572 individuals) during this period. This is further demonstrated by Figure 9, which illustrates that more than 80% of disaster economic losses belong to floods and storms.
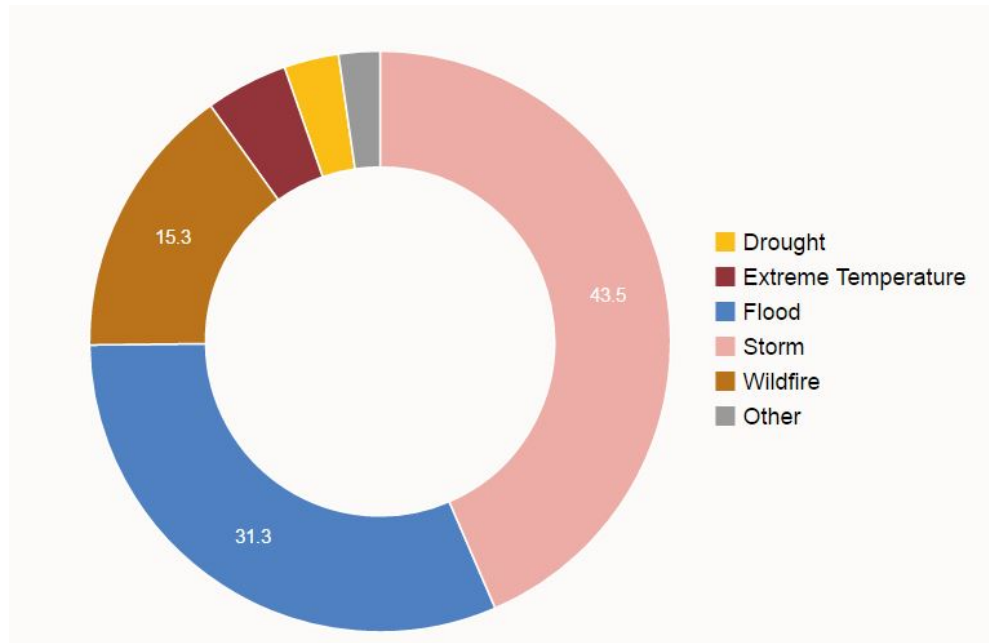
Figure 8. Disaster frequency in Australia—occurrence percentage (UNISDR, 2015)
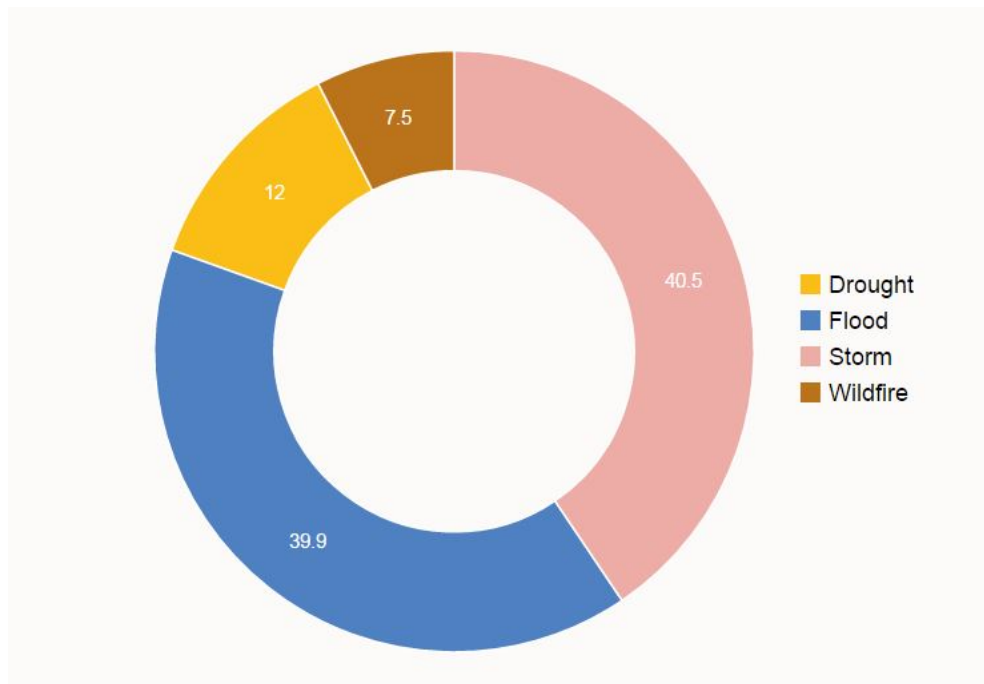
Figure 9. Economic losses percentage per disaster type in Australia

Natural disasters, and in particular climate-related disasters, have significant impacts on communities, economies, infrastructure and the environment.

Collectively, these factors demonstrate the need to enhance community resilience to disasters. Therefore, building and enhancing resilience to climate disasters such as floods and storms is one way to reduce losses in the future and to minimise any reduction in quality of life. This postulation has been supported in recent publications addressing Australian resilience to disaster. Khalili et al. (2015, 2016) for instance, assesses social resilience across three phases of disaster using data collected from NSW SES volunteers to advance the current state of knowledge on social indicators of resilience in Australia. This research is particularly important in Australia, as the country has historically been vulnerable to natural hazards and, as emphasised, the frequency of these disasters, and those related to climate in particular, is increasing. This creates greater risk of disruption to society.

Understanding the factors of resilience and recovery can be used to limit the disruption caused by these disasters and, at some scales, prevent disruptive events from growing to the level of a disaster. As unexpected events, disasters cannot always be prevented or defended against; however, it is important to understand how resilience can be developed to limit the threat disasters pose. Given the growing risk of the likelihood of disaster events, resilience is also increasingly emphasised by community disaster management and recovery practitioners and researchers (Zhou, Wang, Wan, & Jia, 2010). In Australia, the frequency of unexpected large-scale disasters has greatly affected populations. It is, thus, important to advance the state of knowledge on resilience in Australian communities through measuring and assessing associated factors to enhance the ability of these communities to limit the impact of, and recover from, disasters.

As one of the most substantial components of disaster management, there is extensive literature addressing building and enhancing resilience within communities; however, much of this research seeks to provide a specific insight to resilience within communities and, to this effect, focuses on a single aspect of resilience. Unquestionably, to build and enhance resilience within a community, one must consider all aspects of resilience and each aspect must be evaluated properly. In acknowledging

this gap in the extant literature, this research seeks to advance the state of knowledge on social resilience to disasters. The next sub-section outlines the purpose of the study.

1.2 Addressing the Research Gap

While the background information introduced in Section 1.1 of this paper has highlighted the increased risk of disasters and, in particular, the increased risk posed to Australia, this section presents the manner in which this research seeks to advance the state of knowledge on disasters and ultimately improve social resilience to disasters. To provide this information, the motivation, problem, objectives, research questions and research design are presented herein.

The majority of the literature on community resilience has focused on economic (Chang & Shinozuka, 2004; Norris, Stevens, Pfefferbaum, Wyche, & Pfefferbaum, 2008; Rose, 2004), organisational (Tierney & Bruneau, 2007), environmental (Chang & Shinozuka, 2004; Gommes, Guerny, Nachtergaele, Brinkman, & Low, 2005), infrastructural (Bruneau et al., 2003; McDaniels et al., 2007) and technical (Perrow, 2011) aspects. The social aspect is also one of the fundamental elements in community resilience and, to this point, there have only been a few studies about social resilience (Adger, 2006; Paton & Johnston, 2001) in a very constricted area. To date, there is no general framework for social resilience in all phases of disaster; therefore, in this study I focus only on the social aspect of resilience within a community. Thus, this research is motivated to fill this gap in an effort to alleviate some of the risks posed by future disasters. As discussed, extreme events and natural disasters are increasing in frequency and potential damage. Consequently, this research is ultimately motivated by the opportunity to develop policy that is capable of improving the lives of those affected by disaster through advancing social resilience. This motivation is summarised in the research problem.

There is considerable research interest in community resilience from different aspects; however, only a few studies have addressed social resilience, and no studies, to my knowledge, have gathered the most essential social resilience indicators to develop a unified framework of three phases: pre-disaster, response and recovery. The objective of this research is as follows: to provide a novel and general framework for social resilience with the aim of enhancing resilience within communities throughout the three

disaster phases. To achieve the stated purpose of reducing the impact of disasters through advancing social resilience, the following questions are addressed within this research:

1. How do we create resilient communities? How can social resilience be fostered within communities?
2. How can community social resilience be measured? How does this vary across the three disaster phases?
3. What are the essential social resilience indicators within a community across the disaster phases?
4. How do social resilience indicators affect social resilience in each disaster phase? What is the impact level of these indicators on social resilience?
5. How do social networks affect social resilience?

To address these research questions in the Australian context, this study consisted of three phases to conduct mixed methods research, each with associated research steps. In the *first phase*, a literature review was conducted to assess the current state of knowledge on social resilience indicators within communities. This has identified the most essential social resilience indicators within communities from previous studies in all phases of disaster management. Referencing three case study areas, the identified indicators were then clarified and assessed through interviews with subject matter experts in disaster and emergency management. In the *second phase*, qualitative research was completed to collect interview data from NSW SES experts across three case studies (see Section 1.3 for more detail on the SES). This information was then used to develop a framework for social resilience across the disaster management phases.

Finally, in the *third phase*, quantitative research was conducted to assess the social resilience framework through a survey of SES volunteers. During this phase, I assessed the model, tested relevant hypotheses through quantitative research, collected responses from communities to verify my unique model, and then finalised the social resilience framework in each of the disaster management phases. It is through these efforts that I sought to meet the objectives of the research—to create a framework that can be used to measure and assess the resilience of communities and enhance community social resilience, and thereby identify suitable methods to improve it.

1.2.1 Qualitative Research

This research employed a mixed method approach, beginning with one-on-one in-depth interviews. To ascertain insights from subject matter experts on social resilience indicators, I interviewed SES leaders and council members. The SES is a key emergency planning and response organisation for climate disasters and is a lead organisation for building and enhancing community resilience in NSW. Since I wanted to collect different views on social resilience, I needed to conduct interviews with small and medium-sized enterprises (SMEs) in council areas where disasters had recently occurred. This was important because SMEs have experts in disaster management who possess a good understanding of community requirements and of how the community has coped with disasters. The SES and council SMEs interviewed were ideal for providing insight into the aspects most important for assessing social resilience qualitatively. The data were then used to build a framework of social resilience.

1.2.2 Quantitative Research.

In addition to the qualitative data collected in the interviews, I sought to elicit data from a broader sample of community members using a quantitative survey. To collect community perspectives in this study, SES volunteers were chosen because they have an advanced understanding of disaster management through their direct work with the SES and good knowledge about disaster management and resilience, as well as being members of communities. Section 1.3 provides greater detail on NSW SES and its volunteers, including their role in increasing community resilience.

Through developing this framework, I quantify social resilience indicators and provide insight into the social resilience needed to build and improve resilience within communities. The measurement and identifications of these indicators and their emphasis within each of the three phases of disaster can be used by emergency management practitioners to develop policies for improving their respective communities' resilience (Khalili et al., 2015). In improving the ability of communities to prepare for and respond to disasters, this research will minimise the adverse effects associated with disasters, thereby improving the lives of those affected.

1.3 The New South Wales State Emergency Service

The NSW SES is an emergency response and rescue service dedicated to building and supporting safe and resilient communities. The NSW SES provides the state's most adaptable and utilised volunteer emergency corps (Khalili et al., 2015). It was formed in April 1955 in response to disastrous floods that affected the Australian north coast in the northern part of the state in the Hunter Valley, which resulted in considerable loss of life, and damage to property and infrastructure. The floods demonstrated the need for a training response organisation and prompted the formation of the NSW SES to respond to future disasters. While the organisation now primarily responds to floods and storms, it also promotes disaster preparation to limit the impact and prepare communities to be more resilient. Response operations focus on the protection of life and property, as well as the coordination of community response and evacuation (Khalili et al., 2015). The NSW SES is concerned with the welfare of affected communities and coordinates volunteers to aid in protecting affected individuals and communities. To this end, the organisation works with its own trained volunteers, as well as the NSW Police Force, the NSW Rural Fire Service, the NSW Fire Brigades, and the Ambulance Service of NSW to carry out major disaster response efforts (Khalili et al., 2015).

The SES has a central State Headquarters, which is located in Wollongong, as well as 17 regional headquarters located across the state. Each of the regional headquarters serves an SES region based on river catchments as boundaries. As the organisation is predominately supported by a volunteer corps, these individuals are organised into 231 units throughout NSW (Khalili et al., 2015) (see Table 1).

NSW SES	State level	1 headquarters
	Regional level	17 regions
	Unit level	231 units

Table 1. NSW SES structure level

The SES State Headquarters coordinates the training, planning, and operational activities. The headquarters also supplies and equips the 231 volunteer units and oversees the operation of the organisation's human resources, corporate services and public relations functions (Khalili et al., 2015). Each of the 17 regions has a headquarters staffed by a Regional Controller and three supporting staff. The Regional

Controller leads the efforts in the region and is responsible for disaster response within that region, including working with the State Headquarters to oversee the volunteers. The regional headquarters is responsible for providing administrative support to the units in their region and has a fully functioning operations centre and a volunteer corps that aids in training, planning, operations and other functions (Khalili et al., 2015). Finally, the 231 SES volunteer units operate at the local level within all the regions based on council boundaries to provide services to the community in the event of a disaster. Each unit has an operations centre from which it coordinates its disaster-related activities.

The SES has approximately 10,000 volunteer members and 100 staff. The SES regards its volunteers as its most important asset. The volunteer corps is made up of highly skilled individuals who are able to provide first aid, rescue and other important services in the event of an emergency. Most units have an active flood management role to prepare against flooding, thereby mitigating the impact; all units are involved in flood and storm response (Khalili et al., 2015). Moreover, volunteers are not restricted to their unit in the event of a large-scale disaster requiring more volunteers than currently exist in a region. Thus, volunteers are ready to travel to other unit areas on short notice to respond to emergencies and are prepared to stay for extended periods if their services are required.

Figure 10 displays the role of the NSW SES as it evolves during a disaster, highlighting differences before and during a disaster. The circles in the top of the figure show the SES position before a disaster and the transposed circles in the bottom of the figure demonstrate the SES position during a disaster. Thus, the role of the SES transitions to that of helping and assisting communities through the coordination of resources or volunteers as needed in response to a disaster. Since volunteers are both community members and trained to respond to disasters, they play a unique role in responding to disaster from both the SES and the community perspectives (Khalili et al., 2015).
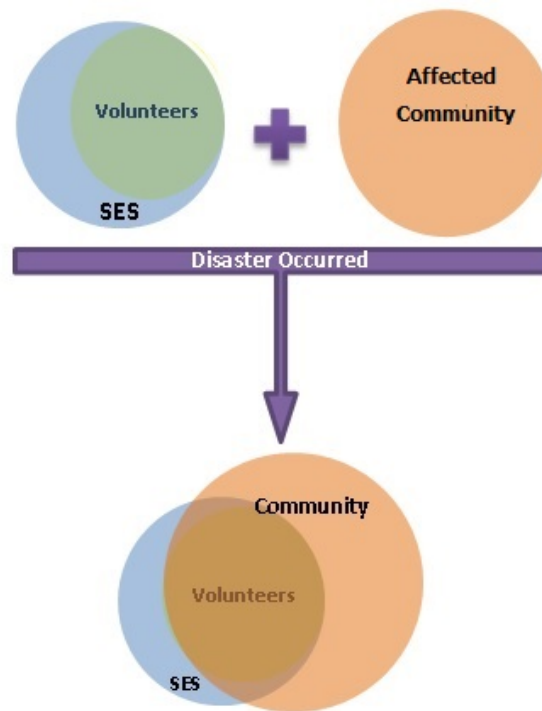
Figure 10. NSW SES involvement in disaster within community
(Khalili et al., 2015)

This study relies on data collected from NSW SES volunteers for two reasons. First, the role of the NSW SES is not only key in disaster response, but also in building resilient communities. As such, the volunteers are key actors and serve as valuable sources of data. To this effect, they were interviewed as individuals with first-hand accounts of disaster response. Second, as over 90% of the volunteers within a unit are members of the community in which they volunteer, these individuals also have first-hand accounts of the needs of the community and, specifically, their needs in terms of disaster resilience and recovery. Thus, based on their in-depth knowledge of both disaster resilience and the communities in which they live and serve, SES members were selected as interviewees in the qualitative research phase and as the target population for the survey in the quantitative phase of this research (Khalili et al., 2015). As it was important for participants in both phases of this research to have meaningful knowledge and understanding of disaster management and needs from a community perspective, affiliates of the NSW SES were ideal candidates for data collection.

While this chapter has introduced the need for this research, highlighting both the increased risk of natural disasters and the lack of current research, and has provided a brief overview of the research approach, Chapter 2, on social resilience, will provide a

more thorough assessment of the literature addressing resilience, with an emphasis on social resilience and social resilience indicators.

Chapter 2: Social Resilience

2.1 Introduction

Human societies are complex and the intricate networks that constitute them span the interrelated realms of the social and psychological, economic and environmental. As the populations and impacts of human beings on our planet continue to increase, so too do the consequences of that growth. Among these consequences are a growing number of climate-related disasters. This research concerns the social impacts of these disasters and concentrates on the resilience displayed by communities in the face of such threats. To limit the losses and damage—both social and material—that result from disaster, social resilience needs to be optimised. To achieve optimal levels of resilience, however, a thorough understanding must be gained in regards both to the constitutive components and processes of resilience and to how these relate to the various phases of disaster. This review covers the underlying mechanisms and processes of disaster coping and resilience presented in the literature, surveying relevant research and theories to identify the key indicators of social resilience.

Section 2.2 outlines the three core concepts upon which this study has been built: resilience, disaster and community. In summarising the existing approaches and applications related to these concepts, this section also defines each term as it is used in the context of this research.

Section 2.3 of the literature review provides a more in-depth analysis of resilience. Moving beyond simple definitions, this section presents theoretical and empirical work on resilience at the collective level of the community. It also outlines the chief phases of disaster, noting their relevance in regards to resilience.

Section 2.4 then narrows the focus specifically to the social aspects of resilience, specifying the capabilities required for achieving social resilience, as well as the vulnerabilities that undermine or threaten it.

In Section 2.5, the literature is used to identify the chief components of social resilience, which are then framed as core indicators. Sixteen such indicators are presented along with research findings that justify their validity and relationship to social resilience.

2.2 Conceptual Overview & Definitions

Given that the objective of this research is to provide insight into how social resilience may be built and enhanced among communities facing increasing climate-related disasters, three core concepts are of particular interest: resilience, disaster and community. As this literature review demonstrates, resilience has long been recognised as a multidimensional and multi-determined concept, complexly rooted in the relationships within and between multiple levels of systems, and constantly changing over time (Walsh, 2015). In the following subsections then, each of the three concepts of resilience, disaster and community will be explored in terms of their representation and application in the literature, and final definitions as applied in this current study will be noted.

2.2.1 Resilience

Resilience is a broadly used concept, being applied across a range of disciplines including engineering, psychology, science, sociology and economics. Initially, resilience was derived from the Latin word *resilio*, meaning 'to jump back' (Klein Nicholls, & Thomalla, 2003). The first known scientific use of the term is credited to Sir Francis Bacon, the said inventor of the modern scientific method (Alexander, 2013). In contemporary times, the concept of resilience has been attributed to C. S. Holling, an ecologist who applied the term in the context of systems ecology in the early 1970s (Holling, 1973). Resilience was also a core concept among psychologists and psychiatrists at this time, being applied in the evaluation of adaptive traits (Anthony, 1974). In general, and across many disciplines, the concept of resilience is used to refer to strength and flexibility (Bruneau et al., 2003), indicating an ability to 'bounce back' from a disruptive event and to return to a previous state of quality of life (Wildavsky, 1984). Even cursory reviews of conceptualisations and applications of resilience reveal considerable variability, not only in how the concept is understood, but also in the approaches used in its research and assessment. Appendix A lists a number of definitions that have been suggested for this term, and the following discussion will highlight some of the key definitions offered in relevant areas of the literature.

In disaster management studies, resilience has been broadly described as the capacity of communities to resist and recover from losses. In an effort to develop a framework for

the assessment of resilience and vulnerability, Buckle, Mars and Smale (2000) operationalise a definition of resilience as the capacity to mitigate and reduce the effects of disasters and losses, thereby recovering with minimal social disruptions (Buckle et al., 2000). Likewise, Adger (2006) suggests that resilience is the ability of communities or groups to cope with shocks, social losses, and political and environmental change (Adger, 2006). Along similar lines, Pelling (2004) describes resilience as communities' ability to cope with or adapt to external stresses, and Buikstra (2011) considers resilience to be the ability of a community to recover from adversity.

In hazards research, resilience is typically defined as the ability to continue, survive and cope with a disaster with minimal social or economic damage (Berkes, Colding, & Folke, 2002). Thus, resilience is strongly implicated in pre-event activities involving both social and engineering systems. In this sense, resilience is tied to prevention and the development of various anticipatory strategies for coping with disaster and minimising impacts after the event (Bruneau et al., 2003). However, in the context of disasters, resilience is a factor across all phases and indicates the need to address changes that demand rapid and flexible responses (Berkes & Ross, 2013). Many have thus suggested that resilience is best understood not as an outcome, but rather as a process (Brown & Kulig, 1996).

Processual approaches to resilience emphasise adaptability over stability (Brown & Kulig, 1996; Handmer & Dovers, 1996) and highlight the multiple resources involved in managing and overcoming challenges across time. In their study on the longitudinal effects of disaster experiences in Mexico, Norris, Baker, Murphy and Kaniasty (2005) call attention to the crucial role of social and psychological functioning in resilience, defining it as a process of linking resources with adaptive capacities (Norris et al., 2005).

Others have focused on the personal resources involved in resilience, usefully distinguishing between the contribution of personality traits (termed 'resiliency') and the actual dynamic process of competence to which resilience refers (Masten, 2001). Conceptualisations of resilience as a dynamic process have been further linked to human development through notions of protective and compensatory factors operative within an individual's life (Burack, Blidner, Flores, & Fitch, 2007). Theorists have also extended such atomistic understandings by insisting that the processual nature of

resilience is necessarily embedded in systems beyond the individual. As Waller (2001) has argued, resilience is a constantly changing product of interacting forces within a given eco-systemic context. Overall then, resilience is appropriately understood as a dynamic process occurring over a developmental trajectory defined by continual engagement with the challenges and changes of life (Director & Sehdev, 2009).

In this study, the definition of resilience adopted comes from Wildavsky (1984), a political scientist who contended that resilience is the capacity to cope with unexpected hazards and to bounce back to a previous situation. Much of Wildavsky's work focuses on societal risk, and the courses of action collectively taken to cope with destructive situations and/or uncertain events. He suggests that two dominant strategies are evident in human societies: anticipation and resilience (Wildavsky, 1984). While strategies of anticipation involve the capacity to prevent and guard against danger, destruction and harm, resilience is defined by response and the capacity to reallocate resources, reorganise and redirect action. In his estimation, resilience requires 'improvement in overall capability, i.e., a generalised capacity to investigate, to learn, and to act, without knowing in advance what one will be called to act upon' (Wildavsky, 1984). Wildavsky's view of resilience can be conceptualised largely in terms of coping and learning to 'bounce back' and will inform the general approach to resilience used in this study.

2.2.2 Disaster

Given that this research explores social resilience within communities in response to climate-related disasters, this section will present an overview of existing definitions of disaster to clarify the conceptual approach adopted in this study.

The earliest investigations and theorising of disaster are generally attributed to Prince (1920) in his study of a Canadian explosion, and to Carr's (1932) definitional analysis of disaster sequences. While research on the topic was limited in the decades to follow, studies related to disasters have significantly increased since the 1950s. Additionally, a proliferation of definitions and conceptualisations has emerged across many fields, which vary greatly because of a lack of consensus on the causes, characteristics and consequences of disasters (Perry, 2007). After more than seven decades of research effort (Oliver-Smith, 1999), it is widely acknowledged that disaster may be naturally

occurring (e.g., earthquakes, floods, draughts and volcanic explosions), human-made (e.g., war, industrial accidents and terrorism) or a combination of both (e.g., human-made disasters that trigger natural disasters and vice versa) (McDonald, 2003). Regardless of the source or type, disaster concerns a disrupted state of negative social and economic conditions (Kapucu, 2005). The literature also displays a general move towards understanding disaster as a social phenomenon. Barton (1969) for instance, defines disasters as collective stress situations arising among members of a distinct social system, characterised by four core dimensions: scope of impact, speed of onset, duration of impact and social preparedness (p. 38). Others also define disaster in terms of the disruption to the society after the event (Quarantelli & Dynes, 1977). These approaches emphasise the fact that everyone within a community is affected by disasters and no singular individual or organisation can prevent the harm caused by the event. Quarantelli (2005) defines typologies for disaster research and defines the core features of a disaster as follows:

1. They are sudden-onset occasions.
2. They seriously disrupt the routines of collective units.
3. They cause the adoption of unplanned courses of action to adjust to the disruption.
4. They have unexpected life histories designated in social space and time.
5. They pose danger to valued social objects.

In this current research, disaster is also understood in social terms and is considered to be an unforeseen and often sudden event that involves a large number of people and causes widespread damage, destruction and human suffering. Disaster thus has a profound effect on specific communities and society in general, as well as causing economic or environmental losses. I assume natural disasters to be naturally occurring events that affect humans and the built environment, while human-made disasters are the consequence of technological or human hazards. In this research, I focus on natural disasters and, specifically, floods and storms.

2.2.3 Community

The concept and term 'community' has various meanings and applications. It is invariably used to refer to collectivities of people joined by shared geography, interests

and concerns, or identity (Jewkes & Murcott, 1996). Communities are composed of social, natural and economic environments that influence one another, as well as those living within them, in complex ways (Norris et al., 2008). Common definitions of community highlight existence within a geographical boundary, engagement in ongoing social interaction and psychological connections to both the surrounding people and place as key components (Christenson & Robinson, 1980). In communities, intent, belief, resources, preferences, needs, risks and a number of other conditions may be held in common, affecting the identity of the participants and their degree of cohesiveness. In their daily activities, each community develops routine ways of handling their tasks, allocating their resources, channelling communications, making decisions and maintaining their community's domains. Over time, communities develop a relative balance between the demands made upon them and their capabilities to meet these demands. Further to that, they establish relationships with other communities, thereby significantly determining their relationship within and beyond the group (Dynes, 1970) and enabling them to reduce the risk of and response to disasters (Comfort et al., 2001). In this research, community refers to a social unit larger than a household whose members share common values and live in some physical proximity to each other. Specifically, I assume three different communities in relation to climate-related disaster response: (i) the people who live in one region and who have been directly affected by disaster; (ii) volunteers in NSW SES, involved in the response to a disaster and (iii) emergency organisations, such as the SES, which are government-based, characterised by multi-layered communication structures, and typically follow a federal, state, district, and local hierarchical approach. In the context of this study, it should be noted that the majority of disaster information coordination and decisions are processed at the state level, while many of the key strategic and tactical decisions are made at the local level.

2.3 Resilience in Communities Faced with Disaster

Having outlined the core concepts upon which this study is broadly based, this section will explore in greater detail, the notion of resilience at the community level, identifying noted theories and dimensions of community-based resilience. It will also review key

findings and theoretical contributions regarding disaster, namely its chief phases and implications in regards to resilience.

Resilience is a factor implicated in many different levels of experience, from individual biological and psychological levels, to the level of the family, and up through macro social and structural levels that include a city, state or nation. Given the interconnectedness of these levels and the complex interrelationships that bind one level to the next, a growing trend in the field of resilience research is an emphasis on collective processes and community-based factors (Richardson, 2002). Resilience within communities implies an integrated effort to understand the social, physical and natural components that define a population and determine its ability to face, cope with and recover from a disruptive event. As such, resilience at the community level is multidimensional and represents a concept that many have attempted to clarify (Plummer & Armitage, 2007).

Resilience has been conceptualised as encompassing four interrelated dimensions: technical, organisational, social and economic (Bruneau et al., 2003) (see Figure 11).
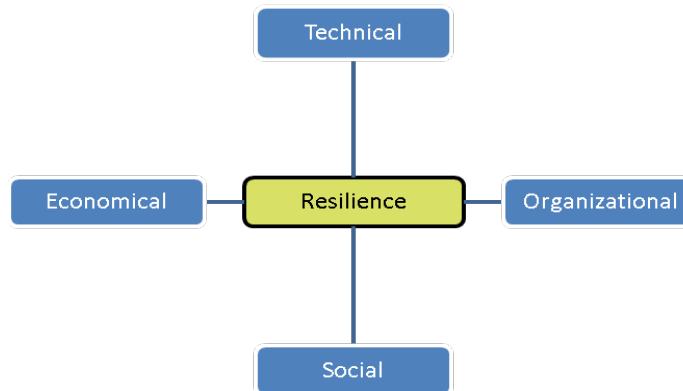
Figure 11. Resilience framework (Bruneau et al., 2003)

According to this framework, the technical dimension of resilience denotes the ability of physical systems and related components to perform to adequate levels once disaster occurs. The organisational dimension of resilience refers to the capacity of emergency organisations to mitigate disaster loss. These organisations are in charge of managing critical disaster-related functions and making decisions to achieve less redundancy and greater robustness, resourcefulness and rapidity. The economic dimension of resilience refers to the capacity to reduce both direct and indirect economic loss once disaster

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occurs. The social dimension of resilience relates to efforts of reducing the negative consequences of disaster in terms of losses or impacts on social life (Bruneau et al., 2003).

A second approach is built upon the assumption that resilience is defined by two chief qualities. The first is inherent and refers to effective functioning during non-crisis periods; the second is adaptive and relates to the flexibility displayed by social, institutional and economic systems, as well as infrastructure in response during disasters (Cutter et al., 2008). This perspective informs a model of disaster resilience of place, or DROP (Cutter et al., 2008). This model addresses resilience by considering the relationship between vulnerability and resilience. As a concept relevant to this study, vulnerability will be addressed further in a later section of the review; however, in summary, the DROP model conceptualises resilience as a changeable process dependent upon pre-existing conditions and the severity, duration and time between disasters, as well as a range of additional external factors (Cutter et al., 2008). Overall, the indicators of community resilience, which emerge from the development and application of the DROP model, cluster around six core dimensions: ecological, social, economic, institutional, infrastructure and community competence (Cutter et al., 2008).

Working from a geographical perspective, Zhou and colleagues (2010) represent a third notable approach to resilience within local community contexts. They developed a model of disaster resilience of 'Loss–Response' of Location (DRLRL) based on three distinct dimensions: the temporal and the spatial scales of resilience, and the attributes of hazard-affected bodies (Zhou et al., 2010).

Alternatively, Adger (2000) adopts an ecological approach that highlights the link between social and ecological resiliency. He defines social resilience as the ability of communities to withstand external shocks to their social infrastructure (Adger, 2000) and emphasises resource accessibility and adaptability as chief determinants of community resilience.

Mileti (1999) considers a resilient community to be defined as one that 'can withstand an extreme natural event with a tolerable level of losses' and that 'takes mitigation actions consistent with achieving that level of protection'. Other approaches to community-based resilience minimise resource-based concerns, focusing instead on

social processes rooted in culture-specific values, social structures, dynamics and practices (e.g., Clauss-Ehlers & Levi, 2002; Kirmayer, Sehdev, & Isaac, 2009).

Tierney and Bruneau (2007) describe the resilience of communities and systems to have properties such as resourcefulness, robustness, redundancy and rapidity. Resourcefulness refers to the capacity to identify problems, to prioritise them and to mobilise resources accordingly, whereas robustness refers to the system's ability to withstand a given level of stress without loss of function. Redundancy is the extent to which systems exist that are substitutable, and rapidity denotes the capacity to achieve goals in a timely manner to contain losses and avoid future disruption (Tierney & Bruneau, 2007). Further, resilient communities reduce the consequences of failures, such as injuries, deaths, social loss, and negative economic and social consequences. They also reduce the time required to recover and restore themselves to the previous level of performance (Bruneau et al., 2003). Within this framework, resilience indicates the ability of the system or community to reduce the chances of a shock, to absorb a shock and to recover quickly. It follows, then, that community resilience can be achieved by enhancing preparedness and the ability of community members to perform during and after a disaster or disruptive event. In turn, this is can be achieved by employing effective coping and recovery strategies that enable the community to return to levels of pre-event functioning (Bruneau et al., 2003).

Evidently, the complexity and dynamism defining these capabilities and strategies are only further complicated by the particularities of the various environments in which the disruption or disaster occurs. This means that the responses, actions and efforts required by a given community will vary depending on location as well as the type and severity of the event. Moreover, because it is not possible for any one community or actor to take responsibility for all responses and to meet all demands, achieving resiliency and accomplishing the common goals of recovery require specific and coordinated efforts (Kapucu, 2005). In terms of disruptive events, disasters—and particularly natural disasters—pose extreme challenges to communities, especially if the time, location and disaster severity are uncertain, even when the community's vulnerability is known (Comfort et al., 2001).

Efforts to describe disaster resilience have given rise to numerous models, most of which adopt a linear structure and build upon Neal's (1997) foundational stages model

of disaster, which enumerates the key stages as preparedness, response and recovery. Variants of the linear process model have been proposed by Harrald and Stoddart (1998) who concentrate on the tasks and functions of organisational structure to describe four key stages: initiation/mobilisation, integration (norming), production (performing), and demobilisation (transition). Along similar lines, Myers (1993) suggests that the disaster management process occurs across four periods: (i) normal operations, (ii) emergency response, (iii) interim process, and (iv) restoration. Models of disaster that move away from a linear process approach include circular, cyclic conceptualisations (Kelly, 1999). These periods account better for the overlap and interconnection between disaster and development phases. Another model that focuses on the intersections of development and disasters was proposed according to a spiral structure, which facilitates the representation of both the positive and negative effects of disaster (Kelly, 1999).

Taking a multi-factor 'phase plane' approach, Kelly (1999) suggests a disaster process model represented as a two-dimensional Cartesian plane with four quadrants. This model proposes a 'phase plane' organised with 'response' and 'input' along the y-axis, and 'event' and 'impact' along the x-axis (Kelly, 1999). More recently, from a disaster management perspective, Cyganik (2003) defines the stages as mitigation, preparation, response and recovery. Conversely, Asghar, Alahakoon and Churilov (2006) have developed a comprehensive model that presents a two-layered framework. The first layer addresses the relationship between hazard assessments and risk management, while the second focuses on the relationship between risk management and disaster management, and includes the traditional actions of mitigation, preparedness, response and recovery (Asghar et al., 2006). While each of these models, along with the many others not included here, contributes a useful perspective on the disaster process, the basic progression of disaster phases that emerges throughout involves four distinct phases: (i) planning and mitigation, (ii) preparedness, (iii) response, and (iv) relief and recovery (see Figure 12).

Figure 12. Four phases of disaster management

Each phase involves different challenges and so requires different strategies and resources. The purpose of considering each disaster phase is to optimise response and lessen potential overall losses.

Mitigation and preparedness are involved in the pre-disaster phase and allow for potential risks to be identified and pre-event actions to be taken, which have important implications for reducing the disaster's impact. Mitigation reinforces the community's ability to withstand the shock of a disaster, and preparedness involves the pre-event activities that predict the resources required for effective recovery and relief (Forgette & Boening, 2009). Preparedness activities help to build social resilience to disasters. Preparation not only helps in preventing disasters but also minimises the impact of disasters once they occur. While pre-disaster functioning is an important component of disaster, it does not involve the adaptation requirements of post-disaster or recovery phases. The response phase occurs during and immediately following a disaster occurrence. It has been suggested that successful disaster response requires an integrative and agile approach to collaboration and coordination that combines structured management systems as well as non-structural factors such as adaptability, improvisation and creativity (Harrald, 2006). The recovery phase follows from response. It is thus greatly affected by the decisions and courses of action (or inaction) that had been applied during the response phase. In a study of disaster recovery and what is termed the 'redevelopment' phase of disaster, Haas, Kates and Bowden (1977) take a 'value added' approach that describes four sub-phases: (i) emergency responses (e.g., search and rescue, debris removal, establishing temporary shelter); (ii) the

restoration of public services (e.g., water, power, telephone); (iii) the replacement and reconstruction of capital stock; and (iv) the initiation of economic and developmental stimulus. While some, such as Quarantelli (1986), contend that the recovery phase and its attendant redevelopment efforts do not necessarily follow this linear and ordered progression, all of these actions do indeed occur, though just in a less organised and temporally sequential manner.

The nature of these stages can therefore be represented diagrammatically, such as in Figure 13, which considers the impact on the quality of life of people within a community through the stages of a disaster. The pre-disaster phase shows the existing overall situation of quality of life before a disaster. Once a disaster occurs, the response phase commences and quality of life decreases sharply for that period. In the recovery phase, quality of life improves due to different interventions within various realms. Technical, economic and social resilience is supported with the expectation of returning to a state comparable to that existing pre-disaster. In some cases, however, factors such as innovation and improvisation facilitate an actual improvement and increase in quality of life, which therefore comes to exceed that of the previous period (Forgette & Boening, 2009). The lower temporal line indicates, as previous studies have also shown, that the point at which the relief phase ends and recovery begins is vague. With that being said, the goals of the relief phase are tactical, while the goals of recovery are strategic (Forgette & Boening, 2009).
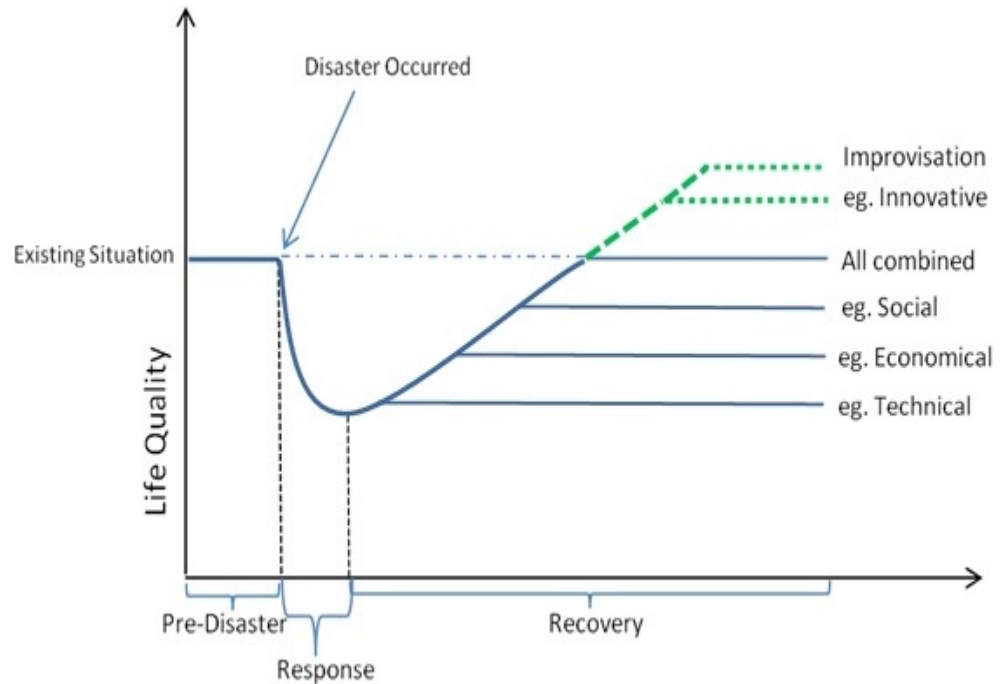
Figure 13. Temporal resilience—adapted from Adger (2000), Bruneau et al., (2003), and Maguire and Hagan (2007)

Overall, disasters can provide an opportunity to revise human behaviour and activities, and to redesign and rebuild the human environment damaged by the event (Bruneau et al., 2003). Additionally, disaster loss inspires me to develop and support resilient systems and communities.

The preceding review has described various approaches and models of disaster. In this study, I combined the first two phases of mitigation and preparedness into a singular pre-disaster phase, which is then followed by a disaster phase and, finally, a post-disaster phase. Generally, pre-disaster relates to pre-event actions that anticipate the resources needed to return to the previous situation, and post-event activities include those intended to lessen the time required to return to the pre-disaster state (Forgette & Boening, 2009). These three stages correspond, respectively, to the management stages of pre-disaster, response and recovery (see Figure 14).
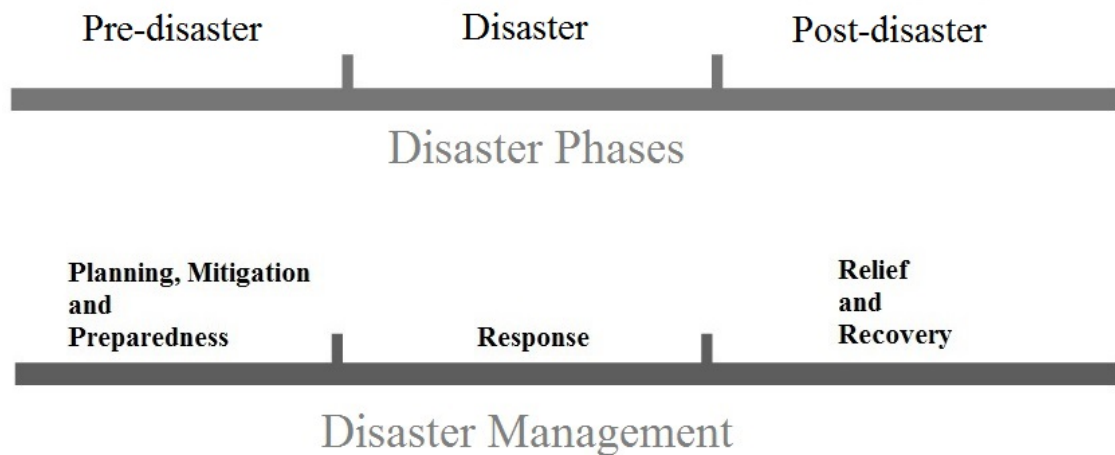
Figure 14. Disaster management phases

The pre-disaster management stage involves planning, mitigation and preparedness. The response phase refers to processes of actively combating a disaster and assisting those immediately affected. Actions in this phase must be swift, effective and make the area safe for affected people. Recovery is the post-event phase that includes activities aimed at minimising the time required to return to the pre-disaster situation. It also involves the restoration of all aspects of the disaster's impact on a community. The aim of the recovery phase is to bring the affected community back to normality as quickly as possible (Shaluf, 2007).

This inclusive approach to the full spectrum of disaster means that community resilience is not only dependent on pre-existing technical, social, economic and political conditions, but it also depends on post-disaster responses, recovery and relief efforts (Boyce, 2000). This study, therefore, considers community resilience in reference to all three of the stages of disaster management: pre-disaster, response and recovery (post-disaster) (see Figure14).

In summary, this section has established that disasters are highly impactful events capable of disrupting numerous systems—particularly interdependent systems—within a community, straining or destroying existing functional capacities. In this way, disasters pose a very real threat to interconnected community systems, with social, economic and technical infrastructure being at significant risk (Comfort, Ko, & Zagorecki, 2004). Failure or excessive incapacitation of one operational system is likely to create failure in other interdependent systems (Comfort, Ko, & Zagorecki, 2004). Geographical and temporal factors are also important elements in determining threat

salience in the context of disaster (Miller, Paton, & Johnston, 1999). Given this, understanding how resilience within a community can be developed and enhanced, both to protect against such threats as well as cope with them once they occur, is crucial. In this sense, both resilience and disasters implicate multiple realms of human experience, from the technical and organisational, to the social and economic. This also means that resilience dimensions need to be considered across all phases of a disaster, including pre-disaster, response and post-disaster (Tobin & Whiteford, 2002). Due to this complexity and the multidimensional nature of both resilience and disasters, a broad model of resilience has not yet been empirically tested at the community level (Cumming et al., 2005) and the proper scales for measuring social resilience within communities do not currently exist (Khalili et al., 2015). Moreover, many existing models or frameworks fail to capture adequately antecedent social factors that affect resilience. For these reasons, and in an effort to identify ways of improving and enhancing community resilience, this study limits its focus to only one component of resilience within communities: social resilience. In the section to follow, the concept of social resilience will be clarified, both in regards to the capabilities that underlie it and its relationship to notions of vulnerability.

2.4 Social Resilience

2.4.1 Capabilities and Social Resilience

Resilience within communities is complex and while growing emphasis has been placed on the social dimensions of resilience, standard parameters, indicators and frameworks applicable within academic discourse are notably meagre (Khalili et al., 2015). Indeed, in the context of disaster and resilience research, it has been noted that the social aspects of community systems, must be taken into account (Lorenz, 2013) if applicable knowledge, and therefore effective policies and procedures are to be developed.

In this study, then, I focus on the social dimension of resilience within communities, and provide a broad overview of this concept, which informs the identification and elaboration of specific indicators presented in the final section of this review. Firstly, key issues and definitions of social resilience will be discussed, including the chief capabilities that have been theoretically and empirically linked to this concept.

Social entities, including individuals, communities and organisations, are variously implicated in definitions of social resilience, as are their unique capacities to cope with, absorb, and adjust to both social and environmental threats (Keck & Sakdapolrak, 2013). Social resilience has thus been defined as 'the way in which individuals, communities and societies adapt, transform and potentially become stronger when faced with environmental, social, economic or political challenges' (Cuthill et al., 2008). For the purposes of this research, social resilience is defined as the ability of a community to withstand external social shock (Adger, 2000) and its efforts towards enhancing the social capacity to resist losses during disaster and regenerate it after a disaster (Zhou et al., 2010). This definition includes, therefore, the performance of recovery activities in ways that minimise social disruption and mitigate the effects of future disasters (Bruneau et al., 2003).

Although it is generally not possible to prevent or directly manage every aspect of a disaster, it is possible to mitigate some of the impacts and subsequent social consequences. The impacts of disasters on the community are thus not necessarily determined by the scale of a disaster but are significantly influenced by the preparedness and particular characteristics of a given community. A community's social situation in both the pre- and post-disaster phases becomes extremely relevant (Boyce, 2000) as it significantly determines how a community responds and rebounds from crisis (Tobin & Whiteford, 2002).

Social resilience has been characterised according to three core attributes: resistance, recovery and creativity (Maguire & Hagan, 2007). In the case of resistance, this is the attribute describing a community's ability to withstand major disruption and challenge. Recovery refers to the ability to 'bounce back' to a pre-disaster state. High resiliency in this sense is connected to a quick return to pre-disaster functionality, or even to a higher and improved situation. Finally, creativity is connected to a community's ability to learn from a crisis and to apply this learning to improve functioning and enhance resilience (Maguire & Hagan, 2007). Others have likewise defined highly resilient communities as those that learn from a disaster experience and effectively adapt to its new circumstances (Bruneau et al., 2003). These attributes of social resilience are thus underlain by particular capacities. Some have identified communication, risk awareness and preparation as key capacities (Paton & Johnston, 2006) while others have listed

vision, leadership, trust and the development of social networks as crucial capacities (Folke, 2003). Berkes and Turner (2006) identify sharing knowledge and information as essential in building social resilience, and Lebel and colleagues (2006) note the importance of governance, defined by representation, deliberation, empowerment and social justice (Lebel et al., 2006). Collaborative and social learning have also been identified as significant in social resilience (Fazey et al., 2007).

Essential attributes of social resilience are said to include six core capacities: knowledge, skills and learning; community networks; people–place connections; community infrastructure; a diverse and innovative economy; and engaged governance (Maclean et al., 2014). Still others emphasise categories of capacity, including adaptive, coping and participative capacities (Keck & Sakdapolrak, 2013; Lorenz, 2013; Voss, 2008). Adaptive capacities involve the modification of system structures in order to prevent future disasters (Lorenz, 2013). Adaptive capacities are thus described as proactive and anticipatory (Obrist, Pfeiffer, & Henley, 2010). They involve strategic agency and are geared towards long-term, incremental change (Keck & Sakdapolrak, 2013). Coping capacities are more reactive (Obrist et al., 2010) and involve the means by which individuals and groups use available resources to overcome threats and challenges associated with disaster in an effort to restore a level of wellbeing (Keck & Sakdapolrak, 2013). The third type of capacity is a participative or transformative capacity, which functions as a measure of a system or a community's ability to alter its structures and draw on the assistance and assets of other groups or systems (Lorenz, 2013; Voss, 2008). Participative capacities are generally geared towards enhancing wellbeing and social cohesion. Thus, they include the creation of new institutions or systems to improve the post-disaster situation and foster social resilience (Keck & Sakdapolrak, 2013).

2.4.2 Vulnerability and Social Resilience

To address social resilience fully, attention must be given to wider societal conditions, particularly those that may create vulnerability within the community. In the broadest sense, vulnerability may be defined as the potential for loss (Mitchell, Devine, & Jagger, 1989). Vulnerability has inherent characteristic that create harm after disaster. It refers to the levels of exposure that people and places have (Adger, 2006) and the potential harm that may be incurred from disaster experience (Cutter et al., 2008). Some

research emphasises vulnerability as differential access to resources or differential susceptibility to loss (Alexander, 1993), while other studies extend the concept of vulnerability to include such elements as exposure, coping capacity and adaptation capacity (Oliver-Smith, Cutter, Warner, Corendea, & Yuzva, 2012). Anderson (1985) asserts that communities may be vulnerable in three main areas: the material, the organisational and the socio-psychological. Material vulnerability relates to economic and physical entities and is reduced when the community has access to adequate resources for meeting and for sustaining their basic needs during the potentially extended non-productive period that follows a disaster. Organisational vulnerability of a society exacerbates material vulnerability, and socio-psychological vulnerability involves weaknesses or inadequacies in either the individuals or the community as a whole, which compromise the ability to cope effectively with disaster. Anderson goes on to suggest that reduced vulnerability in any of these areas (or combination of areas) enables a community to better cope with threats, crises and disasters (Anderson, 1985). Vulnerability is, thus, the pre-event, inherent characteristics or qualities of social systems that create the potential for harm. It is a function of the exposure (who or what is at risk) and sensitivity of a system (the degree to which people and places may be harmed) (Adger, 2006; Cutter, Boruff, & Shirley, 2003).

Given the broad scope of vulnerability within communities, over the last few decades researchers have focused on elucidating different models and aspects of vulnerability, concentrating, for example, on such dimensions as the socioeconomic and political (Blaikie et al. 2004; Bohle, Downing, & Watts, 1994) or economics and poverty (Alwang et al., 2001). Others have also made an effort to measure vulnerability (Luers, Lobell, Sklar, Addams, & Matson, 2003), and numerous models along these lines have been proposed. One of the most popular models of vulnerability draws on concepts from engineering and natural disasters and—referred to as the Natural Hazards Model (Adger, 2006). The Risk Hazards Model (White & Haas, 1975) focuses on risk factors present in both social and environmental systems. Social, political and economic factors are the focus of the Political Ecology Model (Zimmerer & Bassett, 2003), which considers vulnerability in terms of coping abilities relevant to these domains. One final model of note is the Human Ecology Model (Furedi, 2007), which highlights the ways in which various social groups are disproportionately exposed to risk in disaster contexts.

In this study, I focus only on the social aspect of vulnerability. Cutter, Emrich, Webb and Morath (2009) offer a useful distinction between vulnerability and social vulnerability, noting that vulnerability is 'the susceptibility of a given population, system, or place to harm from exposure to the hazard and directly affects the ability to prepare for, respond to, and recover from hazards and disasters,'. Meanwhile social vulnerability focuses explicitly on the 'demographic and socioeconomic factors that increase or attenuate the impacts of hazard events on local populations' (Cutter et al., 2009). Social vulnerability has similarly been conceived as the diminished capacity of communities to anticipate, cope with, resist and recover from the impact of a disaster, and also refers to the inability of communities to withstand adverse impacts from the multiple stressors to which they are exposed (Ballesteros, 2011).

Social vulnerability has been shown to affect disaster survivors' perceptions of recovery, both at a personal and community level (Forgette & Boening, 2009); Moreover, research shows that social vulnerability is particularly acute among people who are isolated, insecure and defenceless in the face of disaster. Marginalised groups that are removed socially, economically or politically from society tend to experience extremely high impacts because of disasters (Hewitt, 1983). Mileti (1991) described marginalised people as those suffering from a lack of education and skills, and from poverty prior to the disaster. Because disasters typically worsen fundamental social problems, pre-existing economic and social marginality affect the ability of particular groups, and even entire communities, to recover after a disaster (Tobin & Whiteford, 2002). Societies are inherently defined by competition over limited resources, and so those with the least resources (i.e. marginalised people), are the hardest hit and the least able to cope with disasters (Peacock, 1997). Explicitly social factors, such as social connectedness, closeness to family and friends, and strong support networks, also play an important role and represent a key resource in disaster situations. People with intact social resources and strong social support networks are able to regain independence and return to previous states of wellbeing sooner than isolated individuals who are forced to remain dependent on formal assistance programmes (Tobin & Whiteford, 2002). In fact, Chappell, Forgette, Swanson and Van Boening (2007) have demonstrated that government aid often fails to provide immediate relief to those survivors experiencing social disruption. Government responses to disaster are often aimed initially at providing security and safety, with resources being directed to immediate relief, not to

ensuring the long-term recovery of affected communities. This is problematic given that long-term recovery is a significant component of social resilience (Forgette & Boening, 2009) and is especially difficult for marginalised individuals and communities to achieve.

A fuller understanding of the concept of vulnerability in disaster contexts may be developed by considering its relationships and intersections with social resilience. So far, social resilience has been described as the ability of a social system to respond and recover from disasters, to cope with a disruptive event through pre-event and post-event activities, and to employ adaptive processes that enable the social system to change, learn and become re-established in response to disaster. While some view resilience and vulnerability as static phenomena (Cutter et al., 2008), both represent different yet interrelated aspects of disaster response (Cutter et al., 2008; Miller et al., 2010), which are actually quite dynamic and continually in flux. This complicates the ability to measure or assess the core components of either, let alone the interrelationship that links them. These two concepts are both crucially important aspects of disaster experience and are typically seen as counterparts to one another, related through an obverse relationship (Cutter et al., 2008). Some have suggested that resilience is actually just an aspect of vulnerability (Blaikie et al., 2004). Others contend that while resilience indicates the presence of strong capacities and positive attributes, vulnerability represents their absence (Adger, 2006). While vulnerability and resilience are often viewed and presented in a type of oppositional form, they are perhaps best conceived as alternative sides of the same thing (namely disaster), meaning that a community or group is able to simultaneously be both vulnerable and resilient (Whittle et al., 2010). For example, negative impacts of a disaster, such as injuries and death, may be high (because of vulnerability), but recovery and re-stabilisation may also be quick and effective if resilience within that community is also high. In general, social resilience is initially developed by identifying a community's vulnerabilities and capacities. Then, planning and implementation of strategies to lessen the effects of disaster are initiated in order to enhance resilience within a community (Forgette & Boening, 2009).

To summarise, social resilience is a particular aspect of community-based resilience that refers to the ability of a community to withstand external social shock, such as that initiated by disaster. This implies that a community has the ability to recover and

regenerate after a disaster, which it does by pre-empting its vulnerabilities and exploiting its capacities (Forgette & Boening, 2009).

2.5 Social Resilience Indicators

To build and increase social resilience within a community, identifying its chief indicators and recognising their level of impact and changeability within communities, is essential. As previously defined, social resilience is the ability of a community to absorb shocks, recover from disturbances, and avoid negative and potentially irreversible effects (Alliance, 2007). Such effects may be effectively reduced by the enhancement of key social factors, including increased wealth, strong and stable social networks, adequate understanding of threat and risk, and increased community engagement (Cutter et al., 2008). Indicators relevant to social resilience may be derived, then, from a wide range of factors and include such things as social capital, leadership and learning (Miller et al., 2010), as well as psychological factors including a sense of community, coping style and self-efficacy (Bachrach & Zautra, 1985; Tobin, 1999). Moreover, it has been suggested that social resilience should be conceptualised and managed in a contingent rather than a prescriptive manner (Paton, Millar, & Johnston, 2001). In the context of this study, an indicator is defined as a parameter or a value describing the social resilience of a specific community that can be measured and is assumed to vary over time and through different phases of a disaster. The identification of such indicators represents a significant tool for evaluating and assessing community resilience from the social perspective. Much research and considerable policy-related work have addressed resilience as a particularly significant means of mitigating the impacts of disaster. However, continuing multiplication and diversification of key terms and concepts (including social resilience itself), as well as variation in intended policy targets (i.e., emergency management, environmental restoration, climate change, long-term recovery), have impeded progress towards the development of systematised and consensually applicable measures and metrics (Cutter et al., 2008; Cutter, Burton, & Emrich, 2010).

This research aims to contribute to the clarification of the social aspect of resilience by developing a comprehensive list of indicators relevant to community experience and functioning in relation to disaster. Measuring and assessing such indicators may enable

the classification of their impact on social resilience with the aim of providing targeted areas for improvement and further insights into social processes of resilience.

2.5.1 Self and Collective Efficacy

Self-efficacy is a concept used to describe an individual's appraisal of their performance capability (Bachrach & Zautra, 1985). Ormrod (2000) similarly defines it as an individual's belief in his or her own capabilities of performing and his or her own ability to complete tasks. Bandura (2002) suggests that self-efficacy, as the belief that one can attain desired outcomes by performing challenging tasks, reflects a sense of self-confidence and an optimistic feeling of control over one's environment. He further notes the crucial role that self-efficacy plays in adaptation processes, which has relevance for post-disaster experience. Because self-efficacy influences the actions that people take and is an appraisal of the ability to act, regardless of actual knowledge or skills (Bachrach & Zautra, 1985), it has important implications in contexts where people are faced with unexpected disruption, threat or disaster. Indeed, Gist and Mitchell (1992) have identified self-efficacy as a key protective motivational construct in situations of disaster, and Benight and Bandura's (2004) contention that it facilitates coping and a sense of control in challenging situations further demonstrates its relevance to disaster-related resilience (Benight & Bandura, 2004). Numerous sources suggest that self-efficacy activates motivational behavioural and affective mechanisms and thus may be considered a component, or at least a promoter, of resilience (Rutter, 1987; Schwarzer & Warner, 2013; Tedeschi & Calhoun, 1995).

High self-efficacy beliefs function as a type of buffer, protecting people from the intense stressors associated with threat and disaster, and increasing their motivation in regards to resource seeking (Benight & Bandura, 2004). Meta-analyses demonstrate a strong and consistent relationship between self-efficacy beliefs and psychological outcomes of collectively traumatic events (e.g., natural disasters, war) (Luszczynska Benight, & Cieslak, 2009). Longitudinal research on self-efficacy among survivors of the 2010 earthquake in Chilli has shown that there is a definite relationship between self-efficacy and post-traumatic stress symptoms, and that this relationship is moderated by fear in disaster contexts (Guerra, Cumsille, & Martínez, 2014). Efficacy is thus not only a concept related to individual coping and response, but also one that functions as a collective attribute.

Benight (2004) defined collective efficacy as the shared belief that one's community can effectively meet environmental demands and improve lives through concerted effort. Collective efficacy has been defined as a combination of trust and shared willingness to work within a community and neighbourhood (Sampson, Raudenbush, & Earls, 1997) and reflects a shared belief in the collective ability of the community to produce organised, unified actions and desired results (Perkins & Long, 2002). It has been suggested that collective efficacy comprises two related dimensions: social control and social cohesion (trust) (Sampson et al., 1997). Social cohesion is the trust and sense of connection that is experienced between members of the group, and social control is related to the performance and maintenance of actions that are reflective of common community beliefs, values or principles (Sampson et al., 1997). Given that it reflects both of these core dimensions, collective efficacy represents the connection binding members of community to each other by way of normalised and collective behaviours, shared expectations, trust, and a willingness to help and engage with others within that same community (Cagney et al., 2009).

Research has demonstrated that both individuals and communities with high efficacy are less adversely affected by disaster than are those with low efficacy (Norris et al., 2008). Others have shown that communities characterised by higher collective efficacy display less crime (Odgers et al., 2009) and experience lower rates of depressive symptoms (Vaeth, Ramisetty-Mikler, & Caetano, 2009). Theorists suggest that because collective efficacy positively correlates with self-efficacy, it has a significant influence on social resilience (Benight, 2004). Furthermore, Miller et al. (1999) demonstrate in their research that self-efficacy reduces vulnerability and may thus be an indicator of social resilience. This research also reveals that greater self- and collective efficacy results in lower levels of disaster-related harm and loss. Increasing self- and collective efficacy through local project and activity involvement may reduce vulnerability and increase resilience among communities (Miller et al., 1999).

While much less research exists on community-level characteristics like collective efficacy in relation to disasters, some studies have reliably demonstrated that even after adjusting for various socio-demographic and socioeconomic factors, both individual- and community-level efficacy are associated with lower post-traumatic stress disorder following a disaster (Ursano et al., 2014). This prompted the authors to suggest that

enhancing collective efficacy among communities may be a vital prevention practice that stands to reduce the negative psychological effects of major threats and disasters.

Overall then, efficacy, at both the individual and collective level, is a significant factor in disaster experience and, as indicated above, an important aspect of resilience in communities as well.

2.5.2 Sense of Community

Previous studies have advanced various different definitions of a sense of community. McMillan and Chavis (1986) describe a sense of community as the feeling a person has about their belonging and their relations with other community members, and as a shared trust among the community. Some have characterised a sense of community as a high concern for community issues, respect for and service to others, a sense of connection and needs fulfilment, which is assumed to be a dimension of community capacity (Goodman et al., 1998). Other affective approaches to a sense of community define it as an attitude of trust and belonging among members of a community (Perkins & Long, 2002). Norris and colleagues have qualified a sense of community in terms of shared concerns and values (Norris et al., 2008). A sense of community has also been linked to more objective demographic type qualities, such as age and the length of time a person has lived within a community (Bachrach & Zautra, 1985). In the author's early work, Gusfield (1975) identified two dimensions of communities that are implicated in the notion of 'sense of community': the territorial and the relational. The relational dimension has to do with the nature and quality of relationships in a community. Some communities may have no discernible territorial demarcation, as in the case of a community of scholars working in a particular specialty. Thus, for communities such as these, members maintain some kind of contact and quality of relationship. However, they may live and work in disparate locations, perhaps even throughout the world. Other communities seem to be more strongly defined according to territory, as in the case of neighbourhoods. However, proximity or shared territory cannot constitute by itself a community; the relational dimension is also essential.

In a related vein, others have emphasised a sense of community in terms of its relationship to attachment, particularly to attachment associated to a certain place (Tartaglia, 2006). Place attachment entails an emotional connection to specific places or

people who live in the same area (Manzo & Perkins, 2006). Place attachment triggers citizens' efforts to invigorate a community (Norris et al., 2008) and underlies community revitalisation efforts (Perkins, Hughey, Speer, 2002), as well as promoting general resilience within a community (Cox & Holmes, 2000).

Given that the effects of disaster implicate both relational and territorial aspects of community life, understanding the role of a sense of community across the multiple phases of disaster is of great value. Pre-disaster activities may foster a sense of community, encouraging the development of trust and connection, and increasing access to social networks (Kaniasty & Norris, 1999), all of which would inspire members to be involved in disaster response and post-event activities as well. In this way, a sense of community mitigates disaster consequences and maximises the potential for recovery. Subsequent to a disaster, individuals without any sense of community, who do not feel as though they belong, demonstrate little investment in their community and develop a level of detachment. That detachment contributes to feelings of isolation, encourages learned helplessness, enhances vulnerability and, consequently, lessens community resilience (Bachrach & Zautra, 1985). Even when a sense of community is highly developed and strong within a particular community, disasters may disrupt this sense and cause a significant decrease in the local sense of community (Erikson, 1976; Norris et al., 2008). On the other hand, disasters also have the potential to enhance the sense of interdependence within a community (Edelstein & Wandersman, 1987). As such, several researchers believe that a sense of community can be an indicator of social resilience (Ahmed, Seedat, Van Niekerk, & Bulbulia, 2004; Pfefferbaum, Reissman, Pfefferbaum, Klomp, & Gurwitch, 2007; Saul, 2004; Tse & Liew, 2004)

2.5.3 Coping Style

Any range of stressful, traumatic, or extremely taxing and challenging situations may initiate a coping response among the individual faced with dealing with such events. Stress and coping theory has long noted that this is a multidimensional process (Folkman, 1984; Folkman & Lazarus, 1980). Coping generally refers to an individual's behavioural and cognitive efforts to manage and deal with stressful situations (Lazarus & Folkman, 1984). Coping is, thus, a predominantly regulative strategy aimed at regulating the problem or cause of conflict as well as the psychological and emotional responses that this conflict generates.

While multiple factors determine the scope of a disaster, in physical/environmental as well as social/psychological terms, such events undoubtedly represent challenging situations of great consequence. Researchers suggest that in the context of a disaster situation, people typically display three separate forms of coping: avoidance coping, emotional coping and task-focused coping (Pooley, Cohen, O'Connor, & Taylor, 2013). Lazarus's (1966) early work divided coping styles into two general categories: problem-focused and emotion-focused. Problem-focused strategies involve confronting the disaster directly; whereas emotion-focused strategies represent emotional responses without trying to actively tackle the problem, including the deliberate or subconscious suppression and denial of such emotions. Bachrach and Zautra (1985) suggest that a problem-focused coping strategy is more effective for disaster response; hence, in this study, I only refer to the problem-focused style of coping. In disaster situations, multiple coping strategies may prove effective. These include religious belief and activity, engaging support from available community resources and, especially, spending time with family and friends, and sharing and keeping busy with familial responsibilities (Smith et al., 2014). Disaster-related stress can be effectively dealt with through varied coping strategies that enable release and support though social interaction, distraction via work or activity, and religious practice and contemplation (Salloum & Lewis, 2010). Zhou et al. (2010) have demonstrated that disasters increase options for coping within a community and can actually build and enhance resilience. In fact, adaptive and health-promoting coping has been shown to promote resilience by mediating mental health problems (Clarke, 2006; Evans & Oehler-Stinnett, 2006). Miller et al. (1999) point out that while it is not generally possible to control the occurrence of natural disasters, by encouraging individuals within a community to undertake activities that facilitate the development of active coping strategies, particularly problem-solving skills, it may be possible to reduce social vulnerability and increase social resilience. Problem-focused coping thus represents an important mechanism for facilitating resilience (Bachrach & Zautra, 1985). Coping style is also a significant predictor of community stress levels and is considered to be learned; therefore, developing mitigation strategies, including coping, may facilitate the minimisation of disaster effects on social vulnerability (Miller et al., 1999).

2.5.4 Learning

Researchers have suggested that along with a variety of adaptations, approaches for collective action and efforts concentrated on community cohesion, social learning is an important facet of resilience in disaster contexts (Adger, 2006). Learning and improvisation, along with the development of ongoing, community-wide planning efforts, crucially affect social resilience. Planning mechanisms as well as repeated disaster occurrences may facilitate and promote social learning (Forgette & Boening, 2009). Social learning is a key adaptive capacity that reflects the ability of a system to improve its capacity to manage a disruptive event (such as a natural disaster) through (1) proactive planning and anticipatory preparation, and (2) reactive learning, wherein direct disaster experience informs spontaneous and innovative actions that become a source of learning (Joerin, Shaw, Takeuchi, & Krishnamurthy, 2012). There are, thus, distinctive learning processes during pre- and post-disaster phases. Pre-disaster learning would be concentrated on increasing awareness, the development of applicable skills and abilities that will be useful once a disaster occurs, preventative protocols and other proactive actions that prepare the community, as a collective, for the upcoming onset of disaster (Adger, 2000; López-Marrero & Tschakert, 2011). Pre-event learning is informed by experience and prior or existing knowledge. In contrast, post-disaster learning is more reactive and involves improvisation comprising unplanned and unprepared actions that aid in the recovery phase of disaster. Social learning during this phase occurs when valuable unplanned actions are endorsed and validated by the community and also recorded and formalised into policy for managing and responding to future disasters. In this sense, social learning directly affects social resilience through feedback loops leading into the next disaster (Cutter et al., 2008). Zhou et al. (2010), however, argue that combining different types of knowledge for learning is a particularly effective strategy for bridging gaps and stimulating learning and innovation. Diversified knowledge sources increase a community's capacity to learn from disasters and demonstrate how learning functions as a significant indicator of resilience (Zhou et al., 2010). Additionally, Folke et al. (2002) recommends that community resilience be measured by the degree to which that community is capable of organising itself in order to increase its capacity to learn from past disasters and translate that learning into future protection and risk reduction.

2.5.5 Education

Largely due to the influential nature of group norms and behaviour within communities, the education and training of community members becomes a significant factor in resilience processes. In relation to disaster education, providing community members with information through techniques such as disaster scenarios can be useful. Such techniques help people to identify the resources and knowledge they need to define the problems posed by a disaster. Moreover, they help to formulate strategies to deal with them in ways that are consistent with community needs, attitudes, perceptions and beliefs (Paton et al., 2001).

In addition to this method of direct education using scenarios, there is a range of methods and approaches to disaster education, including both formal and informal approaches to disseminating disaster information. Formal educational approaches are more systematised courses, training and curricula that offer elaborate information covering the full scope of the disaster process (Petal & Izadkhah, 2008). Informal strategies represent a rapid entry point for disaster risk-reduction education and include such things as written materials, performative or cultural arts, clubs, and competitions or drills, which all encourage engaging opportunities for information exchange (Petal & Izadkhah, 2008). Public awareness programmes also represent a broad public education approach where information is exchanged through a range of media (i.e., drills, plans) ensuring that both personal and community safety information reaches the widest number of community members as possible (Davis, 2000).

Thus, social resilience may be enhanced by integrating disaster education into community development programmes, which encourage the community to define and identify the disaster activities, develop strategies to resolve these issues and problems, and that encourage working with other communities and emergency organisations to implement these strategies (Paton et al., 2001). Many disaster research studies indicate that communities that have undergone education and preparedness training experience less damage and reduced numbers of causalities (Davis, Hosseini, & Izadkhah, 2003). One longitudinal study in Indonesia, spanning the period before and after the 2004 Indian Ocean tsunami, shows that education plays an important role in regards to long-term resilience. Better-educated community members were far less likely than were others to live in a camp or other temporary housing and were more able to minimise

personal economic impacts. Moreover, five years after the tsunami, the better-educated displayed superior psycho-social health compared with those with less education (Frankenberg, Sikoki, Sumantri, Suriastini, & Thomas, 2013). Developing and supporting a 'culture of safety' through continual education across both formal and informal platforms creates a continuous learning environment, making societies less vulnerable to disaster impacts in the future (Petal & Izadkhah, 2008).

A few important aspects of disaster-related education noted in the literature include the value of developing localised education programmes and of involving children and youth in the educational process. Shiwaku and Shaw (2008) highlight that a crucial aspect to effective education is that it be developed in association with local community members and be adapted to the specific, localised situation. It has been shown that in developing countries, broad and inclusive educational campaigns aimed at all levels of society are not feasible, but one of the most effective means of reaching wide swathes of the population is to concentrate on children. Izadkhah and Hosseini (2005) suggest that children are able to disseminate messages throughout their societies, beginning with their parents and immediate families. Thus, they recommend integrating disaster education programmes into school curricula and children's activities, noting that such an approach strengthens resilience among communities by enabling them to withstand the shocks and challenges of disaster and to bounce back from disaster impacts.

2.5.6 Information and Communication

Information and communication are two vital components in disaster and emergency situations. Interactions related to the exchange of information and communication within a community is a significant determinant of effective disaster management. Additionally, effective communication practices are very important to the formation and maintenance of social resilience.

In recent decades, information technologies have improved significantly. While the effective communication of accurate information acts as a type of decision support within communities, a lack of information limits response efficiency and compromises the adaptability of communities (Comfort, Ko, & Zagorecki, 2004). Comfort has shown that information is the primary resource in all systems that enable adaptive performance (Comfort, Dunn, Johnson, & Skertich, 2004). Accurate and appropriate information

systems assist in establishing coherent programmes of action and increase community performance in complex and dynamic environments (Comfort et al., 2001) during emergency or disaster situations; in particular, communities require quick, direct and precise information, including available behavioural and response options. A major function of disaster management is the accurate assessment not only of the specific causes of a particular disaster, but also of the interdependent functions and structures of the community that are affected by disaster. This assessment provides a means of monitoring and mitigating the impact of disaster and is, therefore, crucially dependent on accurate, valid and quality information (Comfort et al., 2001). Having accessible, appropriate and reliable information enables the community's capacity to take the right action and thereby increases social resilience in complex and dynamic environments (Comfort et al., 2001). Indeed, in the context of disaster, information being disseminated may be accurate or inaccurate, but a community cannot double-check information before acting on it. This highlights the need for access to trusted information sources and senders (Longstaff & Yang, 2008).

Communities use trusted information to make critical decisions in response to disaster (Blanchard-Boehm, 1998). Trusted information comes from a source with access to accurate information who is capable of disseminating reliable information that is timely and consistent with the facts (Longstaff & Yang, 2008). Resilience in disaster situations is therefore significantly tied to the ability of the community to receive trusted information from a central source or trusted sender (Quarantelli, 2002). If a community does not have access to trusted information, the chances of panic rise (Glass & Schoch-Spana, 2002). On the contrary, if a community does have immediate access to a trusted source of information, they are able to act immediately on the information and thus adapt more effectively to the disaster situation. This, in turn, enables the community to bounce back quickly (Longstaff & Yang, 2008). Evidently, if a community does not trust the message or the sender of the message (Griffin, Neuwirth, Dunwoody, & Giese, 2004), their resilience and ability to cope will be compromised. Longstaff (2005) argues that correct information, correctly transmitted information and trusted information senders can increase resilience within a community. Correspondingly, he shows that trusted sources of information are the most significant resilience asset that any community has.

In fact, communication functions as a basis for common understandings within a community, as well as articulating community members' needs, attitudes and views (Norris et al., 2008). Trust and social relationships are, thus, vital to information and communication processes, and the ways that ideas and values are communicated within communities are important. One of the functions of social interaction in disaster or emergency situations is emergent norms. This refers to the fact that people in a community look to similar 'others' to help them make decisions about appropriate behaviours (Fritz & Williams, 1957). Increasing interconnectedness within communities may therefore create more possibilities for sharing and exchanging information (Kapucu, 2005). Moreover, research shows that people with greater social ties receive more information. Riad, Norris and Ruback (1999), for example, found in Hurricane Hugo and Hurricane Andrew that residents with stronger social interactions were twice as likely to safely evacuate than residents with weaker social interactions and support.

Information dissemination is not only crucial prior or at the time of disaster onset, but is also vital during all phases of disaster. Comfort and Zagorecki (2004) argue that different phases of disaster response require different types of information, with information about disaster severity, type and availability of resources, and details regarding response strategies all exerting a significant impact on the efficiency of overall disaster response. In the pre-disaster phase, precise pre-planning and the sharing of relevant information have been shown to increase a community's preparedness significantly (Kapucu, 2008). Post-disaster recovery has also been shown to be dependent on the collective generation and exchange of stories related to a community's experience (Saul, 2004). Comfort et al. (2001) proposed that using information technologies significantly strengthens a community's capacity, resilience and effective performance from the pre- to post-phases of dynamic situations.

Overall, significant research on communication demonstrates that it is essential for community resilience (Ganor & Ben-Lavy, 2003; Goodman et al., 1998; Longstaff & Yang, 2008; Pfefferbaum et al., 2007). Goodman and colleagues (1998) propose that communication and social relationships, including the intensity and frequency of interactions, are among the most crucial components of community capacity and community resilience (Goodman et al., 1998). Resilience at the collective level of the community depends on such varied capacities as the mental processes of sense-making

(Weick, 1995), improvisation (Mendonca, Beroggi, & Wallace, 2001), innovation (Demchak, 2006) and problem-solving (Comfort, 1999), each of which requires access to immediate, accurate and precise information on the changing conditions that define a disaster situation (Comfort, Oh, Ertan, & Scheinert, 2009). The effective dissemination of information through strong communication processes is an important indicator of social resilience because of such underlying roles and because it helps generate innovative approaches to collective learning, provides decision support, and enhances social cohesion and adaptive capacity (Comfort et al., 2001).

2.5.7 Trust

Trust in a community context is the faith that members have in each other and is a relational bond that is built over time. Trust plays an essential role in disaster response, in particular, community preparedness and recovery support. Trust facilitates cooperation and collaboration and enables community members to work successfully together, which enhances the coordination of disaster communications (Longstaff & Yang, 2008) and relief efforts.

As previously discussed, communication and information exchange is a key element of resilience during each phase of a disaster, and the literature further emphasises the role of trust in these areas, given that the trust community members have in experts, authorities and government significantly affects their consumption and application of disaster-related communications. Trusted communication sources have been linked to risk perception and to the preparedness measures that community members engage in prior to a natural disaster (Wachinger Renn, Begg, & Kuhlicke, 2013). Trusted communications allow communities to build their own community resilience (Longstaff & Yang, 2008) through increasing their potential for adaptation and change (Berkes & Folke, 2002), facilitating rapid reactions (Longstaff & Yang, 2008) and enhancing adaptation capacity (Holling & Gunderson, 2002). Trust has also been identified as a key variable influencing risk perception and degree of acceptability related to natural hazards and disasters (Bronfman, Vázquez, Gutiérrez, & Cifuentes., 2008). On the other hand, when community members have no or low trust in experts, authorities or information sources, they tend to feel greater risk and uncertainty in the face of disaster (Espluga, Gamero, Prades, & Solà, 2009).

Research demonstrates that trust is deeply rooted in culture and remains generally stable over time (Bjørnskov, 2007). Additionally, trust is a process influenced by both structural (community competence) and situational (information availability) factors (Mayer, Davis, & Schoorman, 1995). It is perhaps not unexpected then that studies demonstrate strong associations between past disaster experience and levels of trust.

As natural disasters generally require that communities and community members work together to cope and overcome effects, they can represent opportunities for increased social connection. Toya and Skidmore (2014) note that while disasters have significant negative effects on economic and environmental systems, they may create certain social benefits by increasing social cohesion and trust among affected communities. They demonstrate a long-term relationship between disaster propensity and trust by showing that disaster frequency is correlated with levels of societal trust (Toya & Skidmore, 2014). Similarly, others have also noted that communities exposed to higher levels of disaster (in this case floods) displayed higher levels of trust not only for and from neighbours, but for society at a national level and also for the media (Barnes, Goonetilleke, Correa-Velez, McMichael, & Conteh, 2014). Moreover, trust has been linked to positive rates of subjective wellbeing and can function as a key asset in disaster coping processes (Hommerich, 2012), further demonstrating its utility as an important indicator of social resilience within disaster-affected communities.

2.5.8 Community Participation

Community participation is the engagement of community members in organisations and activities within their community, including resident associations, neighbourhood watches, self-help groups and religious congregations (Perkins & Long, 2002; Wandersman & Florin, 2000). This type of member involvement and engagement is available to anyone within the community but represents an especially valuable opportunity for members who are sensitive to uncertain situations and dynamism within complex environments (Pfefferbaum et al., 2007).

The basis of community participation is the individual, whose role is vital in terms of leadership, teamwork and the management of relationships with other communities (Pfefferbaum et al., 2007). Even distinct aspects of community participation, such as political participation via voting, have been shown to be positively associated to social

resilience (Booth & Richard, 1998). Indeed, resilience within communities is optimised by the active participation of its members in processes geared towards capacity building in areas such as adaptability and coping (Skerratt & Steiner, 2013). Wandersman and Florin (2000) have provided a framework for examining community participation across various disaster phases, which concentrates on (1) participants (the reason they participate and how community characteristics influence participation), (2) the effects of participation on community conditions, and (3) participants' own feelings of efficacy. They demonstrate that community participation has a positive impact on social efficacy and resilience.

Community participation is thus a fundamental and significant element of community resilience (Goodman et al., 1998; Norris et al., 2008). Studies show that when community members actively participate in the identification of resources, community capabilities, vulnerability assessments and coping strategies, the resulting plans and disaster responses are not only better suited to specific, local needs, but are also more effective in general (Newport & Jawahar, 2003). Research focused on water-induced disasters has also demonstrated that strong community participation is the best strategy for ensuring prevention, mitigation and rehabilitation processes that are not only immediately more cost-effective and environmentally sound, but also extend those benefits into long-term effects (Osti, 2004).

2.5.9 Leadership

Leadership is the process of influencing a community's activities to facilitate the achievement of relevant, self-determined goals. In disaster scenarios, one of the most important aspects of leadership is planning to produce coordinated and effective efforts. In this sense, through proactive and coordinated persuasive mechanisms, leadership facilitates developing and enhancing resilience within communities (Hegney, Ross, & Baker, 2008). Leadership can be formal or informal. Formal leadership refers to official emergency organisations and governments, whereas informal leadership points to more spontaneous and less bureaucratic elements within a community. In this research, informal leadership is the main focus.

Edelstein (1988) argues that community leaders are usually those who have the strongest attachments to place (Edelstein & Wandersman, 1987; Norris et al., 2008).

Ganor and Ben-Lavy (2003) likewise argued that community leaders play a significant role in community resilience and they can be credits for their community. To support resilience successfully, leadership must be dynamic and responsive to changing physical as well as social conditions. While I tend to think of leaders as singular and autonomous social actors, research shows that for resilience to be established and maintained within a community, multiple leadership roles, fulfilled at various levels of society by different individuals or groups, are actually required (Walker et al., 2006). Leaders are thus instrumental as models and inspirational motivators capable of fostering larger-scale social participation, civic engagement and collective action (Folke, Hahn, Olsson, & Norberg, 2005; Lebel et al., 2006; Olsson, 2003). In their roles as instigators and supporters of collective participation, leaders and, hence, leadership, are key components of social resilience (Abesamis, Corrigan, Drew, Campbell, & Samonte, 2006).

In regards to disaster contexts, leadership is vital across all phases. In the pre-event or pre-disaster phase, preparation leadership is essential in planning, training and various aspects of preparedness (McConnell & Drennan, 2006). In these early phases, leaders must direct attention towards infrastructure (social as well as physical), emergency planning and medical support systems, monitoring and warning systems and other vital areas (Shrivastava, Mitroff, Miller, & Miclani, 1988). Longstaff and Yang (2008) demonstrate that leadership is associated positively with both coordination of disaster communications and disaster preparedness. However, both of the relations become insignificant with the level of disaster surprise. Hence, the effect of leadership in disaster management is moderated by surprise (Longstaff & Yang, 2008). When the actual disaster hits, studies show that people expect authority to be concentrated among established leaders. They turn to leaders for guidance, assuming they will take action and ameliorate the situation by coordinating efforts. This is particularly true of community members who lack the resources and structural supports to cope adequately with the disaster (Gladstein & Reilly, 1985).

In the post-disaster phase, different leadership skills and styles may be needed to recover and restore damaged systems and lost resources (Porfiriev, 1996). In the period following a disaster, research shows that in order to achieve these recovery goals and relieve the anxiety of affected individuals, leaders should adopt an open and transparent

approach, and make every effort to keep the community informed of available supports, recovery plans and restorative process (Seifert, 2007). Leaders who fail to be forthright and transparent risk losing the trust of their community and may foster an environment rife with rumours of misinformation (Gephart, 1984). Foldy, Goldman and Ospina (2008) further suggest that post-disaster recovery efforts are most effective when leaders employ sense-giving approaches that emphasise commitment to future preparedness and the empowerment of the community.

Above all, leadership within disaster contexts must be contextualised, dynamic, and responsive, with approaches and styles shifting over the course of disaster phases (Hannah, Uhl-Bien, Avolio, & Cavarretta, 2009). To be effective, leadership must facilitate sense-making (Foldy et al., 2008), adaptive coping (Moxley & Pulley, 2004) and be defined by intentional, direct and purposive action (Gray, 1958). Bass and Stogdill (1990) indicate that leader behaviours may reduce feelings of helplessness during a disaster and an uncertain situation, and can replace those feelings with a sense of security and belonging. In addition, reducing panic and increasing feelings of belonging and confidence support adaptive coping approaches within a community (Harland et al., 2005). Community resilience thus requires reliable leadership (Ganor & Ben-Lavy, 2003), making it a fundamental element and significant indicator for social resilience (Norris et al., 2008, Goodman et al., 1998).

2.5.10 Improvisation and Innovation

Improvisation is a component of resilience that is consistently stressed by researchers and theorists. Improvisation refers to inventiveness, creativity and ingenuity, and on a collective level it indicates a community's ability to plan and devise a solution, even when necessary information is deficient (Lalonde, 2011). Coutu (2002) argues that resilient individuals have a strong capacity to absorb shocks and disaster losses, and that they display a positive, imaginative and innovative attitude in facing disasters in complex environments. In communities then, this becomes a collective trait and anticipation, innovation and improvisation combine to support social resilience (Coutu, 2002; Lalonde, 2011). The ability to develop innovative strategies reinforces the adaptive capacity of a society and facilitates the management of crisis (Adger, Lorenzoni, & O'Brien, 2009). Innovative strategies allow communities to adjust to the variable functioning of systems and networks impacted by disaster and to organise and

coordinate individual and community interactions, which may be strained in the uncertain and turbulent contexts of a disaster (Chang & Shinozuka, 2004).

While improvisation and innovation may appear to be outside of or even in opposition to set plans, many researchers have emphasised the connection between planning and improvising. Weick, Sutcliffe and Obstfeld (2008), for example, consider improvisation as the ability to reconfigure existing activities and plans into novel combinations to adapt and cope with unforeseen effects (Weick et al., 2008). Evidently, planning and preparation are essential to dealing with a disaster, yet it is impossible to anticipate all possible effects or to foresee all potential outcomes; thus, improvisation is a necessary skill in order to deal with the unexpected consequences of disaster and to generate appropriate emergency responses (Mendonca et al., 2001; Webb, 2004). Kreps (1991) also observes that improvisation and planning go hand in hand, since planning creates clarity and efficiency while improvisation provides flexibility in disaster management. In fact, he suggests that preparation enhances the ability to improvise (Kreps, 1991).

Research shows that improvisation and innovation are key contributors to organisational resourcefulness and social resilience. Indeed, in analysing the disaster response to the September 11 attack, Tierney (2003) notes that disasters and catastrophic events necessarily require novel approaches and improvisation in order to meet disaster-related demands. Theorists have also developed the concept of autonomous innovation to capture the resilience-enhancing processes of innovative improvisation. The core characteristics of autonomous innovation comprise the following: they are inductive (bottom-up); indigenous and suited to local cultural norms; inexpensive and frugal; developed through subjective processes that rely on the innovator's intuition; and entail a high degree of iteration through trial and error (Bahadur & Doczi, 2016). Given the implications for adaptability and recovery, innovation and improvisation are, therefore, important indicators of resilience within communities (Forgette & Boening, 2009).

2.5.11 Social Capital

The concept of social capital emerged from community studies as a way of describing the networks of social relationships that enable a society to function and that act as the basis for cooperative, collective action and trust (Jacobs, 2015). Many iterations and conceptualisations of social capital have since emerged across a number of disciplines.

From Bourdieu's perspective (1986), social capital consists of the interpersonal connections and the societal norms concerning reciprocity and trust. The networks of these connections act as a form of collective capital, or a credential available to the members of the given community (Bourdieu, 1986). Kadushin (2004b) gathered and summarised social capital definitions in a thorough review. In general, social capital encompasses the social trust, norms and networks that affect economic and societal activities (Nakagawa & Shaw, 2004). It refers as well to processes by which individuals invest in, access and use resources embedded in social networks to gain returns (Lin, 2002b). Loeffler (2004) defines social capital in the context of social work as a process of building trust, mutual understanding and shared actions that bring together individuals, communities and institutions. Many notions of social capital likewise emphasise the cooperative behaviour that it engenders, highlighting relationships among individuals and relationships between individuals and larger communities and neighbourhoods (Manzo & Perkins, 2006; Perkins et al., 2002; Saegert & Winkel, 2004). Other approaches to the concept concentrate on the core social psychological dimensions of social capital, which have been identified as place attachment, a sense of community and citizen participation (Norris et al., 2008). Each of these actually appear as distinct indicators of social resilience in this review, and point to the complexity of both resilience and social capital, as well as to the overlapping associations between them. Social capital comprises different components such as social support, social psychological factors, social vulnerability, community structure and community linkages within a network (Norris et al., 2008), which again represent components affecting social resilience.

When research pertaining to social capital is considered, there is a general focus on the significance of relationships as a resource for social action (Coleman, 1994). Studies show that communities displaying high levels of social capital are more likely to have effective social institutions and be more prosperous (Putnam, 1993). Social capital has also been shown to reduce community distress (Snowden, 2005). Other studies reveal that the effective use of social capital is essential in building community and institutional capacity necessary for managing disasters (Mathbor, 2007). Social capital is extremely relevant to notions of social resilience and may indeed function as an indicator for resilience in communities facing disaster.

2.5.12 Social Cohesion

Group or social cohesion is a long-established concept, developed originally to describe the psychological experience of group belonging, and used to measure the degree to which forces related to satisfaction and attraction generate cohesion (membership continuity and adherence to group norms) (Festinger, Back, & Schachter, 1950). Social cohesion thus relates to the desire and capacity of individuals to live together, as a group, in relative harmony (Jensen, 1998). It involves processes of participation, integration and social solidarity (Kawachi & Berkman, 2000) and has been considered as both an independent and moderating variable affecting social, psychological and health outcomes (e.g., Beauvais & Jenson, 2002).

The literature demonstrates a range of analytic approaches in regards to social cohesion studies, including works focused on collective affect (Perkins, Florin, Rich, Wandersman, & Chavis, 1990), attachment (Van Vugt, 2001), group cognition (Roy, 2001) and group behaviour (Chang & Chen, 2006). Several studies have also considered the role of social cohesion in disaster contexts. One particular study looking at intergroup relations following a natural disaster found that the threat of an earthquake was associated with a greater sense of belonging that transcended in- and out-group boundaries, supporting instead positive and supportive relations between minority and majority groups (Vezzali, Cadamuro, Versari, Giovannini, & Trifiletti, 2015). A longitudinal study comparing pre- and post-disaster data on social cohesion found that social cohesion increases in the immediate aftermath of the disaster; however, perceptions regarding community cohesion returned to pre-disaster levels after just one month (Sweet, 1998). These findings suggest that disasters may not have lasting effects on social cohesion within a community. An additional study exploring social cohesion in the post-disaster phase was conducted by Chang (2010) in a flood-affected community. Results from this research indicate that cohesion was not predicted by demographic characteristics, including length of residence, but instead varied along hazard severity lines. In the early phases of the disaster, social cohesion was strong, as community members appeared to come together and support each other in coping with initial effects. However, when the hazard or disaster severity increased, cohesion decreased as residents shifted focus to personal matters and individual interests (Chang, 2010). Other post-disaster findings by Ahern and Galea (2006) similarly indicate that

the stress and paucity of material resources that emerge after a disaster may exacerbate underlying tensions and negatively impact social cohesion in the post-event phase (Ahern & Galea, 2006). Focusing on different aspects of disaster aftermath, Hikichi, Aida, Tsuboya, Kondo, and Kawachi (2016) examined the relationship between social cohesion and post-traumatic stress disorder (PTSD) among a large sample ($N = 3,567$) in Tohoku, Japan. This study compared baseline data to follow-up data collected after the 2011 earthquake and tsunami. Results show that individual- and community-level social cohesion before the disaster were significantly associated with lower risks of PTSD symptoms after the disaster (Hikichi et al., 2016). This was true even after adjusting for symptoms at baseline and experiences during the disaster (including loss of loved ones and housing damage). The conclusions drawn by this research team are thus that community-level social cohesion strengthens the resilience of communities in the aftermath of a disaster (Hikichi et al., 2016).

As indicated by these and other studies, social cohesion is a crucial force within communities and represents a dynamic process that is affected by such disruptive events as natural disasters (Chang, 2010). Others have noted that the interconnectedness and cohesion of a community helps to create resilience during a disaster (Armour, 2010), making social cohesion an important indicator of social resilience.

2.5.13 Social Support

Social support is widely recognised as a protective factor in regards to the negative impacts of stressful events. By providing emotional and functional resources through social relationships, social support contributes and promotes personal wellbeing (Hupcey, 1998). In disaster contexts, social support has also been noted as a particularly salient and effective factor in reducing negative mental and physical outcomes (Norris & Elrod, 2006; Norris & Kaniasty, 1996). Social support is a component of social capital (Norris et al., 2008) and refers to social interactions that provide aid and assistance to individuals, making them feel cared for within a community (Barrera Jr, 1986). Principally, social support captures helping behaviours within a community, in particular from informal networks such as neighbours (Manzo & Perkins, 2006; Perkins et al., 2002; Saegert & Winkel, 2004). There are mutually reinforcing connections between feelings of belonging and attachment (i.e., a sense of community), community involvement and social support networks (Kaniasty & Norris, 1999). Additionally,

social support may be conceptualised both in terms of 'received support' and of 'perceived support'. Received support refers to the actual receipt of help, while perceived support refers to the belief that help would be available if needed. Because receiving support can threaten self-esteem (Dunkel-Schetter & Bennett, 1990), whereas providing support can create stress (Solomon, Bravo, Rubio-Stipec, & Canino., 1993), social support is most beneficial and has the greatest positive effect when there is a balance between receiving and providing support (Hogan, Linden, & Najarian, 2002).

Social support, regardless of whether it is received or perceived, has two different dimensions (Kaniasty & Norris, 1999). The first dimension involves help from the family, other primary support groups (such as neighbours), followed by emergency organisations and volunteers beyond the victim's immediate circle. The second dimension is informational and tangible support (Norris et al., 2005). Social support can be developed in communities when individual members respond to community demands and adapt to the task of assisting others to deal with issues and problems (Paton et al., 2001).

Ganor and Ben-Lavy (2003) and Tse and Liew (2004) have underscored social support as a significant component of community resilience. Pfefferbaum et al. (2007) and other researchers have likewise highlighted the importance of social support for community resilience, because social support after a disaster provides victims with material and practical assistance. While also helping them to reframe their social experience and see others as dependable, social support is crucial in promoting resilience at the collective level (Kaniasty & Norris, 2008).

Research on the role of social support in disasters often concentrates on time-related factors, with some studies indicating that social support is an effective, long-term buffer against disaster-related trauma (Kaniasty & Norris, 2008). Receiving high levels of social support (both emotional and instrumental) during a natural disaster helps to improve social wellbeing and self-perception (Tyler, 2006). In a sample of victims of a major American flood, psychological distress related to disaster experience was extremely high directly following the event, but decreased sharply six weeks post-disaster and continued to gradually decrease in the months following. While perceived social support was not directly related to distress at either the most immediate or most

delayed periods, the two were significantly correlated during the intermediate period (Cook & Bickman, 1990).

When the severity of disaster rather than the time since a disaster is the focus of study, research shows that social support moderates the relationship between stressor (disaster severity) and psychological distress (Arnberg, Hultman, Michel, & Lundin, 2012). Social support has been shown to have a protective effect on all mental health outcomes in both less and more severe disaster situations (Cherry et al., 2015). Overall, social support is widely implicated in social resilience, functioning as an important mediator of disaster effects.

2.5.14 Demographic Information

Social resilience is described according to a range of indicators, many of which correspond to community demographic information. Dispositional resilience reflects how personal and community characteristics influence responses to disaster. Paton et al. (2001) believe that identifying the personal and community characteristics related to resilience may assist a community in promoting pre-disaster activities as well as increasing their capability to get back to a previous situation. The authors propose a model that describes the role of age, gender, wealth, health, culture, education and special needs in predicting resilience to the social consequences of disaster. While all hazard events are unique and may significantly differ from one another on several dimensions, the above variables may be used to track similarities in community response across disasters (Creamer, 1994). Paton et al. (2001) developed and applied their model in the assessment of resilience among the Ohakune community after a volcanic eruption and showed that age and educational level had a significant impact on community resilience compared with other variables.

Using certain demographic attributes of social capacity, Cutter, Burton and Emrich (2010) suggest that the demographic characteristics that would indicate greater disaster resilience among communities include high levels of educational equality, vehicle ownership, telephone access, health insurance and fewer elderly, disabled, and non-native English-speaking residents (Cutter et al., 2010). When resilience is defined in terms of lower post-traumatic stress and depressive symptoms, studies employing multivariate analyses indicate that resilience is uniquely predicted by gender, age,

race/ethnicity, education, level of trauma exposure, income change, social support, frequency of chronic disease, and recent and past life stressors (Bonanno, Galea, Bucciarelli, & Vlahov, 2007).

While research strictly limited to the demographic aspects of social resilience is rare, many demographic qualities have been highlighted throughout the literature, indicating the strong relevance and value of including demographics as an indicator for resilience in communities.

2.5.15 Coordination

Coordination theory emerged from the attempt to understand and explain how the activities of separate actors can be organised into effective, mutually attuned processes (Malone, 1988). The literature demonstrates the difficulty of defining coordination in relation to varied and specific purposes (Malone & Crowston, 1994). Coordination requires perception of what a group, team or, in this study, community is doing and how its members might work together in a more efficient or effective manner (Malone, 1988). Each community has its own capabilities, specialties, priorities, protocols, information systems and capacity for compromise, and each of these are variously affected by disaster. Generally, coordination refers to the integration of different elements of a community or organisation to accomplish a collective set of tasks (Van de Ven, Delbecq, & Koenig, 1976). Coordination connects and unites team members' interdependent activities in order to resolve a problem (Argote, 1982). Previous studies have defined coordination as a set of procedures and tasks that require multiple resources and participants with different levels of knowledge, abilities and responsibility to achieve a complex and common goal (Comfort et al., 2001).

In this study, and for my purpose, coordination is defined as managing dependencies between activities (Malone & Rockart, 1991). This definition implies the need to grasp the different kinds of dependencies as well as identify the coordination processes and mechanisms needed to manage those dependencies (Malone & Crowston, 1994). Group decision-making, communications (Crowston, Rubleske, & Howison, 2006), development of shared understandings and collective sense-making (Britton, Wright, & Ball, 2000) are considered the chief coordination mechanisms for managing various dependencies.

Once disaster occurs, individuals are able to accomplish tasks only by coordination and organised effort (Dynes, 1970). Coordination under uncertain conditions and during disaster requires an understanding of shared risk (Comfort, 1999). Once risk is shared, any individual's action may increase the risk, and escalate the event into a wider disaster. Conversely, their action may reduce the risk, managing and coordinating all relevant actions under control and reducing disaster consequences for the entire community (Comfort et al., 2001). Kapucu (2008) suggests that community coordination is essential for achieving social resilience.

Implementing coordination, sharing information, and monitoring performance in dynamic and complex environments is difficult and often may not be achieved through standard administrative practices (Comfort et al., 2001). In extreme events, communities require dynamic systems to adapt to uncertain situations, as well as to unanticipated and rapidly changing conditions that are not amenable to standard procedures. Standard operating procedures may cause or escalate a crisis as the complexity of the tasks, coupled with the uncertainty of the environment, may become too much for standard operating procedures to handle. In such cases (which include disasters), then, it may be beneficial for a community to rely more on learning mechanisms rather than pre-established standard operating procedures (Lin, 2002c).

Coordination significantly depends on information flow and processes, including the exchange of information within and between communities, as well as feedback that informs community learning. The accuracy, detail, and appropriateness of the information exchanged within a community play significant roles in achieving a common goal. Learning processes that facilitate coordination may also promote mutual adaptation. Malone (1988) shows that effective communication within a community enables varied demands to be met and goals to be achieved successfully (Malone, 1988). Different environments generate various types of demands and responses based on different levels of capacity in the system (Comfort, Ko, & Zagorecki, 2004). Poor communication thus becomes a barrier to coordination. Disasters generate a greater density of communication, which is exchanged via less centralised networks. As communities increase their communications, they share more information and resources and, because of this collaboration, victims may be served better in affected areas (Kapucu, 2005). This increased communicative exchange and collaborative effort

increases social resilience within communities. Prior studies show that poor communication and a lack of coordination negatively affect community performance in disasters and, as a result, decrease community resilience (Comfort, Ko, & Zagorecki, 2004).

In uncertain situations and complex environments, community members might be required to act together. Community responses in times of disaster thus lead to an increase in informal communication networks. Recent perspectives on management in complex and disaster situations acknowledge the importance of these informal networks and the trust that underlies them. Kapucu (2005) believes ongoing collaboration and communication within a community increases trust. He also suggests that effective response and recovery operations require both trust and collaboration in communities. Various aspects of collaboration have thus been highlighted in the literature as crucial elements of social resilience.

2.6 Conclusion

The above literature review attests to the complexity of disaster resilience and to the vast array of factors involved in its development, maintenance and enhancement within dynamic communities. Even in limiting the focus to the social realm, resilience remains a rather unwieldy concept. Indeed, despite substantial research and theorising, some have noted limitations in the state of knowledge surrounding processes of resilience building, lamenting the lack of specificity required for the assessment and implementation of identified factors and domains (Chandra, Acosta, Stern, Uscher-Pines, & Williams, 2011). This is the main problem addressed in this research, which identifies the salient indicators of social resilience and proposes a novel framework for measuring, and hence enhancing, social resilience.

In the context of this study, social resilience was defined as the ability of a community to withstand external threats and disruption by enhancing the social capacity to resist losses and to recover and regenerate after a disaster. Previous sections have outlined the main capabilities required for developing social resilience, which span adaptive, coping and participative capacities, and include knowledge, skills and relationship building within each of these realms (Keck & Sakdapolrak, 2013; Lorenz, 2013; Voss, 2008).

The main goal is to minimise and attenuate vulnerabilities that place the systems and cohesion of a community at risk.

A thorough review of the literature has enabled the identification of 15 core indicators of social resilience. These include various skills and abilities, community characteristics and social relational factors. As measureable parameters, these indicators combine to form a robust and comprehensive tool for evaluating community resilience from a social perspective. The proliferation of concepts and terms relevant to social resilience, coupled with the variety of policy targets and aims underlying related research, make clear the need for comprehensive and systematised measures and metrics (Cutter et al., 2008; Cutter et al., 2010). No studies known to me have developed an inclusive and unified framework that is applicable across all three disaster phases (pre-disaster, response and recovery). Therefore, the central contribution of this work is its clarification of the social aspect of resilience and its development of a comprehensive framework that may be used to identify targeted areas for improving the resilience of communities facing disaster.

Chapter 3: Qualitative Study of Three Cases of Disaster in Australia

This chapter begins with an introduction to the research design, followed by an in-depth presentation of the qualitative research design. Chapter 4 will present the quantitative research design. The findings and discussion for each of these is discussed respectively.

3.1 Research Design Overview

Research is the process of collecting, analysing and interpreting data in order to understand a phenomenon (Leedy & Ormrod, 2005). A research design is the overall strategy and methodical plan to integrate the different components of the research in a coherent and logical way to address the research problem effectively. It comprises the design for the collection, measurement and analysis of data (Jablonski, 2013).

Research designs are determined by the research problem, as the design must be suitable to answer the problem. Thus, if there are issues in the design, the research evidence collected may not be suitable for addressing the research question, resulting in unconvincing or weak conclusions (De Vaus, 2001). Essentially, poor design will affect the validity of the research. Thus, to ensure validity and robustness of the research design, this thesis identifies the research problem and why it was selected (presented in Chapter 1); reviews the extant literature (presented in Chapter 2); specifies the research questions and hypotheses (presented in this chapter); describes the data collection process and then describes the data (presented in this chapter); and describes the relationship between the data and the research problem, as well as how the data was analysed to test the hypotheses (also presented in this chapter). These are all components of the research design (Gorard, 2013; Vogt, Gardner, & Haeffele, 2012). Therefore, the research design was my guideline for answering the research questions through the evidence obtained. Thus, to obtain the evidence, identifying the relevant data was required to test my hypothesis and evaluate the conceptual model in my research.

There are various designs that are used in research, depending on the aims of the study and the nature of the phenomenon (Creswell, 2013). All research designs have specific

advantages and disadvantages. Research designs are commonly classified as causal, cohort, cross-sectional, descriptive, experimental, exploratory, historical, longitudinal, meta-analysis, mixed method, observational, philosophical or sequential. Action research designs, however, are used to understand a problem to develop an interventional strategy (McNiff, 2014). Meanwhile, case study designs are useful for assessing a narrow research problem with a particular phenomenon (Yin, 2003). Studies with a causal design seek to understand the problem in terms of 'if X, then Y' conditional statements (Bachman & Schutt, 2013). Cohort designs, often used in the medical sciences, follow a group of individuals over a period of time and note statistical differences in given variables (Jupp, 2006), while cross-sectional designs study grouped samples based on existing differences at one point in time (Mann, 2003). Research using a descriptive design seeks details such as where, when, what and how, but does not assess why (Salkind, 2006). Experimental designs are used when the researcher can manipulate the variables known to affect the dependent variable through control and randomisation (Salkind, 2006), and exploratory designs are useful for studies in areas in which little research has already been conducted (Mills, Durepos, & Wiebe, 2009). Historical designs are used to collect and analyse evidence from the past (Howell & Prevenier, 2001), while longitudinal designs rely on repeated observations of the same sample over a period of time (Lavrakas, 2008). Studies using a meta-analysis design synthesise the existing results of a number of studies to develop an advanced understanding of the research problem (Timulak & McElvaney, 2013). Mixed method designs, not to be confused with mixed method as in multi-methodology, are used for problems that fall between positivism and interpretivism and require multi-level perspectives (Tashakkori & Creswell, 2007). Moreover, observational designs compare control groups and subjects in situations that have not been manipulated for experimental purposes (Given, 2008b), while philosophical designs are used to challenge the tenets underpinning an assumption (McLaughlin, 2011). Finally, sequential research is staged to occur so that one stage occurs followed by another (Salkind, 2006).

Some studies only use one particular design and others use a combination of the above designs. This study employs aspects of the case study research design, sequential research design and the mixed method design. From a nomothetic perspective, I sought to understand the causal effect that occurs when social resilience indicators, as the

independent variable, relate to variation in social resilience, the dependent variable. The research design affects the extent to which causal claims can be made about the impact of the intervention (Yin, 2009) and, as such, I ensured a design that accounted for an empirical association between the dependent and independent variables, in which the variables occurred in the appropriate time order and the relationship was non-spurious (Salkind, 2006). However, the research was sequential, in that it took place over two distinct phases, and was mixed method, in that it collected data and analysed the research problem from multiple perspectives.

Research designs present logical problems, as opposed to logistical problems (Yin, 2003), so in this chapter I refer to the logical structure of my study, including what data was required, from whom and how it would answer the research question. As stated, failure to attend to these research design matters at the beginning could result in weak and unconvincing conclusions and failure to answer the research question. Therefore, this chapter provides a thorough account of the research design and the decisions made for ensuring that the design was appropriate for the research problem.

In addition to a research design, there are three research paradigms: qualitative, quantitative and mixed methods. Quantitative research relies on statistical analysis of quantitative (numerical) data; qualitative research relies on analysis of qualitative (non-numerical) data; mixed research relies on analysis of both qualitative and quantitative data. While quantitative research methods 'attempt to maximise objectivity, replicability, and generalisability of findings, and are typically interested in prediction,' qualitative research methods 'focus on discovering and understanding the experiences, perspectives, and thoughts of participants' (Harwell, 2011).

Both qualitative and quantitative methods have unique limitations, although often reflective of their strengths. Limitations of qualitative methods include the limited ability to generalise conclusions beyond the phenomenon of interest, including the limited ability to make policy recommendations and the increased risk of bias resulting from the socio-cultural background of the researcher (Anderson, 2010). Quantitative methods, on the other hand, risk producing results that are socially insignificant, but statistically significant. These results might omit important contextual detail as they often provide less detailed accounts of perceived reality (Babbie, 2015). Mixed method

approaches play to the strengths of each approach to account for the associated limitations.

In this study, I used both qualitative and quantitative approaches, and thus a mixed paradigm, to address the research question. Mixed methods research is defined as 'the class of research where the researcher mixes or combines quantitative or qualitative research techniques, methods, approaches, concepts, or language into a single study' (Harwell, 2011, p. 151). My approach employed strategies of inquiry that involved first collecting qualitative, followed by quantitative data, to understand fully the research problems. The data collection involved gathering both textual information through interviews and numeric information through an online survey, so that the final database of data from which the hypotheses could be tested represented both qualitative and quantitative information.

Through qualitative research, I provided a social disaster resilience framework within community and identified all social resilience indicators. After that, through quantitative research, I verified the framework and tested the hypotheses from the qualitative research. Thus, in the systematic integration of both forms of data, this research operated in a mixed methodology paradigm. According to Wisdom and Creswell (2013), 'The basic premise of this methodology is that such integration permits a more complete and synergistic utilisation of data than doing separate quantitative and qualitative data collection and analysis'. Moreover, the authors state that mixed methods procedures have been continuously refined in the social sciences over the past decade and offer advanced rigour.

This mixed method approach also strengthens and reinforces the research findings and conclusions in providing opportunities to triangulate data with its use of multiple data collection methods and analysis techniques (Creswell, 2013). In this research, the validity and reliability of the findings were enhanced as two different kinds of triangulation contributed to verification and validation of the qualitative data (Khalili et al., 2015). This research employed triangulation as follows:

1. Triangulation from different sources (Plano Clark & Creswell, 2008):
   We interviewed multiple individuals holding different positions, from different organisations. Within the NSW SES, I interviewed the CIO, the manager of

community engagement and the regional controllers. From the local councils of the case study areas, I interviewed the director, the manager of community engagement and the planning officer, each of whom gave me different perspectives on each resilience indicators.

2. Triangulation from different methods (Johnson, Onwuegbuzie, & Turner, 2007): We collected data through different methods, such as focus groups and individual interviews, to analyse and assess the same questions by obtaining answers using different research methods.

3.2 Application of Qualitative Research Methods

Qualitative research design is a research method of inquiry employed in many different academic disciplines and used widely by researchers and scientists studying human behaviour and lifestyle (Denzin & Lincoln, 2005). Strauss and Corbin (1990) state that qualitative research methods can be used to improve the understanding of any phenomenon that we do not know much about. This method can also be used to garner new perspectives or to gain a deeper understanding of information that may be difficult to convey quantitatively (Corbin & Strauss, 2008). Qualitative methods were therefore appropriate for my purpose to first identify the social resilience indicators and provide the initial construct that could later be tested quantitatively.

Within this research, qualitative data collection and analysis were regarded as precursors to the quantitative research, in that they were used to identify social resilience indicators that could be used to formulate realistic and testable hypotheses for social resilience in the quantitative phase of the research. Hypotheses developed from the qualitative phase were then comprehensively tested and mathematically analysed with standard quantitative research methods. The qualitative research used in-depth studies of small groups of samples to conduct and support the construction of hypotheses.

Qualitative research methods are not as dependent upon sample sizes as quantitative methods and can often generate meaningful results with only a small sample group (Mason, 2010). The qualitative method of this study investigated the social indicators that affect social resilience; hence, small but focused samples were used, giving outcomes that were more descriptive than predictive. Qualitative research emphasises

the non-numerated qualities and meanings of the social world. Thus, it considers the construction of the reality and situational constraints that are involved in that construction (Denzin & Lincoln, 1994) and are therefore generally value laden.

Qualitative data are rarely analysed mathematically in the same comprehensive way as quantitative results and it therefore requires careful thought and planning beforehand to obtain accurate data. Qualitative methods assist me to give a guide to general trends and develop a framework for understanding the world from a social perspective (Shuttleworth, 2008). The design of qualitative research is often naturalistic, emergent and purposeful. It is naturalistic in that it is used to study real-world phenomenon without control or manipulation and, thus, leads to acceptance of the findings that emerge. It is emergent in that the researchers' understandings of the phenomena deepen with inquiry. Finally, qualitative research is purposeful in that the cases for study are purposefully selected using sampling to generate an in-depth understanding of the phenomenon of interest (Berg, Lune, & Lune, 2004).

The strengths of qualitative research include the richness of the data collected. It produces detailed accounts of the respondents' perspectives of the phenomenon. The data collected by qualitative methods generally provide more depth than those collected by quantitative methods, giving researchers greater insight into perceptions of the lived world (Berg et al., 2004). Researchers using qualitative methods interact with participants in a manner that provides cultural context or situational data to the findings (Merriam & Tisdell, 2015).

In this research, I utilised qualitative methods to uncover innovations, reveal the relevant indicators for measuring social resilience, and then develop a research model through the sequential research process. In summary, the qualitative research design was a plan that guided me in the process of collecting, analysing and interpreting data in the first phase of this study (Frankfort-Nachmias & Nachmias, 2007). There are a variety of methodological approaches available to collect and analyse qualitative data such as phenomenology; ethnography; grounded theory; ethical inquiry; case studies; discourse analysis and more and each one has specific purpose (Creswell, 2007). The most appropriate and commonly used methods for our purpose are case studies. In this case study, events identified as "the case" restricted by time and location. Detailed information has been collected through a multitude of data collection procedures over a

constant period of time (Creswell, 2007). The case study provides a descriptive account of the events' experiences and behaviors through interviews and observation (Patton, 1990).

In this research qualitative data was primarily collected thorough surveys and interviews and then analysed to provide a framework, which was then tested through quantitative research. Yin (2003) listed different strategies of research design based on three main and broad questions (see Table 2). In accordance with Yin's postulation, as presented in Table 2, there are three reasons that I selected the case study design for my research: (1) this research asked 'how' and 'why', as in 'how can social resilience be measured' and 'how and why do some social indicators affect social resilience'; (2) we had little or no possibility of controlling the disasters; and (3) we focused on contemporary events in a real-life context for our research (Yin, 2003). For these reasons, the case study strategy is useful when not much is known about the topic and, to my knowledge, there is no existing model that shows social resilience indicators for all phases of disaster.

Strategy	For of Research Question	Requires Control of Behavioural Events?	Focuses on Contemporary Events?
Experiment	How, why?	Yes	Yes
Survey	Who, what, where, how many, how much?	No	Yes
Archival analysis	Who, what, where, how many, how much?	No	Yes/No
History	How, why?	No	No
Case study	How, why?	No	Yes

Table 2. Components of different research strategies (Yin, 2003)

3.3 Case Study Research Methodology:

Case study methods were introduced into social science in 1829 by Fredric Le Play (Healy, 1947). The case study research method is designed for a variety of disciplines,

such as social science and has been used by researchers for many years. Fundamentally, a case study design is an in-depth study of a particular research problem and is used herein to provide insight on measuring social resilience within communities. It also helps me extend or add strength to what is already explored and revealed through previous research so as to identify social resilience indicators. Case study research is a methodology, which can take either a qualitative or quantitative approaches. Furthermore, case study methods are very adaptable, as they use many methods of gathering information and analysing the data; thus, I can apply variety of methodologies and rely on a variety of sources to investigate my research problem. Although there is no standardized structure for this method, this type of study needs to be carefully constructed and designed.

In this study, the case study was used to focus a very broad field of community resilience into one researchable topic to identify the most essential indicators for social resilience. This method provided indicators for constructing a general and novel framework on a research topic and for assisting me in further elaboration (Shuttleworth, 2008) by testing the model through three case studies (disasters) in the real world. As a final point, the case study method was used to focus on identifying the most essential social resilience indicators within communities in this research.

Researchers, social scientists in particular, use case study qualitative research methods to examine contemporary events and provide the basis for the application of ideas and the extension of methods (Soy, 1997). Thus, this method was useful for identifying and evaluating social indicators through different disasters. In this study, the purpose of selecting case study methods was to assess gathered social indicators from previous research and apply those indicators to each case study. Insights from each case were then used to develop my theory and hypotheses.

This method, like all other research methodologies, has advantages and disadvantages. A number of criticisms have been noted, including (a) lack of systematic handling of data, (b) lack of a basis for scientific generalisation, as the study of a small number of cases can offer no grounds for establishing reliability or generality of findings, and (c) taking too long while still having the likelihood of ending up with unusable documents. However, Yin (1993) states that there is a good solution for each of the above

criticisms: (a) systematic reporting of all evidence, (b) selecting multiple and relevant case studies, and (c) imposing time limits and writing formula.

Yin (2003) provides three categories of case study: explanatory, descriptive and exploratory. Explanatory case studies aspire to link an event with its effects and to analyse or explain why or how something happens or happened. This type is suitable for investigating causality. Descriptive case studies are designed to obtain information on the particular features of an issue and are used to illustrate events and their specific context. Exploratory case studies are conducted to define research questions and associated hypotheses and to look for patterns in the data to develop a model. Research questions for exploratory case studies focus on 'what' questions, which is why I chose this type of case study for my research, with the question: 'what are the social resilience indicators?'

Yin (1993) also classifies two designs for this method: single and multiple case studies (Yin, 1993). Simply put, single case study research focuses on one case and seeks to explain something that is specific to that case. Conversely, multiple case study research uses multiple cases and often seeks to make comparisons between them. In this study, I chose multiple case study research because of its advantages, which will be addressed later in this section.

Robert E. Stake, Helen Simons and Robert K. Yin, three well-known case study researchers, propose six steps for organising and conducting research successfully. These steps, which are outlined below, are the guidelines for structuring and governing case study research methods. Therefore, these steps outline the procedures and provide governing rules regarding the method.

1. Determine and define the research questions.
2. Select the cases and determine data-gathering and analysis techniques.
3. Prepare to collect the data.
4. Collect data in the field.
5. Evaluate and analyse the data.
6. Prepare the report.

3.3.1 Determine and Define the Research Questions

The initial step in the case study research is focused on determining and forming research questions. As discussed in Section 3.1 when introducing the research design, the research questions and research problems are the first step in research as they indicate the type of data that are needed for analysis. Case study research can be used to answer questions beginning with 'how'. In this study, the objective of the case study method was to use a variety of data-gathering techniques to provide data that led to the identification of social resilience indicators within communities across each disaster phase and to understand the impact of those on social resilience.

To determine and define the research questions, one must first conduct a literature review to develop an understanding of the existing knowledge on the topic and to identify gaps in the existing knowledge. The purpose of new research will then be to fill these gaps and advance the state of knowledge. Thus, the foundation knowledge ascertained through the literature review process helps to target and formulate the research questions. Within this research, the review indicated the relevant research on social resilience conducted in the past and led me to develop and improve insightful questions about social resilience and how it could be improved by future research. The literature review and the early decision about the potential audience for the final report guided how this study was considered, designed, conducted and widely reported (Soy, 1997).

In this research, the main objective was to identify the most essential social resilience indicators, with the ultimate motivation being to increase social resilience within communities. This research began with a review of the disaster and social resilience literature to determine what prior studies have been determined regarding social resilience. As presented, there are limited studies that discuss social resilience indicators and their impact on a community in a disaster context. I used the existing literature to define the following questions for the study of social resilience:

1. How do we create resilient communities? How can social resilience be fostered within communities?
2. How can community social resilience be measured? How does this vary across the three disaster phases?

3. What are the essential social resilience indicators within a community across the disaster phases?

4. How do social resilience indicators affect social resilience in each disaster phase? What is the impact level of these indicators on social resilience?

5. How do social networks affect social resilience?

The literature review served as a key step, not only to identify these research questions, but also to identify valid and reliable indicators of social resilience, such as education, sense of community (Paton & Johnston, 2001), leadership (Hegney et al., 2008), trust (Enemark, 2006) and sharing information (Ink, 2006).

3.3.2 Select the Case Studies and Determine Data-Gathering and Analysis Techniques

In the second step of Yin's (1993) approach, one must determine how many cases will be selected, and thus if a single or multiple case study design will be employed (Yin, 1993). As case studies may either focus on a single case or use a number of cases, each of these approaches has unique advantages and disadvantages: a single case forms the research on typical or unusual cases, while multiple cases are used to achieve replication of a single type of disaster in different settings, or to compare and contrast different cases (Schell, 1992).

Multiple case studies are often used to make comparison across the cases or demonstrate contrast between the cases. The contexts of the multiple cases differ, however, under varied circumstances; we arrived at a common conclusion from all cases, the result expanding the external generalisability of our findings. Alternatively, multiple cases are also often selected because they offer contrasting situations: if the subsequent findings support a hypothesised contrast, the results represent a strong start towards theoretical replications (Yin, 2003). Multiple case approaches also allow for the use of methodological triangulation (Morgan & Smircich, 1980), which is useful for very complex research topics.

For the reasons introduced above, this study considered three case studies (sources of data) and investigated the results in three different sets of circumstances because this approach provides more substantial and powerful objectives compared with using a single case study. Each case is treated as a single case and each case's conclusions can

then contribute to the broader interpretation of the results. Thus, the findings are strengthened by the review of multiple cases.

To maximise the utility of this study, the cases needed to be selected carefully. Thus, the three cases were selected to represent three different geographic regions, different frequent disasters and different disaster severity. The cases were selected after conducting a literature review, reviewing SES documents and reports, and contacting the SES for confirmation about the availability of the requisite data for these three cases. The three cases selected for this research were as follows: the 2012 Wagga Wagga flood, the 2009 Kempsey flood, and the 2007 Hunter Region and Central Coast floods and storms.

3.3.2.1 Case 1: Wagga Wagga Flood

The first case study considered within this research was the March 2012 flood in Wagga Wagga. As NSW's largest inland city, Wagga Wagga had a population of about 47,000 in 2011 (ABS, 2011). The city is also an important hub for transport, agricultural and military operations. As the most damaging flood to affect Wagga Wagga in the past 40 years, the 2012 flood resulted in an estimated $530 million, affecting hundreds of homes, roads and farms (Khalili et al., 2015). The resulting loss of livestock and crops, and damage to places of business, had a great economic impact on the city. The flood was also the source of significant social impact, resulting in the loss of life of two individuals, while an additional 8,000 individuals were dislocated from their homes. Finally, the 2012 Wagga Wagga flood is attributed to many secondary impacts, including a regional spider outburst. This case was chosen for the immensity of the economic and social impact (Khalili et al., 2015).

3.3.2.2 Case 2: Kempsey Flood

The second case study considered within this research is the May 2009 flood at Kempsey. Kempsey, a small town consisting of both rural and residential populations with an estimated 2009 population of 29,000, is located on the NSW Mid North Coast in the Macleay Valley along the Macleay River (ABS, 2008). The Kempsey flood resulted in an estimated $25 million in damages, as well as significant damages to the environment (Khalili et al., 2015). Most infrastructure damages could be repaired within three months of the flood. The flood resulted in significant social impacts, most notably

to the rural farming communities—some Kempsey farms located along the Macleay River remained under water for as long as three months, which resulted in the death of hundreds of cattle and associated human health risks, including the impact on the local water quality (Khalili et al., 2015). This case was chosen for its notoriety and for the ability of the Kempsey residents to adapt and recover.

3.3.2.3 Case 3: Hunter Region and Central Coast Flood and Storms

The third case study considered for this research was the flood and storms that affected the Hunter Region and Central Coast in June 2007. Severe flooding was reported in the main business district of Newcastle, Maitland, the Hunter Valley and Lake Macquarie. The Insurance Council of Australia (ICA) estimated the impact of the Hunter flood and storm to be $1.48 billion in damages (ICA, 2016). More than 105,000 homes were left without power and 10 people were killed in the disaster. About 6,000 people evacuated from Maitland after the brake of a levee. Hundreds of cars were stranded or swept away and many shops and businesses flooded. Nearly 6,000 SES volunteers, including crews from across different states, worked in the area and responded to over 20,000 calls for assistance over an 18-day period, described as the second largest event in the 52-year history of the SES. The 2007 storm was selected for this study because it had one of highest flood levels ever recorded and one of the highest costs in recent decades in NSW, according to the ICA.

After the selection of the case studies, it is time to determine data gathering and analysis techniques. I determined that the most suitable data gathering methods were in-depth one-on-one semi-structured interviews with subject matter experts (SMEs) in disaster management. This method has been selected among other techniques to collect data as it matches with my purpose in this research. Additionally, as well be further explained later in this section, the Miles and Huberman approach has been selected for analysing data.

One of the key strengths of the case study method involves using multiple sources and techniques in the data-gathering process. Tools to collect data include documentation review, different types of interviews and surveys, observation and even the collection of physical artefacts (Yin, 2003). Table 3 shows the most common types of evidence used in conducting case studies, as well as their associated strengths and weaknesses.

Source of Evidence	Strengths	Weaknesses
Documentation	Stable—can be reviewed repeatedly

Unobtrusive—not created as a result of the case study

Exact—contains exact names, references, and details of an event | Irretrievability—can be low

Biased selectivity, if collection is incomplete

Reporting bias —reflects (unknown) bias of author

Access-may be deliberately blocked |
| Archival records | [Same as for documentation]

Precise and quantitative | [Same as for documentation]

Accessibility due to privacy reasons |
| Interviews | Targeted—focused directly on case study topic

Insightful—provides perceived casual inferences | Bias due to poorly constructed questions

Response bias

Inaccuracies due to poor recall Reflexivity—interviewee gives what interviewer wants to hear |
| Direct observations | Reality—covers events in real time

Contextual—covers context of event | Time-consuming

Selectivity—unless broad coverage Reflexivity—event may proceed differently because it is being observed |
| Participant-observation | [Same as for direct observations]

Insightful into interpersonal behaviour and motives | [Same as for direct observations]

Bias due to investigator's manipulation of events |
| Physical artefacts | Insightful into cultural features

Insightful into technical operations | Selectivity

Availability |

Table 3. The most common evidence used in case studies (Yin, 2003)

In this research, the interview method was chosen as the most appropriate technique to collect data and address the research problem. Within the interview method, there are different types of interviews that can be conducted when carrying out a research project. For instance, interviews can be structured (closed- or fixed-response interview), semi-structured or unstructured (informal or open-ended interview) (Berg et al., 2004). Unstructured interviews allow the researcher to allow the process to evolve fluidly and follow the conversation based on the participant's responses. There is not a standardised set of questions. Semi-structured interviews begin with a prepared set of questions, but

allow the researcher to deviate as needed to ask questions in response to the answers provided by the interviewee (Berg et al., 2004). Semi-structured interviews are most often used in qualitative studies and they combine a pre-determined set of open questions with the opportunity to explore particular themes or responses further. They also allow respondents to discuss, raise issues and express their views in their own terms—terms that researchers may not have considered. Finally, the structured approach does not allow for deviation from the standardised interview instrument. For my purpose, semi-structured interviews were selected because they provide reliable, comparable qualitative data and because they allowed me to respond to answers with additional necessary questions to investigate the phenomenon at hand.

Identifying the type of construct (formative versus reflective) was a critical initial step prior to my data analysis. As illustrated in Table 4 (Coltman, Devinney, Midgley, & Venaik, 2008), my construct was formative because I formed latent constructs and the causality moved from the items (social resilience indicators) to the construct (social resilience framework). Formative constructs are amenable to the case study approach and to the use of qualitative modes of inquiry. Moreover, throughout this research, social resilience was considered to be composed of independent indicators.

Considerations	Reflective Model	Formative Model	Relevant Literature
Theoretical considerations			
1. Nature of construct	Latent construct exists ➢ Latent construct exists independent of the measures used	Latent construct is formed ➢ Latent constructs is a combination of its indicators	(Borsboom Mellenbergh, & Van Heerden, 2003)
2. Direction of causality between items and latent construct	Causality from construct to items ➢ Variation in the construct causes variation in the item measures ➢ Variation in the item measures does not cause variation in the construct	Causality from items to construct ➢ Variation in the construct does not cause variation in the item measures ➢ Variation in the item measures causes variation in the construct	(Bollen & Lennox, 1991) (Edwards & Bagozzi, 2000) (Rossiter, 2005) (Jarvis, Mackenzie, & Podsakoff, 2003)
3. Characteristics of items used to measure the construct	Items are manifested by the construct ➢ Items share a common theme ➢ Items are interchangeable	Items define the construct ➢ Items need not share a common theme ➢ Items are not interchangeable	(Rossiter, 2005) (Jarvis et al., 2003)

	➢ Adding or dropping an item does not change the conceptual domain of the construct	➢ Adding or dropping an item may change the conceptual domain of the construct	
Empirical considerations			
4. Item inter-correlation	Items should have high positive inter-correlations ➢ Empirical tests: assessing internal consistency and reliability by Cronbach alpha, average variance extracted, and factor loadings (e.g., from common or confirmatory factor analysis)	Items can have any pattern of inter-correlation but should possess the same directional relationship ➢Empirical test: no empirical assessment of indicator reliability possible; various preliminary analyses are useful to check directionality between items and construct	(Cronbach, 1951) (Lunneborg, 1979) (Churchill Jr, 1979) (Diamantopoulos, 2006)
5. Item relationships with construct antecedents and consequences	Items have similar sign and significance of relationships with the antecedents/consequences as the construct ➢ Empirical tests: establishing content validity by Siguaw's (2006) theoretical considerations, assessing convergent and discriminant validity empirically	Items may not have similar significance of relationships with the antecedents/consequences as the construct ➢ Empirical tests: assessing nomological validity by using a Multiple Indicators and Multiple Causes MIMIC model, and/or structural linkage with another criterion variable	(Bollen & Lennox, 1991) (Diamantopoulos, 2006)
6. Measurement error and colinearity	Identifying the error term in items is possible ➢ Empirical test: identifying and extracting measurement error by common factor analysis	Identifying the error term is not possible if the formative measurement model is estimated in isolation ➢ Empirical test: using the vanishing tetrad test to determine if the formative items behave as predicted ➢ Colinearity should be ruled out by standard diagnostics such as the condition index	(Bollen & Lennox, 1991) (Bollen & Ting, 2000) (Diamantopoulos, 2006)

Table 4. A framework for assessing reflective and formative models: Theoretical and empirical considerations (Coltman et al., 2008)

In this stage, it was important to make certain that my study was well constructed to guarantee validity and reliability. Validity refers to the extent that the instrument and data serve the correct purpose and it can be further defined under content validity, criterion validity, face validity and construct validity to assess the validity of research

(Fink, 2002). According to Fink (2002), content validity refers to measures that appropriately measure data based on their intention; criterion validity refers to comparing responses to the existing literature to assess concurrent validity and/or predictive validity; face validity refers to the extent to which measures appear on the surface to meet their purpose; and finally, construct validity refers to the ability of an instrument to differentiate characteristics in the sample.

To ensure validity, I used multiple cases from multiple sources to uncover convergent lines of inquiry. Specifically, in this research, I used three case studies, each from a different place with different people. In comparing indicators across these three areas, I established greater validity in my results. Thus, I used cross-case techniques in which I conducted follow-up focused interviews to confirm gathered data in order to associate the findings with the research questions.

Reliability implies the accuracy and precision of measurement. Reliable results are both valid and consistent. According to (Fink, 2002, p. 47):

> Reliability, or the consistency of information gathered by a survey, can be seriously imperilled by poorly worded and imprecise questions and directions. If an instrument is unreliable, it is also invalid, because you cannot obtain accurate findings with inconsistent data.

In this study, I ensured that the procedures used for the three case studies were well documented and could be repeated with the same results repeatedly. This assurance of consistency is key for reliability.

3.3.3 Preparing to Collect the Data

Case study research produces a huge amount of data that can cause confusion and the loss of the original research purpose and questions. To avoid becoming overwhelmed by the amount of data that is created from multiple sources, systematic organisation of the data plays an essential role. Advanced preparation assists in handling large amounts of data. Therefore, for this study, a database was prepared to assist with categorising, sorting, storing and retrieving data for analysis.

All relevant determining factors, which were deemed valid and reliable, were collected by conducting the literature review. Duplicate factors were removed from the list and placed into an array along with the authors who proposed them (see Table 5).

Indicators	Researcher
Sense of community Feeling of belonging to a community or place	Paton, Millar & Johnston, 2001
Trust Trust in neighbourhood	Enemark, 2006
Community participation Involvements in a community	Paton et al., 2001
Leadership Leadership within a community	Harland et al., 2005; Hegney et al., 2008
Collective efficacy A group's shared belief in collective power to produce specific changes	Moore et al., 2004
Community efficacy A community's belief in its own capabilities of performing and completing jobs	Paton et al., 2001
Social capital Communities invest, access and use surrounding resources in social networks to gain returns	Breton, 2001; Maguire & Hagan, 2007
Social cohesion Community willingness to cooperate with each other	Paton et al., 2001
Community involvement Involvement in community	Clauss-Ehlers & Levi, 2002
Communication and information The interchange and sharing of information within a community	Ink, 2006; Rohrmann, 2000
Resource dependency The reliance on a narrow range of resources leading to social stresses	Adger, 2000
Improvisation refers to creativity and ingenuity Community creativity and innovation to devise a solution for enhancing resilience	Forgette & Boening, 2009; Lalonde, 2011
Innovation Innovative to devise a solution for building and enhancing resilience	Demchak, 2006
Social support Support from neighbourhood	Kaniasty & Norris, 1999; Norris et al., 2008
Learning Learning from previous disasters	Zhou et al., 2010

Education Level of knowledge about flood	Paton et al., 2001
Demographic information Such as age, gender, socioeconomic status (income), health, historical, education, cultural (religious belief) or populations with special needs	Cutter et al., 2010; Tobin, 1999
Coping style Adaptive capacity and developing strategy	Miller et al., 1999

Table 5. List of potential social resilience indicators within a community
(Khalili et al., 2015)

We prepared to collect data by first contacting a key SES actor, the CIO, who would be interviewed for the following reasons: to gain participants' cooperation; to provide an explanation of the study; to generate formats for reports and field notes, and guidelines for collection of the documents to be used; to anticipate key problems and events; to identify key people; to prepare letters of introduction; and to establish rules for confidentiality. The final advanced preparation step was to seek opportunities actively to revisit and revise the research design to address the research questions.

3.3.4 Data Collection

After developing a thorough understanding of the research and determining the data collection and analysis techniques, the next step was to generate instrument questions for collecting data and interview.

3.3.4.1 Developing an Instrument

In the instrument development stage, I constructed the instrument, which consisted of questions for the interview. To this effect, I concurrently developed my list of social resilience indictors (see Table 6) from the literature review to establish what prior studies have determined about social resilience indicators within communities to ensure that all relevant indicators were addressed as needed within the interview instrument. I also reviewed social resilience instruments from previous studies, including those employed in other disciplines, to assist me in developing my instrument.

Essentially, the content from the literature was transformed into questions. In addition, a link among the objectives of the study and their translation into content was established;

therefore, the instrument and questions were developed through the identification of the essential criteria (see Table 6). Thus, the literature review was used to develop the list of social resilience indicators, which was then used to solicit discussion of the indicators with the SMEs. Moreover, the questions were designed to represent each of the research aims (Khalili et al., 2015). As demonstrated in Table 6, interview questions were designed to meet the needs of the research questions, but also based on the indicators that were demonstrated as significant within the extant literature.

Research questions

How can we measure social resilience within a community and in every disaster phase?

What are the essential social resilience indicators that affect social resilience within a community in every disaster phases?

Interview questions

How do you measure resilience?

How and why is considering disaster phases (like pre-disaster, response and recovery) required for measuring social resilience?

Are the indicators below measurable?

What is the impact level of these indicators on social resilience in every disaster phases?

Education, demographic information, community efficacy, community participation, sense of community, social support, coordination, learning, coping style, leadership, exchange and sharing information, innovative, trust.

How and why do the above parameters affect social resilience?

Research question

How do social networks affect social resilience?

Interview questions

How does information exchange and shared information affect social resilience and other indicators?

How is information added, processed and distributed within communities—Is it centralised or decentralised?

How do informal networks assist the sharing of information within communities?

Is there any plan for distributing information regularly? If not, how often? Who are the key people or organisations to distribute information?

Table 6. Link between research objectives and interview instrument

To this effect, the interview instruments developed for this research consisted of three main sections: (1) questions addressing how social resilience can be measured and identifying the most essential social resilience indicators; (2) questions addressing the general processes of SES or associated council; and (3) questions addressing resource management. The full survey is provided in Appendix B.

The instrument, therefore, was mainly designed to identify social resilience indicators for each of the three case studies. The survey asked respondents to indicate social resilience indicators and utilised a five-point Likert scale from 'strongly disagree' (+1) to 'strongly agree' (+5) for each of the social resilience indicators. It also asked subject matter experts if they had recognised any other indicators not listed in the survey and then followed up with questions seeking further detail for measuring any additional indicators captured through this question series.

After developing the interview instruments, I moved on to the data collection stage of the research. At this stage, all data were gathered and organised carefully and systematically in the formats best suited for later reference and analysis. The semi-structured interviews with key members of the SES for each of the case studies lasted for at least an hour per interviewee. In all, nine SES staff members were interviewed, as well as four individuals from the Wagga Wagga council, two individuals from the Kempsey council, and five individuals from the Hunter Region and Central Coast council. Finally, I conducted two focus groups at the SES headquarters in Wollongong. To ensure individual confidentiality and non-biased responses, the interviews were conducted in a one-on-one setting. The individual and focus group interviews followed the same format for collecting data; however, the focus groups were less structured interviews and they approached topics about indicators that were more general. For each of the interviews, including the focus groups, the instrument served as the guide for the process to generate a degree of uniformity and consistency, but deviation was allowed in order to capture additional facts, opinions and unexpected insights.

3.3.4.2 Administrating Data Collection

We used snowball sampling techniques to identify key people and SMEs in both SES and associated councils for this study (see Figure 15). Snowball sampling is a non-probability sampling method in which the researchers identify the first set of interviewees through established criteria and then request those interviewees to recommend further individuals who would be valuable in providing meaning to the research problem (Fink, 2002). Through snowball sampling, I was able to find individuals with the specific range of talents and abilities that were determined as useful. To demonstrate, in Figure 16, the initial interviewee (identified by the researchers based on known knowledge of the disaster) is represented by the circle on

the left. That interviewee would then identify individuals, two in this demonstration, and then the researcher would seek to interview those recommended individuals. The researcher would then ask again in those interviews for the interviewee to make recommendations, and so on.
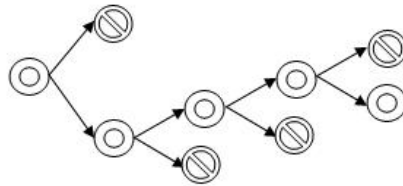
Figure 15. Snowball technique

Identifying the initial contacts and connections made is the main element in this approach; thus, it is important to select the initial nodes carefully and correlate with the right contact to find more contacts. In community power studies, it is common to begin snowball searches with community or organisation elites, such as the chief executives of organisations. Local elites are considered to have a wider view of the community than other community members and, as such, serve as the ideal first points of contact with these communities (Dasgupta & Beard, 2007). Keller (1991, p. 4) adds that these individuals are 'ultimately responsible for the realisation of major social goals, and for the continuity of the social order', which confirms that they are key actors for understanding factors of social resilience in their respective communities. The aim of this approach was to capture the elite network effectively (Hanneman & Riddle, 2005). In the data-gathering stage, I began with a focal actor, the SES CIO, and arranged a meeting with him to ask for copies of the SES's mission statement, brochures, and any other written material describing the SES organisation and its purpose. The final set of interview questions asked the SES CIO to name some of their connections to other actors and introduce me to SMEs within the SES organisation. The interviewees or SMEs were selected from those names based upon their positions. Generally, the individuals with adequate knowledge about communities and resilience were selected, such as incident controllers, operation directors, 'lessons learned' managers, community engagement managers and senior risk planners (Khalili et al., 2015). Then, all the actors named were interviewed and asked for some or all of their connections in the SES or associated councils. The process continued until I had interviewed subject matter experts sufficiently from both SES and associated councils' SMEs, as determined by

saturation of findings. At this point, it was determined that new findings would not be reached from additional data collection.

Table 7 shows the interview schedule with subject matter experts at the SES headquarters in Wollongong and at the SMEs from associated councils, with their positions and whom they nominated as a secondary candidate.

All interview conversations were recorded with the interviewees' permission. For additional accuracy of analysis, notes were also taken during the interviews and flagged for potential use in the final report. Following the completion of the interview data-collection phase, all notes were completed, audio transcribed and the data entered into a database for the analysis phase of this study (Appendix C).

Qualitative Interview Schedule and Interviewee List				
NSW SES				
Key Person Name	**Position**	**Date and Time**	**Nominated Candidate**	**Email Address**
Andrew Edwards	Chief Information Officer	07/08/2013 4.45–5.08 pm	Andrew Richards, Scott Hanckel, Gina Jones	andrew.edwards@ses.nsw.gov.au
Andrew Richards	Manager Community Engagement	15/08/2013 10–11 am		andrew.richards@ses.nsw.gov.au
Scott Hanckel	Assistant Director Operations	15/08/2013 12–1 pm	David Chambers	scott.hanckel@ses.nsw.gov.au
David Chambers	Region Controller (Incident controller)	15/08/2013 1–2 pm		david.chambers@one.ses.nsw.gov.au
Gina Jones	Assistant Director Special Operations	15/08/2013 2–3 pm	Heather Stuart, Simon Opper	gina.jones@ses.nsw.gov.au
Heather Stuart	Manager Lesson Learned	15/08/2013 3–3.30 pm		heather.stuart@ses.nsw.gov.au
Gina Jones	Assistant Director Special Operations	27/08/2013 10.30–11.30 am		gina.jones@ses.nsw.gov.au
Simon Opper	Senior Planning Officer—Risk Management Department	27/08/2013 1–2 pm		simon.opper@ses.nsw.gov.au
David Chambers	Region Controller	27/08/2013 1–2 pm		david.chambers@one.ses.nsw.gov.au
Wagga Wagga Council				
Key Person Name	**Position**	**Date and Time**	**Nominated Candidate**	**Email Address**
Madeleine Scully	Community Service Manager	17/03/2015 10–11 am	Lisa Saffery, Donna Argus	Scully.madeleine@wagga.nsw.gov.au
Lisa Saffery	Manager Community Engagement	17/03/2015 11–12 pm		Saffery.lisa@wagga.nsw.gov.au
Donna Argus	Senior Project Manager for Programme	20/03/2015 11–12 pm		Donna.argus@facs.nsw.gov.au

Key Person Name	Position	Date and Time	Nominated Candidate	Email Address
	Innovation & Design			
Bill Harvey	Wagga Wagga City Council Senior Traffic Officer	24/03/2015 10–11am		Harvey.Bill@wagga.nsw.gov.au

Kempsey Council				
Key Person Name	**Position**	**Date and Time**	**Nominated Candidate**	**Email Address**
Robert Scott	Director Infrastructure Services	23/03/2015 3–4pm		Robert.scott@kempsey.nsw.gov.au
Kathy Oliver	Director Community Engagement	11/05/2015 10–11am		kathy.oliver@kempsey.nsw.gov.au

Hunter Region and Central Coast Councils (Maitland, Lake Macquarie, Newcastle)				
Key Person Name	**Position**	**Date and Time**	**Nominated Candidate**	**Email Address**
David Gibbins	1. Senior Strategist Integrated Flood Planning, The City of Newcastle 2. Director Technical Floodplain Management Association	04/05/2015 4–5pm		davidgibbins@iinet.net.au
Alastair Peddie	Flood Engineer Specialist	10/04/2015 4–5pm		apeddie@ncc.nsw.gov.au
Sandra Feltham	Social Planner	22/04/2015 10–11am		sfeltham@ncc.nsw.gov.au
Sandie Pitter	Special Project Officer (Manager of Be Ready Be Safe Campaign)	13/05/2015		spitter@lakemac.nsw.gov.au
Greg Perry	Hunter SES Region Controller	19/05/2015 10–11am	Amanda Hyde (049313222)	glperry@bigpond.net.au

Table 7. Qualitative interview schedule

3.3.5 Data Analysis and Evaluation

Social resilience is considered to be composed of numerous independent indicators. To find linkages between the collected data and those indicators, it is necessary to analyse the raw data. The data analysis approach draws mainly on the work of Miles and Huberman. Miles and Huberman's (1984) qualitative analysis approach provides a framework for the processes of coding and data display. This approach focuses on three components—data reduction, data display and drawing conclusions—that take place concurrently throughout the data analysis (Miles & Huberman, 1984).

The first step, data reduction, encompasses the way the interview data is analytically coded or reduced without losing the context. After every interview in this study, recorded conversations were transferred to text through notes and verbatim audio transcriptions. Next, related indicators of each disaster phase for all three case studies—Wagga Wagga, Kempsey and the Hunter Region—were gathered, categorised, tabulated, placed into a table and then recombined to address the initial propositions and purpose of the study. Figure 16 shows an example of how codes and indicators were extracted from the scripts. Appendix D provides transcriptions of all interviews.
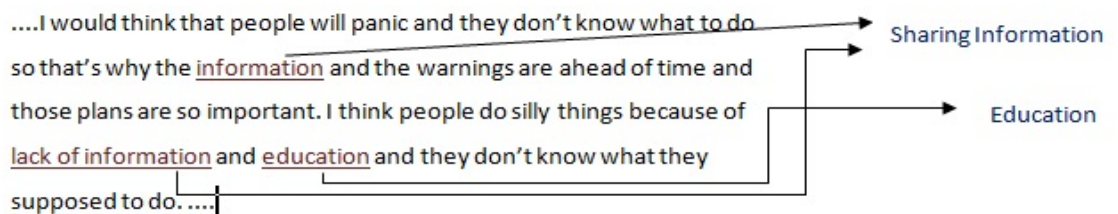
Figure 16. Sample of how codes and indicators were extracted from the scripts

Next, Figure 17 depicts all gathered indicators from the transcripts determined to be related to social resilience. Indicators depicted include both (a) pre-set (i.e., those derived from the conceptual framework and literature review) and (b) emergent codes (i.e., those developed from the interviews with SMEs). However, it must be noted that there was extensive overlap between the pre-set and emergent social resilience indicators, which provided validity to the process.

Figure 17. Gathered indicators from the scripts

All data were placed into different arrays; matrices of categories were created and codes generated; sub-codes and labels were applied to each array. After that, indicators were added, collapsed, revised and collated into potential time sequence themes, which were generated from the literature review: pre-disaster, response and recovery. Subsequently, themes and indictors were reviewed and reduced by grouping similar themes, and then poorly rated indicators were removed from each of the three case studies (see Table 8).

Theme	Codes	Indicators
Pre-disaster	CPR	Community participation
	EDU	Education
	EXI	Exchange information
	LRN	Learning
	SIN	Shared information
	SLS	Social support
	SOC	Sense of community
	TUT	Trust
	DIN	Demographic information
	IMP	Improvisation/inventiveness
	CST	Coping style
	LDP	Leadership
Response	CPR	Community participation
	EXI	Exchange information
	SIN	Shared information
	SLS	Social support
	SOC	Sense of community
	TUT	Trust
	CRD	Coordination
	CST	Coping style
	LDP	Leadership
Recovery	CPR	Community participation
	EXI	Exchange information
	LRN	Learning
	SIN	Shared information
	SLS	Social support
	SOC	Sense of community
	TUT	Trust
	CEF	Community efficacy
	IMP	Improvisation/inventiveness
	CST	Coping style
	LDP	Leadership

Table 8. Data coding: Assigning themes to codes

All indicators were rated based on their emphasis in the interview, as well as on the level of agreement by SMEs across the three separate case studies. Emphasis levels were allocated to each indicator based on the number of times indicators were repeated

by SMEs during the interview. The level of indicator agreements were rated on a Likert response scale from 1 (strongly disagree) to 5 (strongly agree) by each individual subject matter expert. Then, for each of the case studies, the results of level of agreement and level of emphasis of each indicator were gathered and placed into a matrix format, shown in Tables 9 through 15.

Tables 9 and 10 show the results for the first case study, the Wagga Wagga flood. For this case study, I collected 13 responses from subject matter experts (nine from NSW SESs and four from Wagga Wagga council representatives). The highest possible score was 65, in which every individual subject matter expert would strongly agree on the impact of that parameter on social resilience, and 13 was the lowest possible indicator, in which all subject matter experts would strongly disagree. Table 10 shows how I calculated the score for each indicator. To count each indicator's final score, I accumulated the number of interviewees multiplied by the indicator's rating. In Table 9, the frequency of agreement for each of the interviewees is provided in the 'Level of Agreement' columns. These columns total 13 for each of the individual indicators, as there were 13 interviewees answering this question. The calculation of the final score (last column) is demonstrated in the Score column. The equation used to calculate the score weights the level of agreement responses, in which 'strongly agree' was weighted as a 5, 'agree' was weighted as a 4, 'neither agree nor disagree' was weighted as a 3, 'disagree' was weighted as a 2 and, finally, 'strongly disagree' was weighted as a 1. Thus, for the first indicator, community efficacy (CEF), the two 'strongly agree' responses were multiplied by five, the eight 'agree' responses were multiplied by four, the two 'neither agree nor disagree' responses were multiplied by two, and the one 'disagree' response was multiplied by one for a final score of 50. This procedure was repeated for each of the 14 social resilience indicators. The results indicate that social support and information exchange, each with a final score of 65, were the strongest social resilience indicators as determined by the agreement among interviewees. As 65 is equal to 13 times 5, this score indicates a perfect consensus among respondents.

Case Study 1—Wagga Wagga								
Codes	**Indicators**	**Level of Agreement**					**Score** (No. of Interviewees * Level of Agreement)	**Final Score**
		Strongly Agree (+5)	Agree (+4)	Neither Agree nor disagree (+3)	Disagree (+2)	Strongly Disagree (+1)		
		No. of Interviewees						
CEF	Community efficacy	2	8	2	1	0	2*5+8*4+2*3+1*2	50
CPR	Community participation	11	1	1	0	0	11*5+1*4+1*3	62
CRD	Coordination	2	8	3	0	0	2*5+8*4+3*3	51
CST	Coping style	2	2	6	3	0	2*5+2*4+6*3+3*2	42
DIN	Demographic information	1	9	3	0	0	1*5+9*4+3*3	50
EDU	Education	12	1	0	0	0	12*5+1*4	64
EXI	Exchange information	13	0	0	0	0	13*5	65
IMP	Improvisation/inventiveness	3	1	6	3	0	3*5+1*4+6*3+3*2	43
LDP	Leadership	4	0	5	4	0	4*5+5*3+4*2	43
LRN	Learning	12	0	0	1	0	12*5+1*2	62
SIN	Shared information	10	3	0	0	0	10*5+3*4	62
SLS	Social support	13	0	0	0	0	13*5	65
SOC	Sense of community	12	1	0	0	0	12*5+1*4	64
TUT	Trust	11	1	1	0	0	11*5+1*4+1*3	62

Table 9. Indicator levels of agreement: Case Study1 (Wagga Wagga)

To provide meaning to the final score numbers, Table 10 shows the final score of each indicator and how the score corresponds to the level of agreement within this research. In Table 10, the same 14 indicators are provided in the first column and the final scores from Table 9 are provided in the third column. The emphasis levels in the fourth column were calculated based on the number of times the interviewees mentioned the indicators in the interview, aside from the Likert-scale questions relating to the social resilience indicators. Finally, the Agreement column demonstrates the associated level

of agreement for the final score. For the first case study, Wagga Wagga, perfect agreement by the 13 respondents gave a score of 65. Thus, for the purpose of analysis, scores between 52 and 65 were classified as 'strongly agree,' scores between 45 and 51 were classified as 'agree,' and scores below 44 were classified as 'neutral.' Simply put, emphasis levels were allocated to each indicator based on the number of times indicators were repeated by subject matter experts during the interview, while agreement levels were based on the range of weighted calculations from the scaled question portion of the interview. Agreement levels have been colour coded, in which 'strongly agree' is highlighted green, 'agree' is highlighted yellow, and 'neutral' is highlighted red. However, Wagga Wagga interviewees strongly agreed regarding eight of the 14 social resilience indicators, agreed regarding three of the social resilience indicators, and were neutral in regards to the remaining three indicators. The consistency between the Emphasis and Agreement columns in Table 10 provides reliability and validity to the analysis process. The social resilience indicators that respondents strongly agreed with using a Likert scale were also highly emphasised in the interview narrative. Likewise, the indicators with which interviewees only moderately agreed received a 'medium' emphasis in the interview narrative and the indicators for which the interviewees were neutral received a low emphasis in the interview narrative.

Case Study 1—Wagga Wagga				
Codes	**Indicators**	**Final Score**	**Emphasis**	**Agreement**
CEF	Community efficacy	50	Medium	Agree
CPR	Community participation	62	High	Strongly agree
CRD	Coordination	51	Low	Agree
CST	Coping style	42	Low	Neutral
DIN	Demographic information	50	Medium	Agree
EDU	Education	64	High	Strongly agree
EXI	Exchange information	65	High	Strongly agree
IMP	Improvisation/inventiveness	43	Very low	Neutral
LDP	Leadership	43	Low	Neutral
LRN	Learning	62	High	Strongly agree
SIN	Shared information	62	Very high	Strongly agree
SLS	Social support	65	High	Strongly agree
SOC	Sense of community	64	High	Strongly agree
TUT	Trust	62	Medium	Strongly agree

Table 10. Indicators' final scores and level of agreement: Case Study1 (Wagga Wagga)

Next, Tables 11 and 12 show the second case study results for the Kempsey floods. For this case study, I collected 11 responses from subject matter experts (nine from NSW SES and two from Kempsey council representatives). The highest possible score for this case study was 55 (11 x 5), for which every individual subject matter expert would have to strongly agree on the impact of that parameter on social resilience, and 11 (11 x 1) was the lowest possible indicator, in which all subject matter experts would have to strongly disagree. Table 11 shows how I calculated the score for each indicator. As with the Wagga Wagga case study, to count each indicator's final score, I accumulated the number of interviewees and multiplied by the indicator's rating.

Case Study 2—Kempsey								
		Level of Agreement					**Score** (No. of Interviewee * Level of Agreement)	**Final Score**
Codes	**Indicators**	Strongly Agree (+5)	Agree (+4)	Neither Agree nor disagree (+3)	Disagree (+2)	Strongly Disagree (+1)		
		No. of Interviewee						
CEF	Community efficacy	0	6	4	1	0	6*4+4*3+1*2	38
CPR	Community participation	10	1	0	0	0	10*5+1*4	54
CRD	Coordination	1	7	3	0	0	1*5+7*4+3*3	42
CST	Coping style	1	1	5	4	0	1*5+1*4+5*3+4*2	32
DIN	Demographic information	0	6	4	1	0	6*4+4*3+1*2	38
EDU	Education	11	0	0	0	0	11*5	55
EXI	Exchange information	11	0	0	0	0	11*5	55
IMP	Improvisation/inventiveness	0	1	8	2	0	1*4+8*3+2*2	32
LDP	Leadership	0	1	6	4	0	1*4+6*3+4*2	30
LRN	Learning	11	0	0	0	0	11*5	55
SIN	Shared information	11	0	0	0	0	11*5	55
SLS	Social support	10	1	0	0	0	10*5+1*4	54
SOC	Sense of community	11	0	0	0	0	11*5	55
TUT	Trust	10	1	0	0	0	10*5+1*4	54

Table 11. Indicator levels of agreement: Case Study 2 (Kempsey)

It is important to note here that the final scores could not be compared across the three case studies, as the final scores were dependent on the number of interviews, and the number of interviewees varied across the three case studies. For instance, the highest possible score for Wagga Wagga was 65 (13 x 5), while the highest possible score for Kempsey was 55 (11 x 5). Thus, different final score ranges corresponded to different levels of agreement between the three cases. For the second case study, Kempsey, scores between 44 and 55 corresponded to 'strongly agree', scores between 33 and 43

corresponded to 'agree', and scores less than 33 corresponded to 'neutral'. It is a significant finding that there was a consensus across the first two case studies in regards to level of agreement on the 14 social resilience indicators. The respondents in each of the case studies strongly agreed on the same eight indicators and moderately agreed on or felt neutral about the same three indicators, respectively. Moreover, just as in the case of the Wagga Wagga floods, the level of emphasis in the interview narrative correctly corresponded to the level of agreement from the Likert-scale social resilience indicators. That is, indicators about which respondents strongly agreed were highly emphasised, indicators about which respondents moderately agreed received medium emphasis, and indicators about which respondents felt neutral received a low level of interest. This finding is thus consistent across the two case studies examined so far.

Case Study 2—Kempsey				
Codes	**Indicators**	**Final Score**	**Emphasis**	**Agreement**
CEF	Community efficacy	38	Low	Agree
CPR	Community participation	54	Medium	Strongly agree
CRD	Coordination	42	Medium	Agree
CST	Coping style	32	Low	Neutral
DIN	Demographic information	38	Low	Agree
EDU	Education	55	High	Strongly agree
EXI	Exchange information	55	Very high	Strongly agree
IMP	Improvisation/ inventiveness	32	Low	Neutral
LDP	Leadership	30	Low	Neutral
LRN	Learning	55	High	Strongly agree
SIN	Shared information	55	High	Strongly agree
SLS	Social support	54	Medium	Strongly agree
SOC	Sense of community	55	High	Strongly agree
TUT	Trust	54	High	Strongly agree

Table 12. Indicators' final scores and level of agreement: Case study 2 (Kempsey)

Finally, in the third case study, the Hunter Region and Central Coast flood and storms, I collected five responses from SMEs. The Likert response scores for this case study are provided in Table 13. Given that there were only five interviewees for this case study, the highest possible score for any indicator was 25 (5 x 5), further demonstrating why raw final scores cannot be compared across the three case studies without using the individualised agreement scales. For the Hunter Region and Central Coast, final scores between 21 and 25 corresponded with 'strongly agree', final scores of 20 corresponded with 'agree', and final scores less than 20 correspond with neutral agreement. While there was a consensus between the Wagga Wagga and Kempsey interviewees regarding

level of agreement and emphasis on all 14 social resilience indicators, the results for the Hunter Region and Central Coast case study deviate from those demonstrated in Tables 10 and 12 (see Table 14). Moreover, while the level of emphasis corresponded to the level of agreement, this was not the case for all social resilience indicators. For instance, in the third case study, coordination received medium emphasis in the interview narrative, but received neutral agreement in the Likert-style questions. Similarly, leadership received low emphasis in the interview narrative, but interviewees agreed to its importance in the Likert-style questions.

Codes	Indicators	Level of Agreement					Score (No. of Interviewee * Level of Agreement)	Final Score
		Strongly Agree (+5)	Agree (+4)	Neither Agree nor disagree (+3)	Disagree (+2)	Strongly Disagree (+1)		
		No. of Interviewee						
CEF	Community efficacy	2	1	2	0	0	2*5+1*4+2*3	20
CPR	Community participation	3	2	0	0	0	3*5+2*4	23
CRD	Coordination	1	2	2	0	0	1*5+2*4+2*3	19
CST	Coping style	1	2	2	0	0	1*5+2*4+2*3	19
DIN	Demographic information	1	3	1	0	0	1*5+3*4+1*3	20
EDU	Education	4	0	1	0	0	4*5+1*3	23
EXI	Exchange information	3	2	0	0	0	3*5+2*4	23
IMP	Improvisation/ inventiveness	2	1	1	1	0	2*5+1*4+1*3+1*2	19
LDP	Leadership	1	3	1	0	0	1*5+3*4+1*3	20
LRN	Learning	3	2	0	0	0	3*5+2*4	23
SIN	Shared information	4	1	0	0	0	4*5+1*4	24
SLS	Social support	3	1	1	0	0	3*5+1*4+1*3	22
SOC	Sense of community	3	2	0	0	0	3*5+2*4	23
TUT	Trust	2	2	1	0	0	2*5+2*4+1*3	21

Case Study 3—Hunter Region and Central Coast

Table 13. Indicator levels of agreement: Case Study 3 (Hunter Region and Central Coast)

	Case Study 3—Hunter Region and Central Coast			
Codes	**Indicators**	**Final Score**	**Emphasis**	**Agreement**
CEF	Community efficacy	20	Medium	Agree
CPR	Community participation	23	High	Strongly agree
CRD	Coordination	19	Medium	Neutral
CST	Coping style	19	Low	Neutral
DIN	Demographic information	20	Medium	Agree
EDU	Education	23	High	Strongly agree
EXI	Exchange information	23	High	Strongly agree
IMP	Improvisation/inventiveness	19	Low	Neutral
LDP	Leadership	20	Low	Agree
LRN	Learning	23	High	Strongly agree
SIN	Shared information	24	High	Strongly agree
SLS	Social support	22	High	Strongly agree
SOC	Sense of community	23	High	Strongly agree
TUT	Trust	21	High	Strongly agree

Table 14. Indicators' final scores and level of agreement: Case Study 3 (Hunter Region and Central coast)

Table 15 is provided to demonstrate the similarities and differences across the three cases in regards to the emphasis and agreement for each of the 14 social resilience indicators. The final two columns provide an aggregated score for the three cases. As demonstrated in Table 15, eight of the 14 social resilience indicators were rated as high impact (strongly agree), three were rated as medium impact (agree), and three were rated as low impact (neutral). A final ranking was determined by adding the scores from the three disasters and then sorting from highest (greatest agreement) to lowest (least agreement). Thus, community participation was the social resilience indicator of most

importance across the three disasters, while leadership was the social resilience indicator of least importance across the three disasters.

Note that in Table 15, the interviewees' level of emphasis was only consistent across all three case studies for five of the 14 social resilience indicators. For the other 10 indicators, the level of emphasis was consistent for two of the three case studies, with the third being one degree off. For instance, if two scored 'high', then the third was 'medium' (as in the case of community participation) or 'very high' (as in the case of shared information). In these cases, the level of impact used for all case studies was that expressed by the majority of the cases (i.e., at least two out of three). I also noted that the differences in emphasis were likely inherent in the different cases, as opposed to merely differences in perception. Thus, the indicators were present and needed at different levels in each of the case studies and, as such, were—for many of the indicators—emphasised differently across the three studies.

Code	Indicators	Case Study 1		Case Study 2		Case Study 3		All Case Studies	
		Emphasis	Agreement	Emphasis	Agreement	Emphasis	Agreement	Impact	Agreement
CPR	Community participation	High	Strongly Agree	Medium	Strongly Agree	High	Strongly Agree	High	Strongly agree
EDU	Education	High	Strongly Agree	High	Strongly Agree	High	Strongly Agree	High	Strongly agree
EXI	Exchange information	High	Strongly Agree	Very High	Strongly Agree	High	Strongly Agree	High	Strongly agree
LRN	Learning	High	Strongly Agree	High	Strongly Agree	High	Strongly Agree	High	Strongly agree
SIN	Shared information	Very High	Strongly Agree	High	Strongly Agree	High	Strongly Agree	High	Strongly Agree
SLS	Social support	High	Strongly Agree	Medium	Strongly Agree	High	Strongly Agree	High	Strongly agree
SOC	Sense of community	High	Strongly Agree	High	Strongly Agree	High	Strongly Agree	High	Strongly agree
TUT	Trust	Medium	Strongly Agree	High	Strongly Agree	High	Strongly Agree	High	Strongly agree
CRD	Coordination	Low	Agree	Medium	Agree	Medium	Neutral	Medium	Agree
DIN	Demographic information	Medium	Agree	Low	Agree	Medium	Agree	Medium	Agree
CEF	Community efficacy	Medium	Agree	Low	Agree	Medium	Agree	Medium	Agree
IMP	Improvisation/ inventiveness	Very Low	Neutral	Low	Neutral	Low	Neutral	Low	Neutral

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| CST | Coping style | Low | Neutral | Low | Neutral | Low | Neutral | Low | Neutral |
| LDP | Leadership | Low | Neutral | Low | Neutral | Low | Agree | Low | Neutral |

Table 15. Indicator scores and levels for individual and combined cases

The second component of the Miles and Huberman case study analysis technique is to provide a visualisation of the data through diagrams, charts and models, which aligns with the data reduction component of the analysis. For the data display stage of this study, I visualised the SES procedure based on the gathered data from the general process section in the interview instrument (see Figure 18). The SES procedures diagram presented in Figure 18 depicts that while there is a hierarchy in the SES organisation, the resources and flow of information is multidirectional and involves stakeholders to ensure efficiency in operations at all levels. While there are components that are exclusively top-down, such as meteorological and media communication, there are also many factors of consideration in which information forms horizontally, such as when regional SES levels engage with other regions and share resources, as well as factors that exhibit a bidirectional vertical flow, such as the ongoing communication between the different levels.

State Emergency Service (SES)

Combat Agency

SES Levels

Hierarchy coordination

State Level

Only SES staffs

Bureau of Meteorology(BOM)

SES

SES headquarter

Communication Centre
Receive Incident News

Duty Operation Officer
recall internal team (media, community, logistic managers and...)

On going communication- Telconference

Operation Centre

Media Department

Engage Other state Level Organizations and Coordinate with them for resources if required

SEOC
(State Emergency Operation Centre)
Control the emergency operation
Plan for the ongoing emergency operation
Plan ,acquire and allocate resources
Provide public information about the emergency operation

Emergency Organizations Levels

Hierarchy coordination

State Level

SEMC
(State Emergency Management Committee)

| NSW Fire Brigades |
| Ambulance Service of NSW |
| Fire and Rescue NSW |
| NSW Rural Fire Service |
| NSW Police Force |

IC: Reports the situation and requests the for resources from OC
Engage Other district Level Organizations
Coordinate with them for resources if required

Inform 17 Regional areas

Liaising officer
Coordinate with other level

Regional Level
17 Headquarters
SES staffs & Volunteers

Region Headquarters   Specific Region

Engage Other district Level Organizations
Coordinate with them for resources if required

Established REMO
(Region Emergency Management Control)

District Level

DEMC
(District Emergency Management Committee)

Incident Controller
- Distribute information among relevant units
- Coordinate with other emergency organizations
- Mobilize resources (includes region and local volunteers and other organization resources)
- Report to State Level
- Send request for more resources from state level (if not available at region level)

Media

Inform relevant units

IC: Provide resources for unit level
IC: Distribute information among relevant units
UC: Send request to region level for resource
UC: Report the situation to region level

REMO informs other level for more resources

Call in volunteers

Unit Level
229 Headquarters
Only Volunteers

Unit headquarters

Engage Other local Level Organizations and Coordinate with them for resources if required

Local Level

LEMC
(Local Emergency Management Committee)

Unit Controller
- Coordinate with other Local Organizations
- Such as Rural ,RFS, local council
- Mobilize resources(volunteers and other ...)
- Report to Region Level and ask for more resources from region level if applicable

Media

Established LEMO
(Local Emergency Management Control)

LEMO informs other level for more resources

Call in volunteers

Mobilize resources from other agencies

SES Volunteers

Resources from other agencies

Public

Public

Send warning through Social Media(local radio, TV, Mobile) ,word of mouth, knocking on the door

Figure 18. SES process

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The third and final component of Miles and Huberman's approach, drawing conclusions, happens continuously throughout the process. In this study, data were repeatedly revisited to verify, test, or confirm the themes and patterns that were identified. During this process, I remained open to new opportunities and insights throughout the analysis.

In the next section, I will present and discuss the qualitative analysis results. After providing the data analysis and results for the qualitative methods section, I will introduce the quantitative methods section.

3.3.6 Case Study Results and Discussion

Yin (2003)'s case study approach is depicted in the process chart in Figure 19. While the preceding sections of this work have outlined the research questions, introduced the cases studied and methods used—including the data collection processes—and provided an introduction to the results of the interviews in regards to the social resilience indicators, this section presents and discusses these results in greater depth to approach a new model.
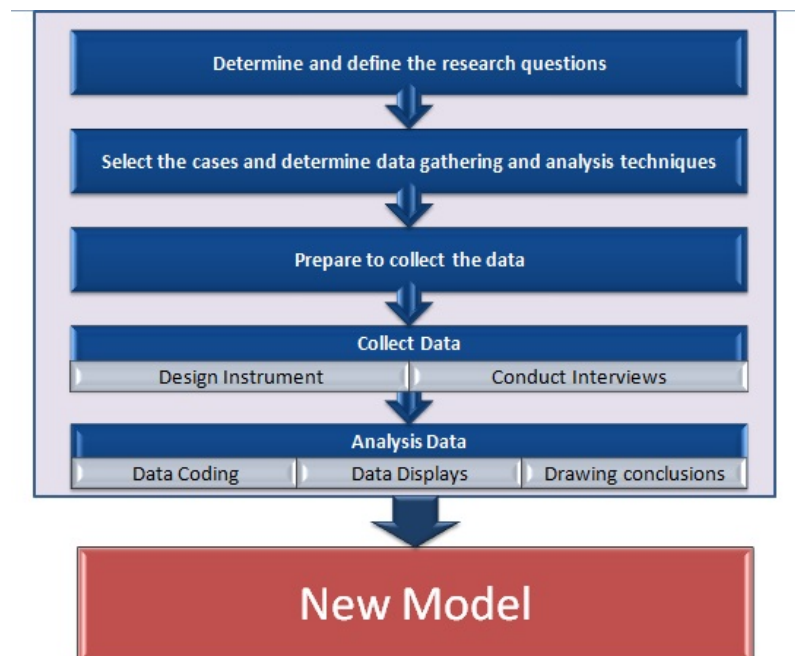
Figure 19. Summary of methodology use (Yin, 2003; Polhill, Sutherland, & Gotts, 2010)

As presented in Section 3.3.5, I identified 14 social resilience indicators through a combination of a review of the literature and interviews with SMEs. The 14 indicators were assessed for each of the three case studies and then aggregated in Table 15. The next step was to generalise these findings to relate outcomes and suggest a general framework of social resilience. As recommended by (Khalili et al., 2015), the subsequent findings were used to support the hypothesised contrast and develop the theoretical replications prescribed by Yin (2003) through methodological triangulation (Morgan & Smircich, 1980). Specifically, analysis of the data produced the following three findings: there are 14 social resilience indicators; these 14 indicators do not carry the same weight; and these 14 indicators have different levels of influence in each of the three phases of disaster.

First, there are 14 social indicators associated with disaster resilience, as determined by a review of the extant literature and consultation with SMEs. These are presented in alphabetical order below:

- Community efficacy
- Community participation
- Coordination
- Coping style
- Demographic information
- Education
- Exchange of information
- Improvisation
- Leadership
- Learning
- Shared information
- Social support
- Sense of community
- Trust

Second, interview data indicated that these 14 indicators do not all carry the same strength in the composition of resilience to disasters. The analysis presented in the previous section demonstrated that some social resilience indicators have a greater

impact than others do. Impact was determined based on emphasis (i.e., the number of times SMEs discussed the indicator in the narrative portion of the interview) and level of agreement with the importance of the indicator based on Likert-scale questions. For this reason, the indicators were (based on emphasis in the interview narrative and agreement in the Likert-style section) trifurcated as high impact, medium impact, or low impact, as follows:

- High Impact ($n = 8$): Community participation, education, exchange of information, learning, shared information, social support, sense of community, trust
- Medium Impact ($n = 3$): Demographic information, coordination, and community efficacy
- Low Impact ($n = 3$): Coping cycle, leadership, and improvisation.

Figure 21 depicts the impact relevance for each of the 14 indicators, with high impact indicators encompassing a larger portion of the doughnut chart than the medium or low impact indicators, and the medium indicators taking a larger portion than the low impact indicators.

Figure 20. Community resilience—social indicators

In drawing many of these social resilience indicators from the literature and then grounding my findings in interviews, I was then in a unique position to provide criterion validity to my findings by comparing the interview data back to the level of importance proposed by the literature for the social resilience indicators. For instance, in the literature review, I found that Miller et al. (1999), Harland et al. (2005) and Forgette (2009) postulate that coping style, leadership and improvisation each have a strong influence on resilience. My interview data, however, indicated that thee indicators were actually less effective as social resilience indicators within the three cases I studied. Similarly, I found that community efficacy is a medium impact indicator, which contradicts the findings of Moore et al. (2004).

Finally, while the first two findings were introduced in the previous sections, the third finding will be demonstrated within this section: these 14 indicators have differing levels of impact in each of the three phases of disaster. In other words, the three phases of disaster each present unique social challenges and so have unique resilience needs. The findings indicated that there were different social needs across the three phases of disaster, yet some needs were consistent across all three phases (i.e., community

participation, coping style). This assertion adds a temporal component to the study by which the social resilience indicators, which have previously been discussed and applied to disaster, in general, and regardless of stage, are now considered within the context of pre-disaster social needs, response social needs and recovery social needs. The needs of each of these phases and associated social resilience indicators were determined in the literature review and interview phases to be as follows:

- Pre-disaster phase ($n = 12$): Community participation, coping style, demographic information, education, exchange information, leadership, learning, shared information, social support, sense of community, trust and improvisation

- Response phase ($n = 9$): Community participation, coping style, coordination, exchange information, leadership, shared information, social support, sense of community and trust

- Recovery phase ($n = 11$): Community participation, coping style, community efficacy, exchange information, leadership, learning, shared information, social support, sense of community, trust and improvisation.

Following Yin's approach, I used a formative construct. To this effect, Figure 21 depicts the formative model developed through an analysis of the qualitative data. As presented in Section 3.2.1, this research was formative in that it constructed a latent construct through a combination of indicators, herein social resilience indicators, and the causality moved from the items (e.g., indicators) to the construct (e.g., social resilience indicators). As such, variation in the construct did not yield variation in the item measures; rather, variation in item measures caused variation in the construct. Finally, in alignment with the formative approach, the indicators defined the framework, which was based on the construct (presented in Figure 22). The formative construct of social resilience presented in Figure 21 presents the relationships between the indicators determined through the interpretation of the three aforementioned findings. The construct, and ultimately the framework, brought the three findings into a single formative construct to depict the 14 indicators, as well as their associated level of importance and the disaster phase to which they apply. This construct aligns with the contextual description and theoretical motivation of the study through providing insight into the assessment and measurement of social resilience in communities affected by disaster(s).
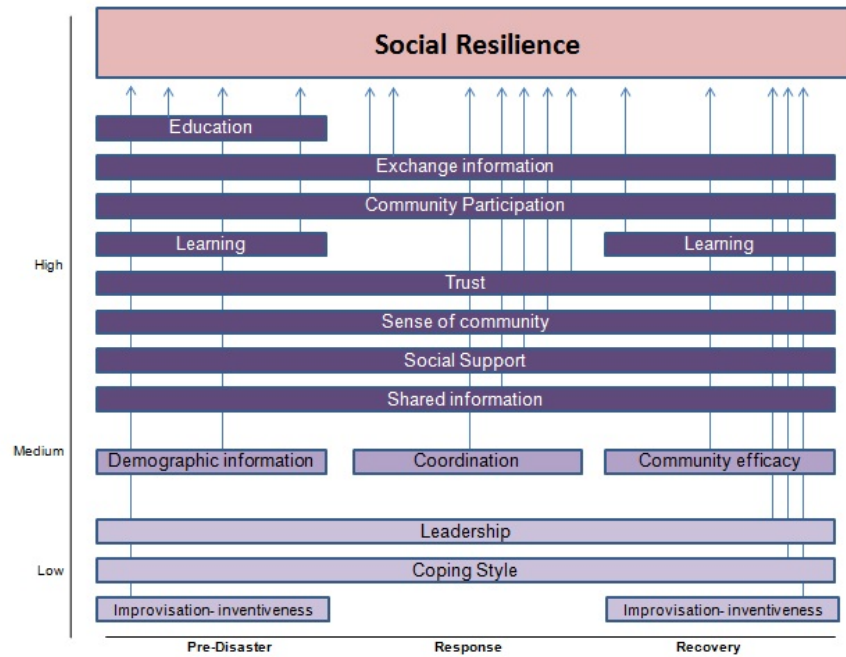
Figure 21. Formative construct for social resilience indicators

Finally, the formative construct of social resilience indicators presented in Figure 21 was developed into a proposed framework of social resilience indicators, which is presented in Figure 22. The framework provides a level of impact by phase of disaster matrix of social resilience indicators (Khalili et al., 2015). Thus, the qualitative research phase of this study has identified magnitude and temporal dimensions of the indicators. Note that 1) some indicators occur only once in the proposed framework (i.e., demographics only occurs as the medium-pre-disaster cell); 2) some indicators occur more than once, but not in all three disasters (i.e., improvisation/inventiveness occurs in the low cells for both pre-disaster and recovery, but not response); and 3) some indicators occur at the same level of impact across all three disaster phases (i.e., community participation is presented as an indicator of high-level impact across all three disaster phases).

	Social Resilience Indicators		
High	Community Participation Education Exchange Information Learning Shared Information Social Support Sense of Community Trust	Community Participation Exchange Information Shared Information Social Support Sense of Community Trust	Community Participation Exchange Information Learning Shared Information Social Support Sense of Community Trust
Medium	Demographic Information	Coordination	Shared Information
Low	Improvisation / Inventiveness Coping Style Leadership	Coping Style Leadership	Improvisation / Inventiveness Coping Style Leadership
	Pre-Disaster	Response	Recovery

Figure 22. Proposed framework—social resilience indicators matrix

This research began with the understanding that only a few studies have addressed social resilience and no studies, to my knowledge, have gathered the most essential social resilience indicators and developed a unified framework across the temporal aspects of a disaster. Thus, the stated objective was to provide a novel and general framework for social resilience with the aim of enhancing resilience within communities throughout the three disaster phases. The proposed framework represents the indicators that were found in the qualitative phase of this study to correspond with the ability of a community to cope with a disaster, thus reducing risk and minimising social impact, allowing the community to return to the pre-disaster quality of life and thrive socially. As presented in this framework, there are numerous considerations in social resilience, including which indicators to consider, what the level of impact among these indicators is, and what the relevance is of each indicator in each of the phases of disaster. This proposed framework, developed from SES SMEs' perceptions of social resilience and a review of the literature will be further assessed in the quantitative phase of the study, Section 3.3.

Chapter 4: Inferential Assessment of Social Resilience (Quantitative Research)

Quantitative research relies on empirical investigation methods (Given, 2008b) using numerical, quantifiable data to conduct research (Grove & Burns, 2005). Quantitative research is used to address research questions and formulate facts by generating numerical data that can be transformed into useable statistics. It is used to quantify dependent and independent variables then generalise results from a sample to an entire population.

Aliaga and Gunderson (1999) define quantitative research as a type of research useful for 'explaining phenomena by collecting numerical data that are analysed using mathematically based methods'. The purpose of quantitative research is to develop and employ mathematical models and hypotheses pertaining to phenomena. Quantitative research focuses on numeric and unchanging detailed data.

Quantitative research design provides guidelines for finalising results and proving or disproving a hypothesis by mathematical and statistical techniques. In this study, quantitative research was useful for testing the results gained by a series of qualitative research methods designed to lead to a final answer and result.

Quantitative research is often classified into descriptive approaches, in which subjects are measured once, and experimental approaches, in which subjects are measured before and after a specified treatment. The former approach is designed to establish associations between variables, while the latter approach is designed to establish causality (Babbie, 2015). The descriptive approach is designed to determine the status of an identified variable through observation, or the exploration of correlation between two or more phenomena. Since the descriptive approach is designed to provide systematic information about a phenomenon, it was used for this study to provide quantitative analysis of the phenomenon of social resilience to disasters.

As it is objective in analysis and data collection, quantitative research is often useful for generalising the results and testing of hypotheses. In this study, the purpose of conducting quantitative research was to determine the relationship between identified indicators (independent variables) from qualitative research and social resilience

(dependent variables) in the sample of NSW SES volunteers, test the hypotheses and then generalise the result to other communities facing disaster. While the qualitative phase used interviews and a literature review to identify 14 social resilience indicators and build a proposed framework of the role and level of impact across each phase of a disaster, the quantitative phase of this study was used to verify the framework and establish its ability to be generalised to other communities.

The quantitative design uses deductive reasoning, which tends to move from the general to the specific. To this effect, I formed hypotheses, collected data to investigate the aforementioned research questions, and then used this data from the investigation—after analysis was conducted and conclusions were drawn—to reject or fail to reject the stated hypotheses.

As with any research method or design, the quantitative research has both strengths and weaknesses. While quantitative methods are generally considered to have greater generalisability, the results may be too general for direct application to specific local situations and contexts, and individuals and researchers are not always able to describe an issue in depth. Thus, while qualitative research is designed to provide depth and context to a phenomenon, quantitative research seeks to provide breadth. The other disadvantage is that a researcher might miss out the important qualities of the studied sample because of concentrating on hypotheses testing rather than hypotheses generation. Many researchers argue that all research is somewhat qualitative in that even quantitative data needs qualitative interpretation to have meaning. Numbers alone do not have significance until interpreted by the researcher.

These methods allow the data to be summarised to support generalisations about the impact of social resilience indicators on communities. The method involves few variables and employs prescribed procedures to ensure validity and reliability of data. After conducting the literature review and developing the initial framework from the qualitative phase of this research, I used the following quantitative design:

- Formulate hypotheses and define variables
- Quantitative research method
    - define sample population
    - determine data-gathering and analysis techniques

- Develop data collection instrument
- Data collection
- Data Analysis and evaluation
  - propose a framework
  - interpret meaning for disaster communities
  - assess relationship to hypotheses.

4.1 Hypotheses and Variables

To assess the proposed framework quantitatively, I formulated hypotheses (defined as propositions set forth to explain a group of facts or phenomena, which is a fundamental component in this research) regarding the role of social resilience indicators in disaster social resilience. Hypotheses consist of statements about a presumed impact of an independent variable (social resilience indicators) on a dependent variable (social resilience). My hypotheses outlined the central arguments that needed testing and whether I would reject or fail to reject these postulations. Finally, both null hypotheses and alternative hypotheses were utilised in this research, in which 1) null hypotheses, denoted by H_0, stated that there is not a relationship between identified social resilience indicators from the qualitative research and social resilience, and 2) the alternative hypotheses, denoted by H_a, stated that there is a relationship between social resilience indicators (at least one) from qualitative research and social resilience.

4.1.1 Dependent Variable

The dependent variable is the consequent variable and, thus, it responds to the independent variable. It is called dependent because it depends on the independent variable and it is measured for variation as a presumed result of the variation in the independent variables. In this research, the dependent variable is social resilience.

4.1.2 Independent Variables

The independent variable is the antecedent that in some way is hypothesised to control, manipulate or have some effect on a dependent variable (Kerlinger, 1986). I vary or manipulate them to get results. There were 14 independent variables in this study. All independent variables were social resilience indictors that were identified through qualitative research: community efficacy, community participation, coordination,

coping style, demographic information, education, exchange information, improvisation, leadership, learning, shared information, social support, sense of community and trust.

The hypotheses propose some association between two variables, one independent and one dependent variable (in order, the social resilience indicator and social resilience). Both variables were measurable phenomena and the value of a dependent variable depended on the value of the independent variable. In line with the hypotheses, I assumed that there was an actual relationship between the dependent and independent variables. If there no relationship existed, then the value of the dependent variable would not depend on the value of the independent variable, in which case I would reject the hypothesis.

An initial social resilience framework was developed through qualitative research (see Figure 23), which provided an outline of the following hypotheses underpinning this quantitative research. Thus, the following hypotheses were developed to assess the proposed framework:

Hypothesis1: The following indicators are associated with social resilience:

Hypothesis 1a: Community efficacy is associated with social resilience.

Hypothesis 1b: Community participation is associated with social resilience.

Hypothesis 1c: Coordination is associated with social resilience.

Hypothesis 1d: Coping style is associated with social resilience.

Hypothesis 1e: Demographic information is associated with social resilience.

Hypothesis 1f: Education is associated with social resilience.

Hypothesis 1g: Exchange information is associated with social resilience.

Hypothesis 1h: Improvisation is associated with social resilience.

Hypothesis 1i: Leadership is associated with social resilience.

Hypothesis 1j: Learning is associated with social resilience.

Hypothesis 1k: Shared information is associated with social resilience.

Hypothesis 1l: Social support is associated with social resilience.

Hypothesis 1m: Sense of community is associated with social resilience.

Hypothesis 1n: Trust is associated with social resilience.

<u>Hypothesis2:</u> Each indicator in the proposed framework has a different level of impact on social resilience.

<u>Hypothesis3:</u> Every phase of disaster has its own individual indicators that affect social resilience.

Since it was not possible to test the above hypotheses directly, we turned the hypotheses into null hypotheses. The null hypotheses were created from the hypotheses by adding the word 'no' to the statements as follow:

<u>Hypothesis1 (H_0):</u> There is no relationship between any of the following indicators and social resilience: community efficacy, community participation, coordination, coping style, demographic information, education, exchange information, improvisation, leadership, learning, shared information, social support, sense of community and trust.

<u>Hypothesis2 (H_0):</u> Each indicator in the proposed framework does not have a different level of impact on social resilience.

<u>Hypothesis3 (H_0):</u> Every phase of disaster does not have its own individual indicators that affect social resilience.

All statistical testing was conducted on the null hypotheses and never on the hypotheses. The results of a statistical test enabled me to reject the null hypothesis or fail to reject the null hypothesis. To test all the above hypotheses, the data were required to be collected using a broader sweep of the communities' perspectives, then analysed and interpreted as follows. These procedures are described in Section 4.1.2.

4.2 Quantitative Research Methods

The next step after formulation of the hypotheses was to determine how the hypotheses would be statistically tested. In this section, I developed a method to address my

objectives. The methods section of this quantitative study provides a determined, systematic and controlled plan to describe how each objective of this research was achieved. This section provides a road map for all aspects of the study, including data collection and analysis. The steps in this plan were to define the sample population and requirements, collect the data and, finally, analyse the data. This section presents the methods used to govern each of these steps.

4.2.1 Define Sample Population

The population was the group to be studied. It is difficult, often impossible, to sample an entire population (Morris & Nguyen, 2008). The sample comprised specific people in the population who responded to the survey. Samples are intended to represent the target population of the study and must be representative of this population to generalise the findings to the population (Fink, 2002).

In this study, the scope of the population encompassed NSW communities and the sample was NSW SES volunteers because they are actively involved in their local communities and have a good understanding of disaster management within this context. Thus, while the qualitative phase of this research developed the proposed framework from three case studies, the sample defined in the quantitative phase of the study sought to improve the framework by testing it against the larger population in which I aimed to generalise the findings.

4.2.2 Data Collection

In regards to data collection, the research design defines the tools used to collect data, including the type of instrument most suitable for the research. As stated, there are not studies to data that have used mixed methods approaches to holistically present a framework of social resilience to disasters and, as so, there are no existing instruments designed specifically for this purpose. Different methods are available in survey research, and most of them are geared towards numerical collection, such as online questionnaire, personal interviews, mailed questionnaires, telephone interviews, and group or focus interviews. There are, however, highly structured techniques available for quantitative surveying and collecting data, such as online questionnaires, and in-person or telephone interviews.

Surveys are a system for collecting the data needed to understand a phenomenon better (Fink, 2002). They are ideal for capturing knowledge, attitudes and opinions needed to describe, explain or compare perceptions of the phenomenon. In this research, I employed a quantitative survey of NSW SES volunteers as my main target population. These individuals provided responses to pre-formulated questions, herein referred to as the survey instrument. The online survey method was selected in this study because it is characterised by being faster, cheaper, more accurate and more manageable by individuals for data collection (Wiersma, 2013). Unlike in the qualitative research phase, which allowed unlimited expression from respondents, the survey instrument was designed with closed-ended responses to be best quantifiable. Survey Monkey, an online survey administration application, was used to administer the survey to the volunteers. It was concluded within the literature that Web studies could be just as useful, if not more useful than traditional dissemination and data collection methods: 'With the continual increase in connectivity and simultaneous decrease in connection cost due to advent in technology and economy of scale, the number of users for the World Wide Web is growing at a rapid pace' (Siah, 2005, p. 116).

In the data collection process, I followed best practices for instrument design and implementation. Aligning with Fink's (2002) seven steps of instrument design, I 1) set the objectives for information collection, 2) designed the survey to meet the objectives, 3) prepared a valid and reliable instrument, 4) administered the survey to my target population, 5) managed and analysed the survey data, 6) reported the results and 7) completed steps 1 through 6 in an ethical manner (Fink, 2002). As stated by Fink (2002), 'when planning a survey and its instrument, you need to define all potentially imprecise or ambiguous terms in the survey objectives' (Fink, 2002, p. 8). Using the sequential research design, this phase of research was preceded by the qualitative phase and, as such, the objectives had been pre-determined. The previous stage also determined the hypotheses to be tested within this stage and, to this effect, determined the survey questions that needed including to test the hypotheses and assess the proposed social resilience framework. Based on these objectives, I drafted questions that solicited information needed to assess the research questions and associated hypotheses.

4.2.3 Data Analysis

The research design describes the procedures for processing and analysing the data. It includes specific tools and the type of computer software used to manipulate the data, as well as statistical techniques of analysis. In this study, I used Microsoft Excel and Statistical Package for Social Sciences (SPSS) tools for analysis of the data. These tools for were used to calculate Cronbach's alpha for checking data response reliability and Pearson's r for identifying relationships between the variables. These steps will be discussed in greater detail in the next section.

4.3 Developing the Data Collection Instrument

Survey instruments are developed for translating the research objectives into specific questions and standardised questions to collect correct information and foster respondents' cooperation and motivation to answer the questions. The online survey provided a script for presenting a standard set of questions and response options. It included questions that addressed the study objectives and it collected demographic information for calculating survey weights. A challenging part of developing the survey was translating questions into items that were sufficiently succinct and simple for the respondents to understand and then provide accurate answers.

We then decided on question content and question wording. Questions were designed to be straightforward, gather accurate and consistent data in an unambiguous manner, be grammatically and syntactically correct, collect one thought at a time and provide a mutually exclusive answer bank (Fink, 2002). Moreover, the survey was designed to be self-administered through the online interface of Survey Monkey and it used a descriptive design in which I solicited information on an existing phenomenon. To develop the survey, I first identified dependent and independent variables, as well as associated hypotheses. For each independent variable (social resilience indicators) in each disaster phase, I translated the variables' content into a question to obtain respondents' views. Additionally, I added three questions to measure the dependent variable, social resilience, in each disaster phase in the survey. To measure variables, a Likert-type scale with fixed choice response formats was used; it was designed to measure respondents' opinions (Bowling, 2014). These ordinal scales measured levels of agreement on a continuum from 'strongly disagree' (+1) to 'strongly agree' (+5) and

assumed that attitudes can be measured. Table 16 provides the questions for each indicator in every phase of a disaster.

Community participation:

Pre-disaster: People in my area have participated in local activities, events (e.g., festivals, fetes, fairs) or public meetings.

During the disaster: People in my area tried to help each other and make a positive difference in the community.

After the disaster: People in my area have been involved in volunteer activities intended to benefit the community (e.g., fundraising, clean-up days, etc.) or have contributed money, food, or clothing to local causes, charities, or others.

Education:

Pre-disaster: People in my area have participated in disaster management activities (voluntary activities, community meetings, seminars, public activities) or have been trained by emergency organisations in order to learn how to face disasters.

Pre-disaster: My community tried to identify weak points within the community, such as high risk areas and vulnerabilities, as well as disaster occurrences and probabilities.

Pre-disaster: My community tried to identify disaster scenarios, then develop the strategies for facing them.

Exchange information:

Pre-disaster: People in my area meet each other in different places, such as social clubs (RSL), service groups, sports teams, churches, the library, or ethnic/ multicultural clubs.

During the disaster: People in my area communicated and exchanged information with each other during the disaster.

After the disaster: People in my area discussed problems and issues caused by the disaster with their neighbours after the disaster.

Learning:

Pre-disaster: People in my area have learned from previous experience and repeated disaster occurrences to have adequate and appropriate coping strategies to face future hazards.

After the disaster: People in my area have learned to absorb the disaster impacts and learned to adapt to changes after disaster.

Shared information:

Pre-disaster: People in my area had access to social media and the internet before the disaster.

During the disaster: During the disaster, people in my area shared information about the

disaster with their neighbours through different channels (social media, face-to-face, etc.)

After the disaster: People in my area have been actively involved in community groups and sporting, scouts/brownies, religious groups, etc.

Social support:

Pre-disaster: In general, people in my area were happy to support each other.

During the disaster: During the disaster, people in my area supported each other.

After the Disaster: People in my area lent things and helped each other after the disaster.

Trust:

Pre-disaster: People in my area trusted each other prior to the disaster.

During the disaster: People in my area trusted the information distributed by neighbours and trusted the advice from their neighbours during the disaster.

After the disaster: People in my area trust each other to respond to meet the needs of its residents.

Coordination:

During the disaster: People in my area worked together to respond to the disaster.

Sense of community:

Pre-disaster: People in my area generally got along with each other and cared about each other.

During the disaster: People in my area shared the same values during the disaster.

After the disaster: People in my area expect to live in this neighbourhood for a long time (even after the disaster).

Demographic information:

Pre-disaster: A mixture of cultures, ages, genders, wealth, health and education level within the people in my area made it difficult to cope with the disaster.

Community efficacy:

After the disaster: People in my area had enough power and ability to adapt to change after the disaster by themselves without help from other emergency organisations.

After the disaster: People in my area believed in their collective capabilities of performing and completing jobs.

After the disaster: People in my area became stronger through connecting with each other.

Improvisation / inventiveness:

Pre-disaster: Before the disaster, people in my area had been thinking about what is

going to happen and came up with new ideas about what to do if disaster occurred.

After the Disaster: People in my area had the ability to devise a solution for disaster issues and problems in ways that are consistent with community needs, attitudes perceptions and beliefs.

Coping style:

Pre-disaster: People in my area made a plan of action for how to deal with the disaster.

During the disaster: People in my area thought about how we might best handle the problem and the next steps to take.

After the disaster: People in my area had the ability to adapt to change after the disaster and cope with the disaster losses.

Leadership:

Pre-disaster: In my area, community leaders developed effective communication and provided direction on disaster preparedness strategies.

During the disaster: In my area, community leaders coordinated with neighbours and emergency organisations to meet the community's needs during the disaster.

After the disaster: In my area, community leaders led people on how to cope with the disaster.

Outcome expectancy:

Pre-disaster: People in my area had undertaken specific activities that involved working together to limit disaster damage or loss to protect the community.

During the disaster: During the disaster, people worked well together and felt under control, so managed the stress well.

After the disaster: People in my area had the ability to adapt to change after the disaster and cope with the disaster losses.

After the disaster: People in my area were able to do all social activities in a sensible time during and after the disaster to get back to the previous situation.

Table 16. Questions for each indicator in every phase of disaster

The survey instrument included many different question formats, including closed, open-ended, scaled and multiple-choice questions. Closed questions were used to solicit data from volunteers about their living area and the number of years they had been a volunteer for the SES. Open-ended questions were used to collect data from participants' general comments; these questions left the answers entirely up to the respondents in order to provide a greater range of responses. The inclusion of open-ended questions was limited. Although this format can be useful for developing depth, it is often time-consuming in the coding stage and less objective that other survey

question formats (Connelly, 2009). A multiple-choice question was used to ask respondents to indicate the area in which they were resident or their preferred location in which to answer the questions. The survey instrument also included scaled questions to assess participants' attitudes on each of the indicators and their relationship to social resilience.

Since the type of question, the language used and the order of questions may all bias response (Rattray & Jones, 2007), the questions were categorised and ordered by disaster phase to make them easier for the respondents to understand.

The final version of the survey consisted of four sections: (a) Section A—general questions, including demographic details and the area in which they faced the disaster; (b) Section B—including questions related to independent variables belonging to the pre-disaster phase; (c) Section B2—including questions related to independent variables belonging to the during-disaster phase; (d) Section B3—including questions related to independent variables belonging to after disaster phase (see Appendix D for the full Quantitative Online Survey).

After defining the social resilience construct from qualitative research data and developing the survey to solicit the data needed to measure the variables, the survey was pilot tested. Pre-testing and piloting testing aims to ensure that each question is measuring what it is intended to measure and produces a reliable and valid measurement. This process helped identify questions that did not make sense to participants or problems with the survey that might have led to biased answers. It allowed for refinements in the ordering of questions, and determined whether additional or specifying questions were needed or whether questions should be eliminated; additionally, it helped validate the survey as a whole.

Validity is the amount of systematic or built-in error in measurement (Norland, 1990) and is the ability of an instrument to measure what it is intended to measure (Bryman & Cramer, 1994). In other words, validity means that we are measuring what we want to measure (Kerlinger, 2011) and it refers to the extent to which an empirical measure adequately reflects the real meaning of the concept under consideration (Babbie, 2015). There are several different types of validity (Bryman & Cramer, 1994; Polgar & Thomas, 2013), such as content, construct, criterion and face validity. The choice

depends on the objectives of the study. In this study, content validity refers to expert opinion concerning whether the scale items represented the proposed framework or the concepts the survey was intended to measure (Rattray & Jones, 2007). To ensure that the survey instrument was measuring what it was intended to measure, was appropriate for my purpose, and that the data collected were accurate, the validity of the survey was checked with nine subject matter experts and went through seven editions to be finalised.

Similarly, I ensured that the instrument provided reliability to the study results. As noted by Jack and Clarke (1998, p. 2), 'Reliability refers to the repeatability, stability or internal consistency of a survey'. There are different classes of reliability: (a) inter-rater or inter-observer reliability, which is used to assess the degree to which different raters or observers give consistent estimates of the same phenomenon; (b) test-retest reliability, which is used to assess the consistency of a measure from one time to another; (c) parallel-forms reliability, which is used to assess the consistency of the results of two tests constructed in the same way from the same content domain; and (d) internal consistency reliability, which is used to assess the consistency of results across items within a test. Different measures of reliability are used for different procedures and are dependent on the nature of the data. Within this study, I determined internal consistency to be an appropriate measure for assessing reliability. Specifically, I used pilot test data, which was collected from SES members not included in the main sample. I analysed this data using SPSS software. To analyse internal consistency, I used Cronbach's alpha, which uses inter-item correlations to determine whether select measures are, in fact, assessing the same domain (Bowling, 2014; Bryman & Cramer, 2001). A Cronbach's alpha of greater than $0·7$ indicates consistency between the measures in an instrument that has been through limited testing, but a statistic greater than $0·8$ represents consistency in more established instruments (Bowling 2014; Bryman & Cramer 1994). Thus, a Cronbach's alpha of less than $0·7$ indicates a lack of internal consistency, which means that the measures are not assessing the same domain; more specifically, items with a score of less than 0.3 do not add to the explanatory power of the instrument or subscale that is being assessed (Ferketich, 1991; Kline, 2013). Although Cronbach's alpha can be used to revise survey instruments, it is important for researchers to make revisions regarding the research questions and the research purpose.

We computed Cronbach's alpha to test internal reliability for each of the disaster phases and relevant items. The statistical outputs are provided below, in which Cronbach's alpha is presented in the left cell and the *n* value is presented in the right cell. The pre-disaster subscale consisted of 13 social resilience indicators ($\alpha = .927$), the during-disaster subscale consisted of 10 social resilience indicators *($\alpha = .908$)*, and the post-disaster subscale consisted of 12 social resilience indicators ($\alpha = .928$). Based on these statistics, all three subscales were found to the highly reliable as all alphas were $> .90$. Thus, the pilot survey data confirmed the internal reliability of the survey instrument.

Pre-disaster items:

Reliability Statistics

Cronbach's Alpha	*n* of Items
.927	13

During-disaster items:

Reliability Statistics

Cronbach's Alpha	*n* of Items
.908	10

Post-disaster items:

Reliability Statistics

Cronbach's Alpha	*n* of Items
.928	12

In addition to testing the internal consistency of the survey instrument, I used the data for statistical analysis to assess their ability to be used to test the stated hypotheses. This pre-testing process is important for the development of an effective survey.

4.4 Data Collection

Surveys are data collection tools used to collect data from a sample of the population of interest to determine the population's perspective of the phenomena identified in the

research question. Following the established best practices for survey usage in research, specifically that relating to online surveying, this study surveyed the NSW SES volunteers as the target population (Khalili et al., 2016). The target respondents were provided a Web link to a Survey Monkey survey: https://www.surveymonkey.com/r/socialresilience (Appendix F provides the survey screen shots). This research employed online surveys as they are considered to be expedient, cost effective, and more accurate than paper surveys for data collection and management. Moreover, this approach allows greater privacy for respondents than would be allowed in the surveys were administered in-person (Khalili et al., 2016). Individuals in the target population received a mail out from the SES commissioner with a direct link on 21 October 2015. This survey invitation is provided in Appendix E. The link then remained open for three months and closed on 21 January 2016. A total of 126 volunteers responded during this period (Khalili et al., 2016). The survey was designed to collect the data anonymously and to include a combination of question formats, as indicated in the survey instrument. This instrument was thus developed to allow the researcher to assess the validity of the data (Khalili et al., 2016).

4.5 Data Analysis and Evaluation

After the survey was closed, the data were processed, cleaned and analysed in the context of the research hypotheses. The data were downloaded from Survey Monkey as a Microsoft Excel spreadsheet and imported into SPSS, quantitative analysis software, for data management and statistical analysis. After the data were downloaded from the Survey Monkey website to the Microsoft Excel spreadsheet, they were systematically cleaned for errors, removing incomplete responses (not finished), non-responses (blank), and 'don't know' responses. Of the 126 responses, 42 were found to be incomplete and 84 were found to be complete.

To analyse the data, each column of the data matrix was assigned a label according to the social resilience indicator that the data measured. The five-point Likert-style scaled ordinal data were treated as interval-level data and, as such, subjected to interval-level data analysis procedures. Next, the variable frequencies, means and weights were calculated to provide descriptive statistics for each of the columns. The data were subjected to statistical analysis using SPSS. Cronbach's alpha was calculated to test internal reliability and found to be greater than 90%. Next, Pearson's bivariate

correlation coefficients were calculated to assess the relation between variables. This included calculating the correlation for each of the three disaster phases to assess the relationship between each of the tested social resilience indicators and the social resilience expectancy, as shown in next tables.

The strength of correlation using r can be assessed by the following general guidelines (Cohen, 1988). According to Cohen, an r value equal to or between $-+.10$ and $-+.29$ (i.e., whether negative or positive, an r value equal to or between .10 and .29) indicates a small or weak correlation; an r value equal or between $-+.30$ and .49 indicates a medium or moderate correlation; and an r value equal to or greater than $-+.50$ indicates a large or strong correlation. To provide greater precision in correlation, I developed Table 17 to determine the strength of relationship based on Pearson's correlation coefficient r value. As illustrated in the table, I determined a five-item scale for strength of relationship. It is important to note that while Cohen (1988) distinguished that the r value could be positive or negative (Cohen, 1988), for instance a correlation of -1.0 is just as strong as a correlation of $+1.0$, this research provided a one-tailed hypotheses in which all relationships were positive and, as such, any negative relationships would be viewed as very weak. To this effect, only positive correlations are presented in the Table 17 scale.

r Value	Strength of Relationship
.00−.19	Very weak
.20−.39	Weak
.40−.59	Moderate
.60−.79	Strong
.80−1.0	Very strong

Table 17. Correlation relationship strength

This scale was used to assess correlations for each of the disaster phases. First, I correlated each of the phase's specific social resilience indicators with outcome expectancy. Next, I ranked the social resilience indicators for each disaster phase by the strength of correlation. Finally, I depicted the correlation that each of the social resilience indicators had with outcome expectancy using a two-dimensional line graph.

These steps were first taken for the pre-disaster phase, followed by the during-disaster phase, the post-disaster phase, and all disaster phases in aggregate.

Correlations between the social resilience indicators and outcome expectancy for the pre-disaster phase are provided in Tables 18 and 19. As presented in Table 18, all 12 of the pre-disaster social resilience indicators were positively correlated with the pre-disaster outcome expectancy. Moreover, all correlations were statistically significant at the 0.01 level. This data reveals that there is, in fact, a positive statistically significant relationship between each of the social resilience indicators and outcome expectancy in the pre-disaster phase.

4.5.1 Each Disaster Phase

4.5.1.1 Pre-Disaster Phase

Correlations

		Pre-Disaster Community Participation	Pre-Disaster Education	Pre-Disaster Exchange Information	Pre-Disaster Learning	Pre-Disaster Shared Information	Pre-Disaster Social Support	Pre-Disaster Trust	Pre-Disaster Sense of Community	Pre-Disaster Demographic Information	Pre-Disaster Improvisation /Inventiveness	Pre-Disaster Coping Style	Pre-Disaster Leadership	Pre-Disaster Outcome Expectancy
Pre-Disaster Outcome Expectancy	Pearson Correlation	.815**	.603**	.548**	.471**	.821**	.492**	.509**	.679**	.636**	.553**	.541**	.693**	1
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	
	n	73	75	75	77	77	71	77	71	58	70	76	79	80

**Correlation is significant at the 0.01 level (2-tailed).

*Correlation is significant at the 0.05 level (2-tailed).

Table 18. The correlation between pre-disaster indicators and outcome expectancy of social resilience before disaster

Table 19 provides the correlation coefficients for the pre-disaster social resilience indicators with the outcome expectancy of social resilience before disaster, categorised by strength of outcome from very strong to moderate, with pre-disaster shared information showing the highest correlation to pre-disaster social resilience. The *p* value and ρ (rho) were calculated for each of these indicators, as presented in Table 18 and ranked here in Table 19 from the strongest correlation to the weakest correlation. Using the scale presented in Table 17, two of the social resilience indicators showed a very strong correlation with outcome expectancy, four had a strong relationship with outcome expectancy, and six had a moderate relationship with outcome expectancy. Thus, while each of the indicators had a positive statistically significant correlation with outcome expectancy in the pre-disaster phase, there were different levels of strength among the relationships.

Strength	Pre-Disaster Indicators	Correlation
Very Strong	Pre-disaster shared information	.821[**]
	Pre-disaster community participation	.815[**]
Strong	Pre-disaster leadership	.693[**]
	Pre-disaster sense of community	.679[**]
	Pre-disaster demographic information	.636[**]
	Pre-disaster education	.603[**]
Moderate	Pre-disaster improvisation/inventiveness	.553[**]
	Pre-disaster exchange information	.548[**]
	Pre-disaster coping style	.541[**]
	Pre-disaster trust	.509[**]
	Pre-disaster social support	.492[*]
	Pre-disaster learning	.471[**]

Table 19. The correlation coefficients between pre-disaster indicators and the outcome expectancy of social resilience before disaster

We have provided the correlation coefficients for each of the pre-disaster social resilience indicators in Tables 18 and 19, but I now present these individually, depicting the relationship between the mean indicator score and pre-disaster expectancy, herein referred to as social resilience, using a two-dimensional line graph.

Pre-Disaster Community Participation: Based on the results (rho = 0.815, $p \leq 0.000$ at 2-tailed, n = 73), a very strong positive correlation existed between community participation and social resilience before disaster.
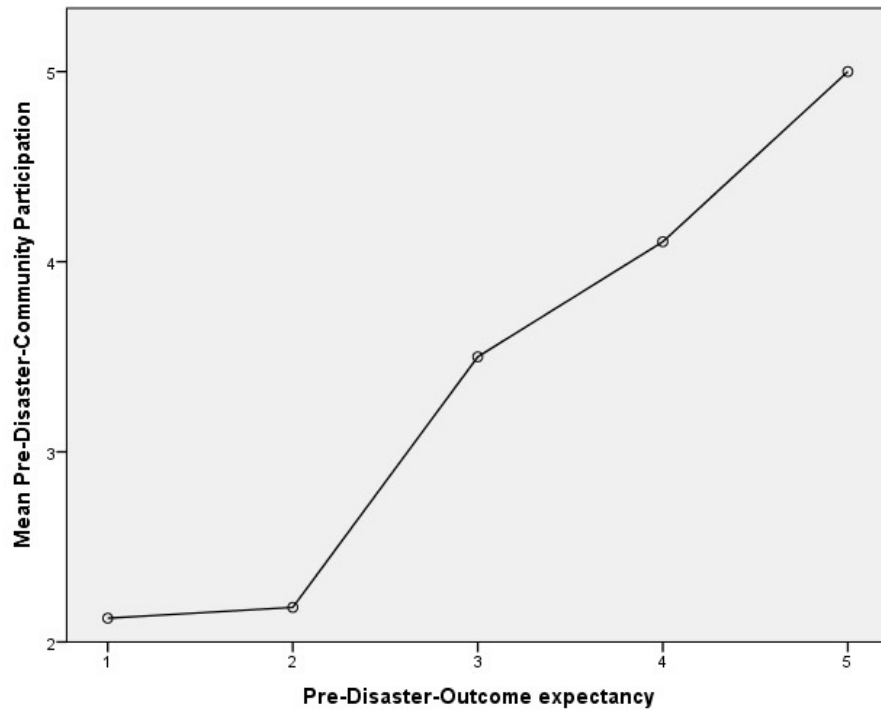
Pre-Disaster Education: Based on the results (rho = 0.603, $p \leq 0.000$ at 2-tailed, n = 75), a strong positive correlation existed between education and social resilience before disaster.
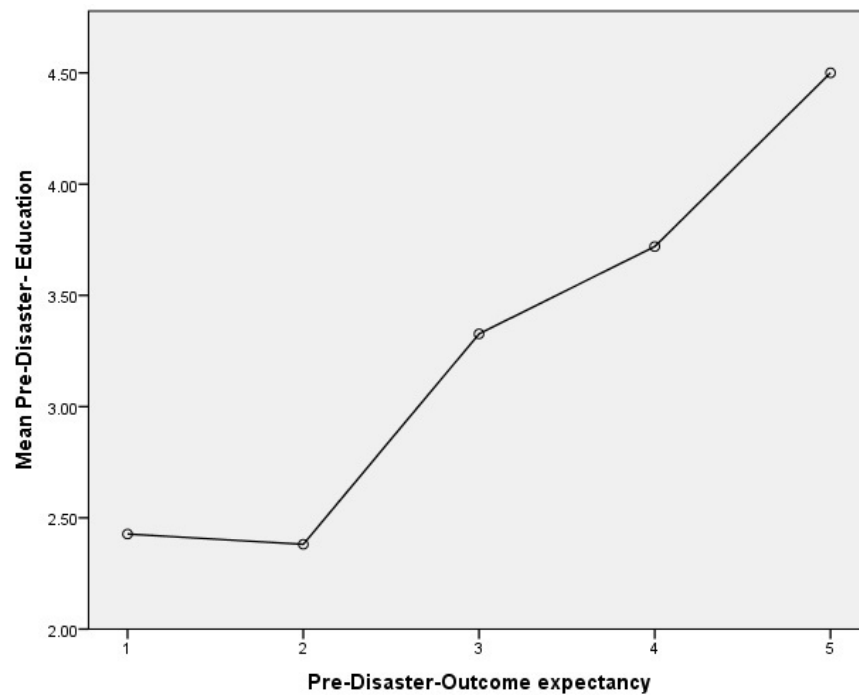
Pre-Disaster Exchange Information: Based on the results (rho = 0.548, $p \leq 0.000$ at 2-tailed, $n = 75$), a moderate positive correlation existed between exchange of information and social resilience before disaster.

Pre-Disaster Learning: Based on the results (rho = 0.471, $p \leq 0.000$ at 2-tailed, $n = 77$), a moderate positive correlation existed between learning and social resilience before disaster.
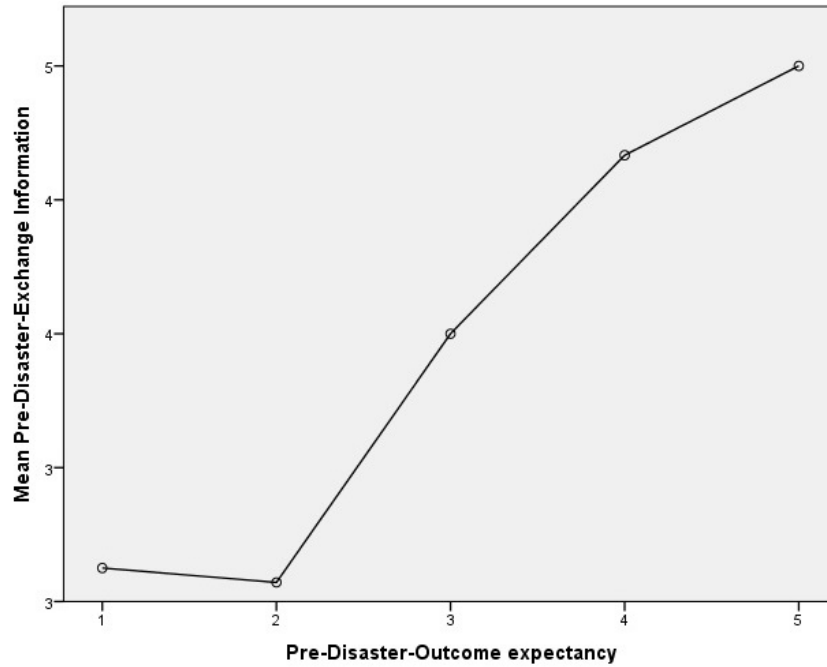
Pre-Disaster Shared Information: Based on the results (rho = 0.821, $p \leq 0.000$ at 2-tailed, $n = 77$), a very strong positive correlation exists between shared information and social resilience before disaster.

Pre-Disaster Social Support: Based on the results (rho = 0.492, $p \leq 0.000$ at 2-tailed, $n = 71$), a moderate positive correlation existed between social support and social resilience before disaster.
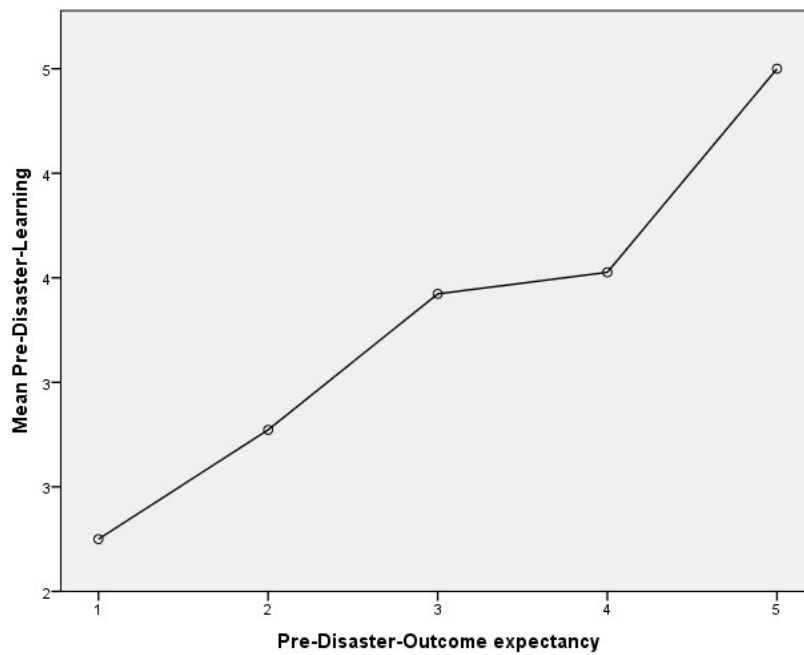

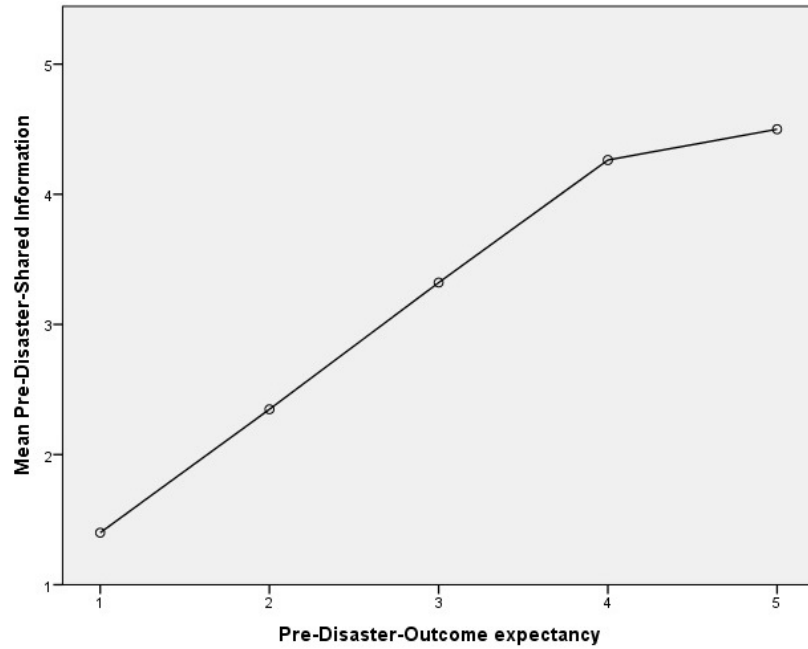*Pre-Disaster Trust:* Based on the results (rho = 0.509, $p \leq 0.000$ at 2-tailed, $n = 77$), a moderate positive correlation existed between trust and social resilience before disaster.

Pre-Disaster Sense of Community: Based on the results (rho = 0.679, *p* ≤ 0.000 at 2-tailed, *n* = 71), a strong positive correlation existed between sense of community and social resilience before disaster.

Pre-Disaster Demographic Information: Based on the results (rho = 0.636, *p* ≤ 0.000 at 2-tailed, *n* = 58), a strong positive correlation existed between demographic information and social resilience before disaster.
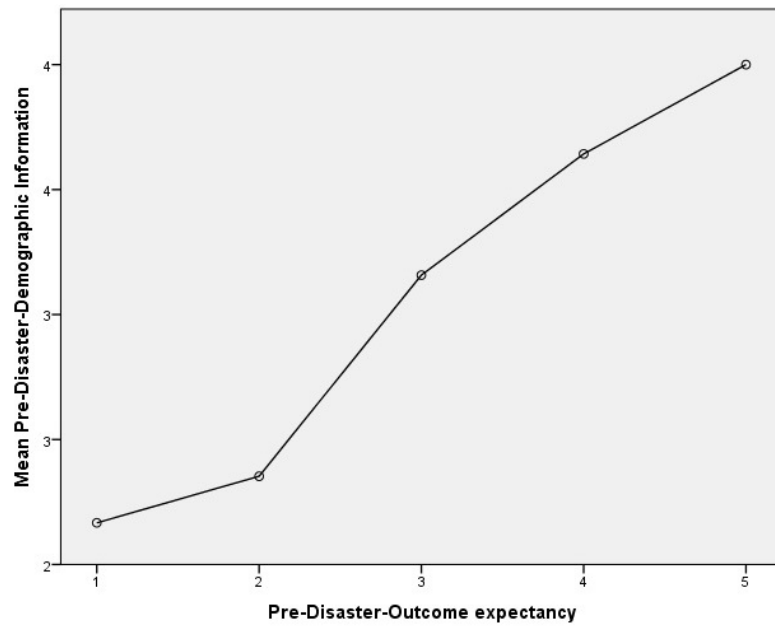
Pre-Disaster Improvisation/Inventiveness: Based on the results (rho = 0.553, *p* ≤ 0.000 at 2-tailed, *n* = 70), a moderate positive correlation existed between improvisation and social resilience before disaster.
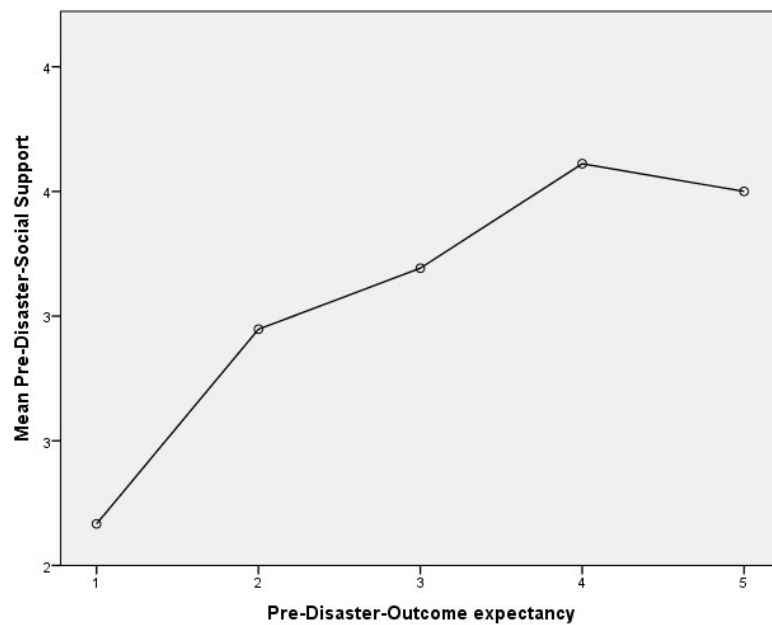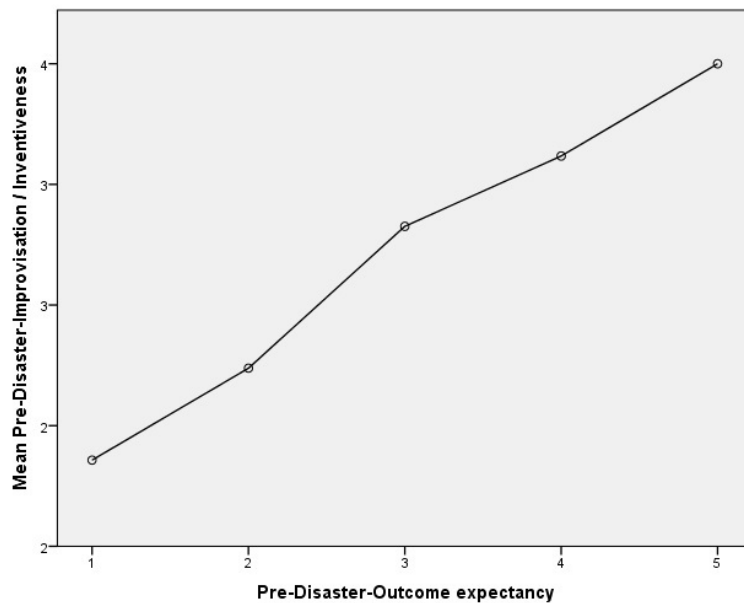

Pre-Disaster Coping Style: Based on the results (rho = 0.541, *p* ≤ 0.000 at 2-tailed, *n* = 76), a moderate positive correlation existed between coping style and social resilience before disaster.
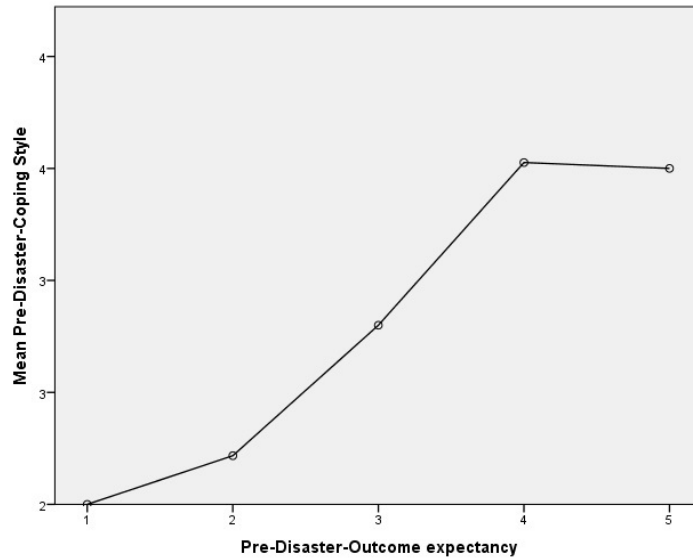
Pre-Disaster Leadership: Based on the results (rho $=$ 0.693, $p \leq$ 0.000 at 2-tailed, $n = 79$), a strong positive correlation existed between leadership and social resilience before disaster.
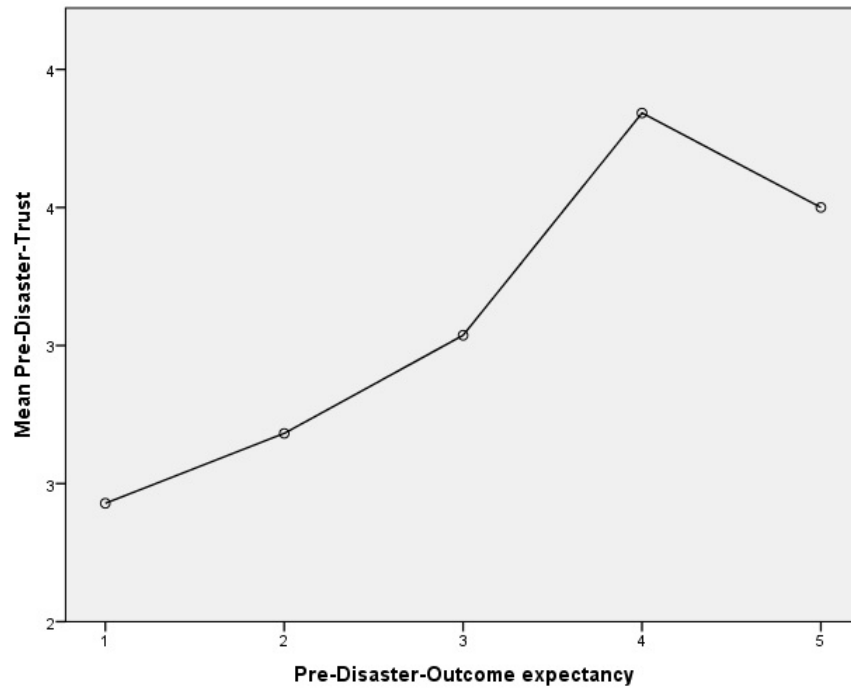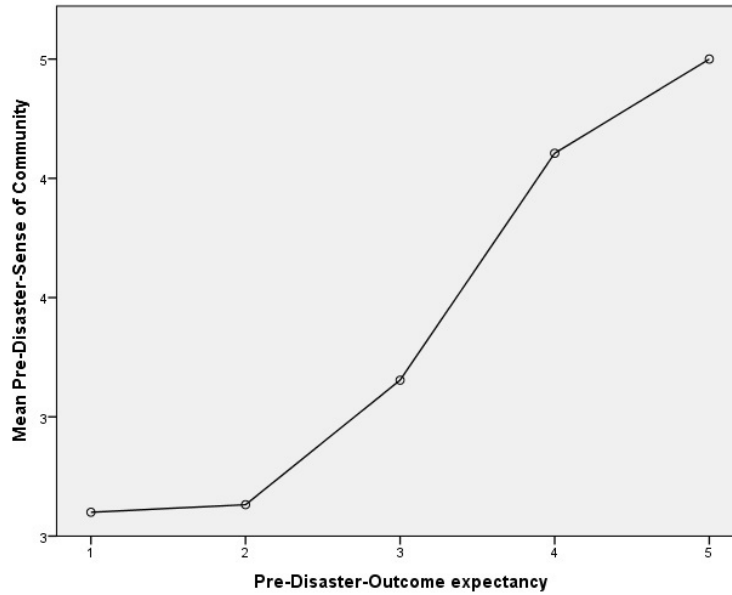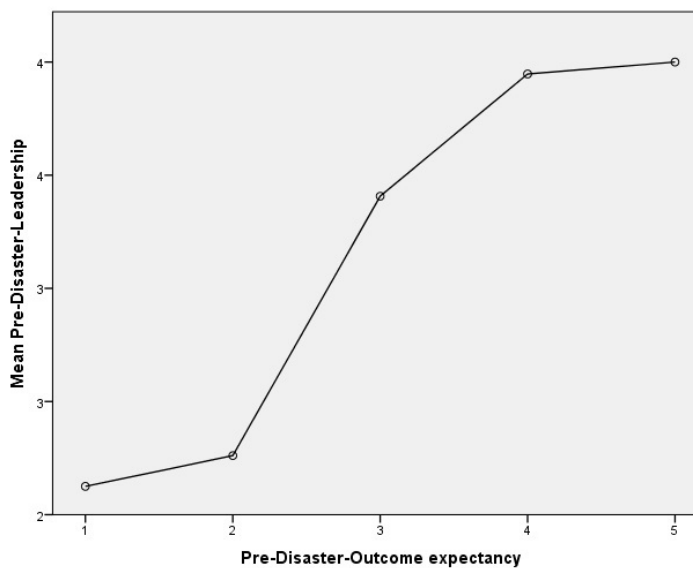

Correlations between the social resilience indicators and outcome expectancy for the during-disaster phase are provided in Tables 20 and 21. As presented in Table 20, all nine of the during-disaster social resilience indicators were positively correlated with during-disaster outcome expectancy. Moreover, all correlations were statistically significant at the 0.01 level. This data reveals that there is, in fact, a positive statistically significant relationship between each of the social resilience indicators and outcome expectancy in the during-disaster phase.

4.5.1.2 During Disaster Phase

Correlations

		During-Disaster Community Participation	During-Disaster Exchange Information	During-Disaster Shared Information	During-Disaster Social Support	During-Disaster Trust	During-Disaster Coordination	During-Disaster Sense of Community	During-Disaster Coping Style	During-Disaster Leadership	During-Disaster Outcome Expectancy
During-Disaster Outcome Expectancy	Pearson Correlation	.641**	.365**	.668**	.363**	.438**	.489**	.331**	.537**	.349**	1
	Sig. (2-tailed)	.000	.002	.000	.002	.000	.000	.005	.000	.003	
	n	71	70	69	71	67	71	70	69	70	72

**Correlation is significant at the 0.01 level (2-tailed).

*Correlation is significant at the 0.05 level (2-tailed).

Table 20. The correlation between response phase indicators and outcome expectancy of social resilience during disaster

Table 21 provides the correlation coefficients for the during-disaster social resilience indicators with the outcome expectancy of social resilience during the disaster, categorised by strength of outcome from strong to weak, with during-disaster shared information showing the highest correlation to during-disaster social resilience. The *p* value and ρ (rho) were calculated for each of these indicators, as presented in Table 20, and ranked here in Table 21 from the strongest correlation to the weakest correlation. Using the scale presented in Table 17, two of the social resilience indicators had a strong correlation with outcome expectancy, three had a moderate relationship with outcome expectancy and four had weak relationship with outcome expectancy. Thus, while each of the indicators had a positive statistically significant correlation with outcome expectancy in the during-disaster phase, there were different levels of strength among the relationships.

Strength	During-Disaster Indicators	Correlation
Strong	During-disaster shared information	.668**
	During-disaster community participation	.641**
Moderate	During-disaster coping style	.537**
	During-disaster coordination	.489**
	During-disaster trust	.438**
Weak	During-disaster exchange information	.365**
	During-disaster social support	.363**
	During-disaster leadership	.349**
	During-disaster sense of community	.331**

Table 21. The correlation coefficients between during-disaster indicators and the outcome expectancy of social resilience during disaster

We have provided the correlation coefficients for each of the during-disaster social resilience indicators in Tables 20 and 21, but I now present these individually, depicting the relationship between the mean indicator score and during-disaster outcome expectancy, herein referred to as social resilience, using a two-dimensional line graph.

During-Disaster Community Participation: Based on the results (rho = 0.641, $p \leq 0.000$ at 2-tailed, *n* = 71), a strong positive correlation existed between community participation and social resilience during disaster.
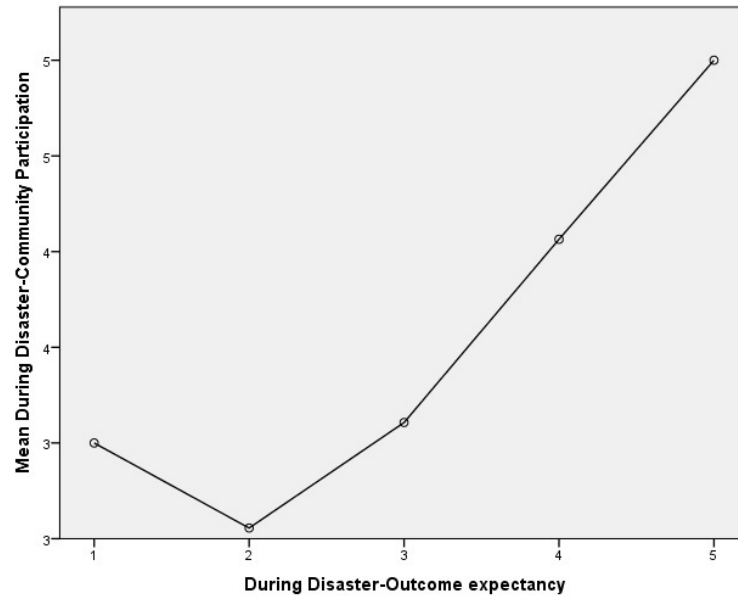
During Disaster-Exchange Information: Based on the results (rho = 0.365, $p \leq 0.002$ at 2-tailed, n =70), a weak positive correlation existed between exchange of information and social resilience during disaster.
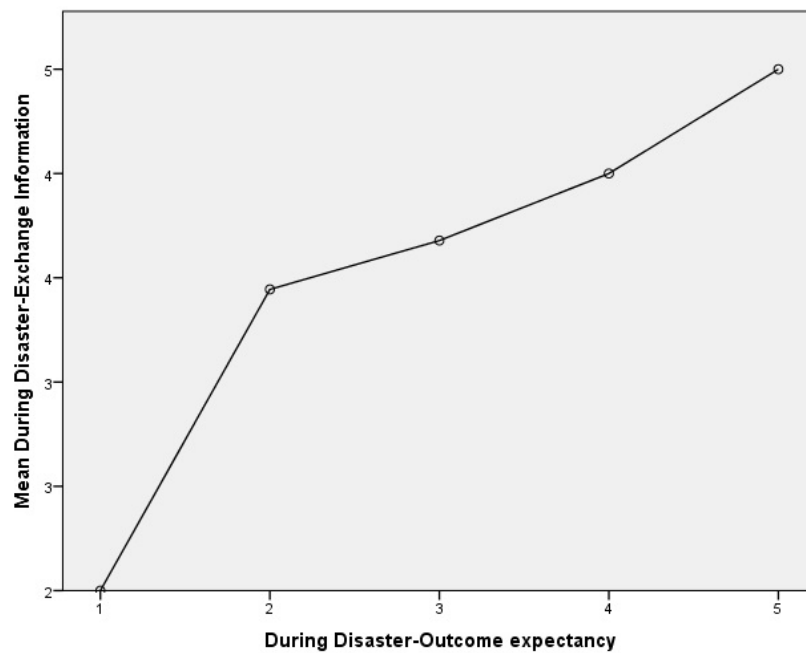
During-Disaster Shared Information: Based on the results (rho = 0.668, $p \leq 0.000$ at 2-tailed, $n = 69$), a strong positive correlation existed between shared information and social resilience during disaster.
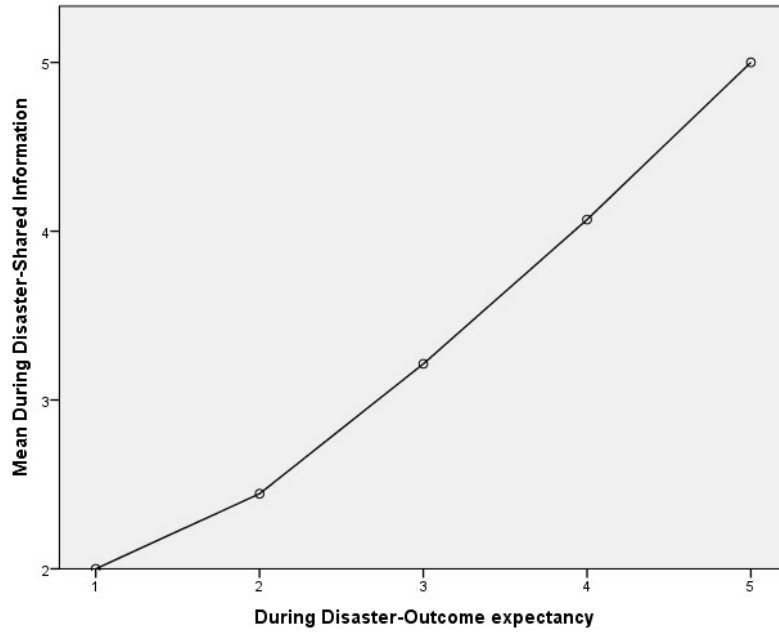
During-Disaster-Social Support: Based on the results (rho = 0.363, *p* ≤ 0.002 at 2-tailed, *n* = 71), a weak positive correlation existed between social support and social resilience during disaster.
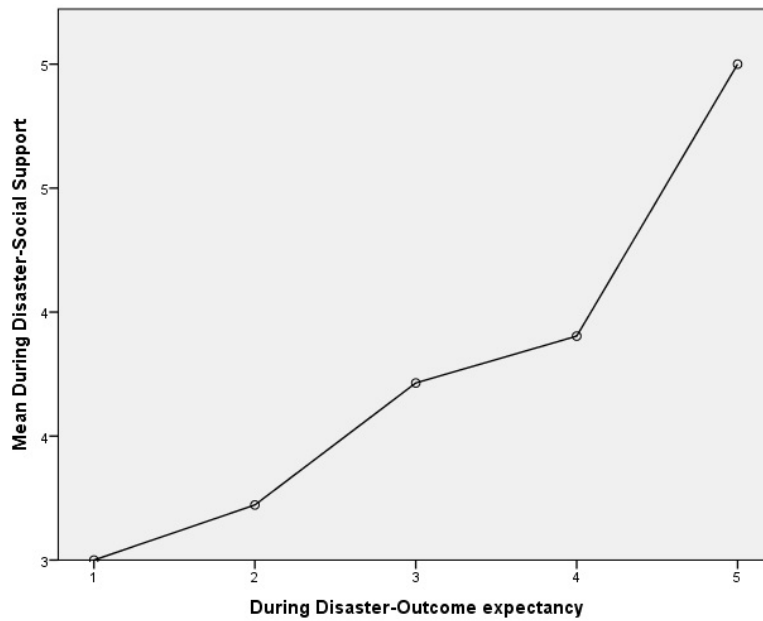
During-Disaster Trust: Based on the results (rho = 0.438, *p* ≤ 0.000 at 2-tailed, *n* = 67), a moderate positive correlation existed between trust and social resilience during disaster.
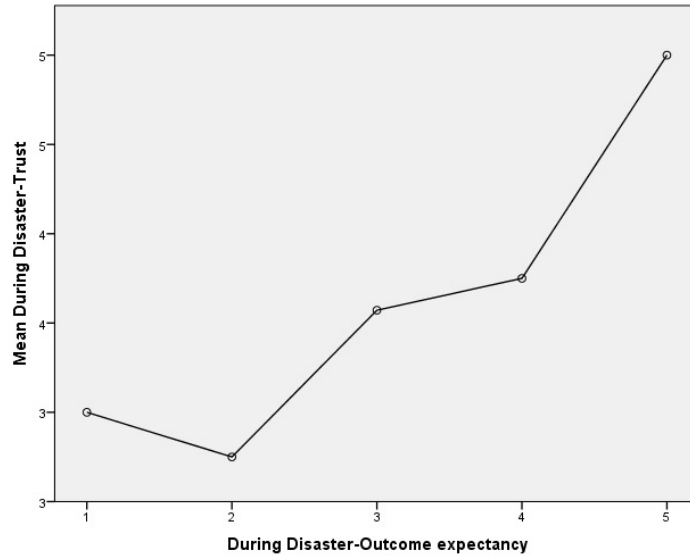
During-Disaster Coordination: Based on the results (rho = 0.489, *p* ≤ 0.000 at 2-tailed, *n* = 71), a moderate positive correlation existed between coordination and social resilience during disaster.
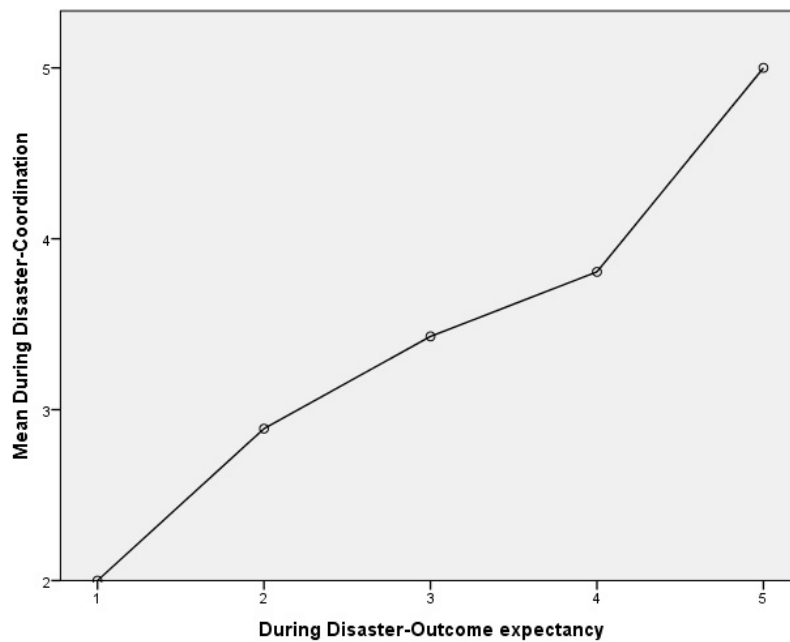
During-Disaster-Sense of Community: Based on the results (rho = 0.331, *p* ≤ 0.005 at 2-tailed, *n* = 70), a weak positive correlation exists between sense of community and social resilience during disaster.

During-Disaster Coping Style: Based on the results (rho = 0.537, $p \leq 0.000$ at 2-tailed, $n = 69$), a moderate positive correlation existed between coping style and social resilience during disaster.
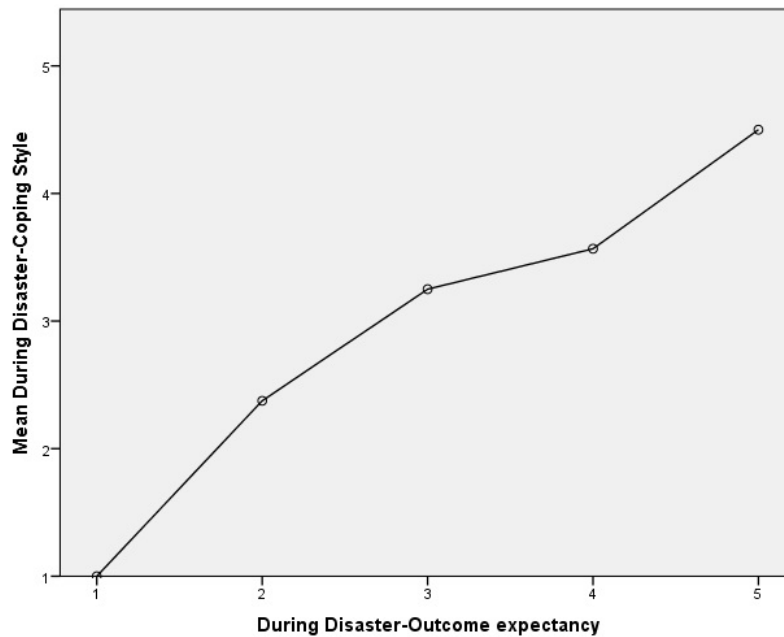
During-Disaster Leadership: Based on the results (rho = 0.349, $p \leq 0.003$ at 2-tailed, $n = 70$), a weak positive correlation exists between leadership and social resilience during disaster.
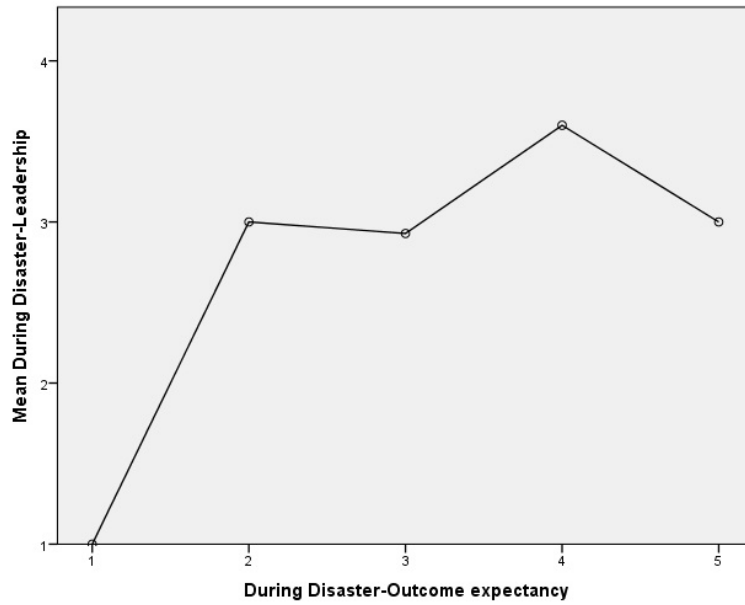
Correlations between the social resilience indicators and outcome expectancy for the post-disaster phase are provided in Tables 22 and 23. As presented in Table 22, all 11 of the post-disaster social resilience indicators were positively correlated with post-disaster outcome expectancy. Moreover, all correlations were statistically significant at the 0.01 level. This data reveals that there is, in fact, a positive statistically significant relationship between each of the social resilience indicators and outcome expectancy in the post-disaster phase.

4.5.1.3 After-Disaster Phase

Correlations

		After-Disaster Community Participation	After-Disaster Exchange Information	After-Disaster Learning	After-Disaster Shared Information	After-Disaster Social Support	After-Disaster Trust	After-Disaster Sense of Community	After-Disaster Community Efficacy	After-Disaster Improvisation / Inventiveness	After-Disaster Coping Style	After-Disaster Leadership	Main After-Disaster Outcome Expectancy Plus Time
Main After-Disaster Outcome Expectancy Plus Time	Pearson Correlation	.424**	.535**	.627**	.650**	.567**	.555**	.553**	.437**	.581**	.844**	.506**	1
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	
	n	66	61	64	65	60	64	64	67	62	65	63	68

**Correlation is significant at the 0.01 level (2-tailed).

*Correlation is significant at the 0.05 level (2-tailed).

Table 22. The correlation between recovery phase indicators and outcome expectancy of social resilience after disaster

Table 23 provides the correlation coefficients for the post-disaster social resilience indicators with the outcome expectancy of social resilience after the disaster, categorised by strength of outcome from very strong to moderate, with post-disaster coping style showing the highest correlation to during-disaster social resilience. The *p* value and ρ (rho) were calculated for each of these indicators, as presented in Table 22 and ranked here in Table 23 from the strongest correlation to the weakest correlation. Using the scale presented in Table 17, one social resilience indicator had a very strong correlation with outcome expectancy, two had a strong relationship with outcome expectancy, and the remaining eight had a moderate relationship with outcome expectancy. Thus, while each of the indicators had a positive statistically significant correlation with outcome expectancy in the post-disaster phase, there were different levels of strength among the relationships.

Strength	After Disaster Indicators	Correlation
Very Strong	After disaster coping style	.844**
Strong	After disaster shared information	.650**
Strong	After disaster learning	.627**
Moderate	After disaster improvisation / inventiveness	.581**
Moderate	After disaster social support	.567**
Moderate	After disaster trust	.555**
Moderate	After disaster sense of community	.553**
Moderate	After disaster exchange information	.535**
Moderate	After disaster leadership	.506**
Moderate	After disaster community efficacy	.437**
Moderate	After disaster community participation	.424**

Table 23. The correlation coefficients between post-disaster indicators and the outcome expectancy of social resilience after disasters

We have provided the correlation coefficients for each of the post-disaster social resilience indicators in Tables 22 and 23, but I now present these individually, depicting the relationship between the mean indicator score and post-disaster outcome expectancy, herein referred to as social resilience, using a two-dimensional line graph.

After-Disaster Community Participation: Based on the results (rho = 0.424, $p \leq 0.000$ at 2-tailed, $n = 66$), a moderate positive correlation existed between community participation and social resilience after disaster.
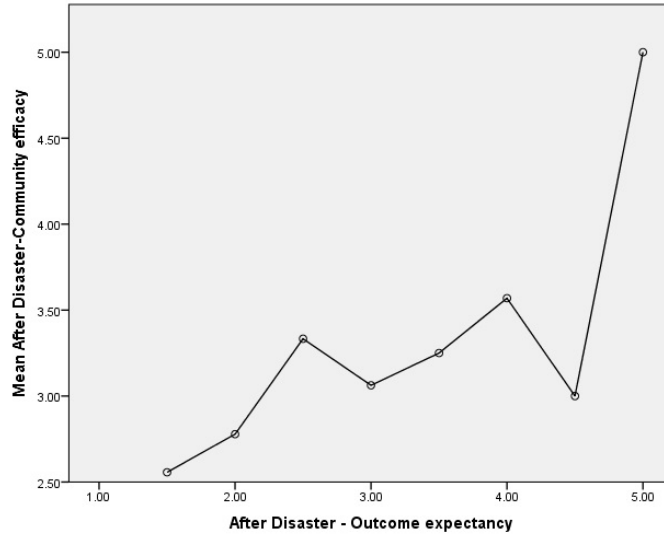
After-Disaster Exchange Information: Based on the results (rho = 0.535, $p \leq 0.000$ at 2-tailed, $n = 61$), a moderate positive correlation existed between exchange of information and social resilience after disaster.
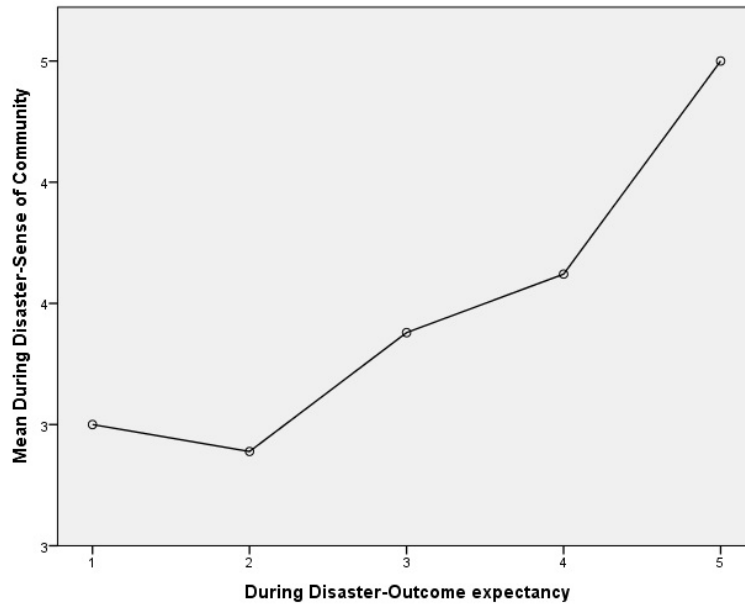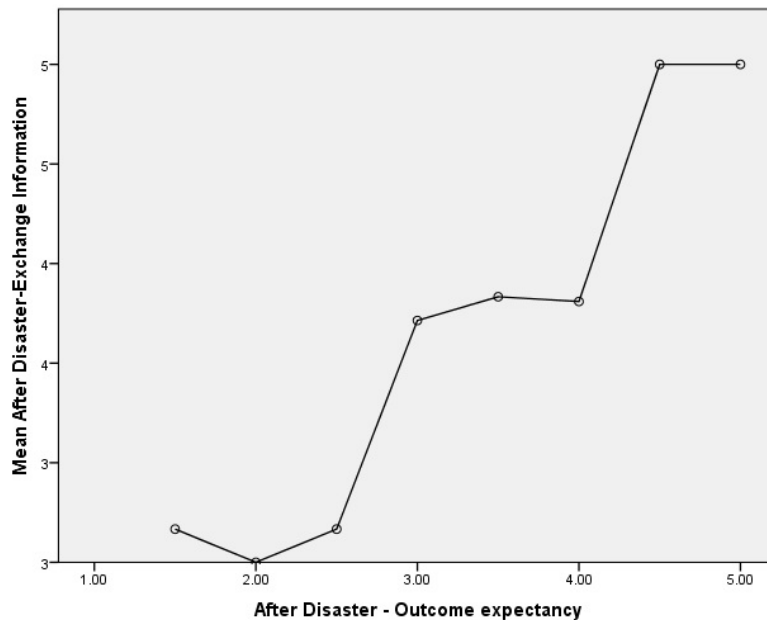

After-Disaster Learning: Based on the results (rho = 0.627, $p \leq 0.000$ at 2-tailed, $n = 64$), a strong positive correlation existed between learning and social resilience after disaster.
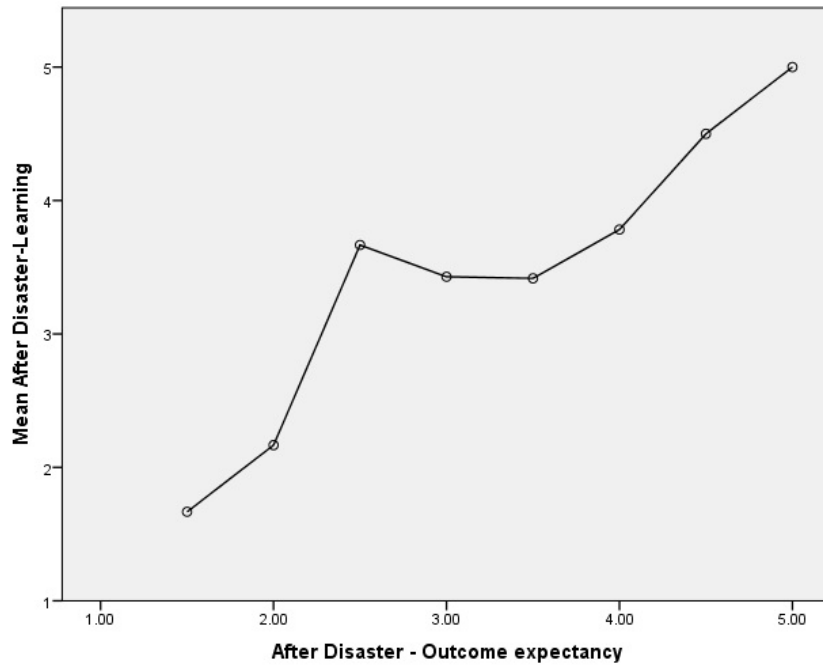
After-Disaster Shared Information: Based on the results (rho = 0.650, $p \leq 0.000$ at 2-tailed, $n = 65$), a strong positive correlation existed between shared information and social resilience after disaster.
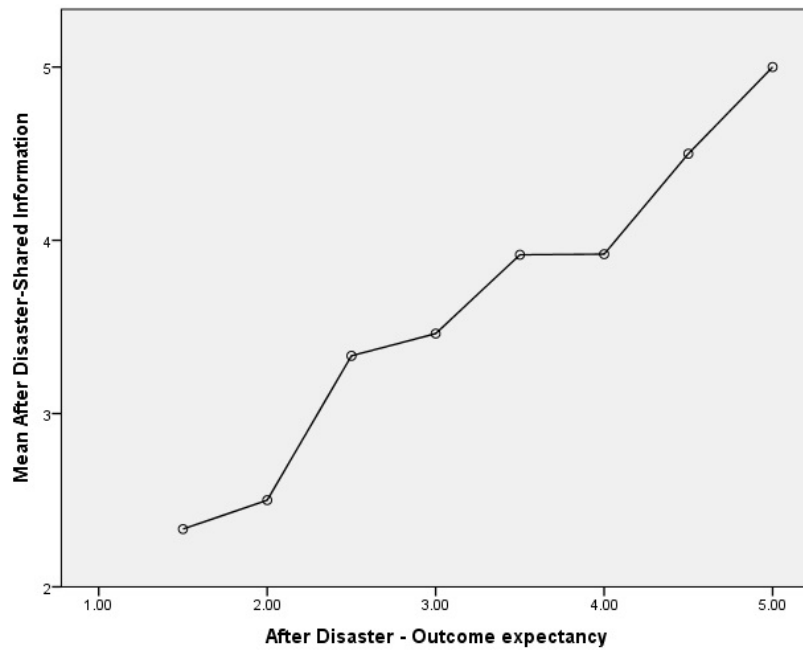
After-Disaster Social Support: Based on the results (rho = 0.567, $p \leq 0.000$ at 2-tailed, $n = 60$), a moderate positive correlation existed between social support and social resilience after disaster.
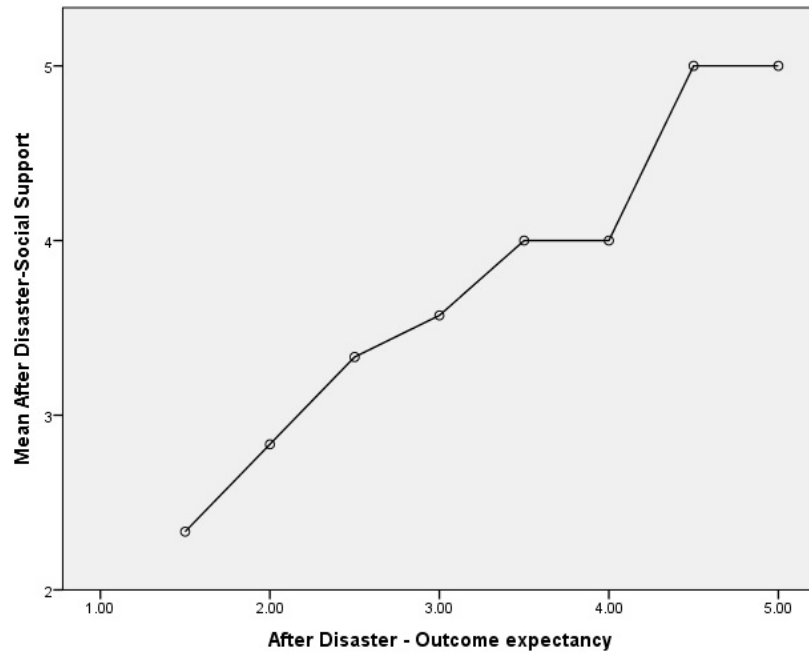
After-Disaster Trust: Based on the results (rho = 0.555, *p* ≤ 0.000 at 2-tailed, *n* = 64), a moderate positive correlation exists between trust and social resilience after disaster.
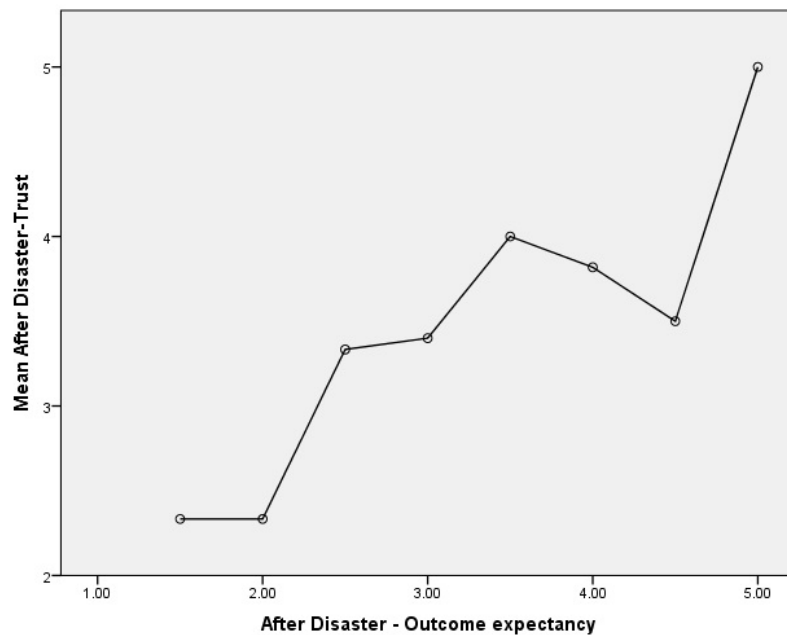
After Disaster Sense of Community: Based on the results (rho = 0.553, p ≤ 0.000 at 2-tailed, n = 64), a moderate positive correlation existed between sense of community and Social Resilience after disaster.
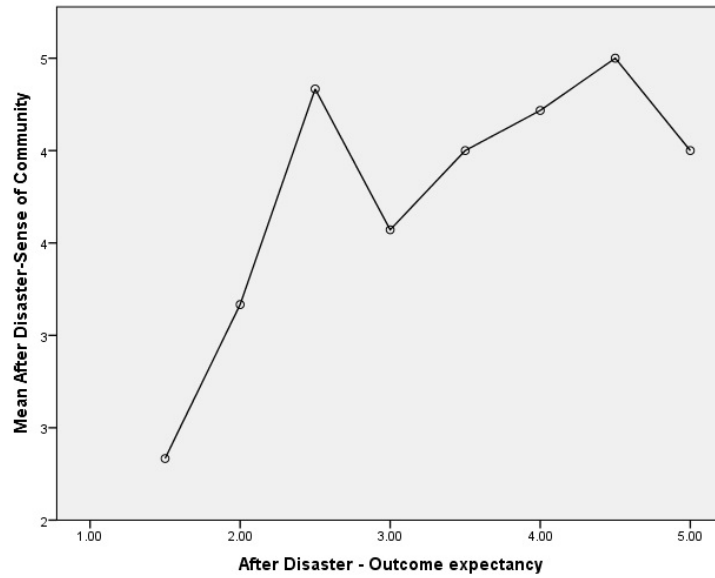
After-Disaster Community Efficacy: Based on the results (rho = 0.437, $p \leq 0.000$ at 2-tailed, $n = 67$), a moderate positive correlation existed between community efficacy and social resilience after disaster.
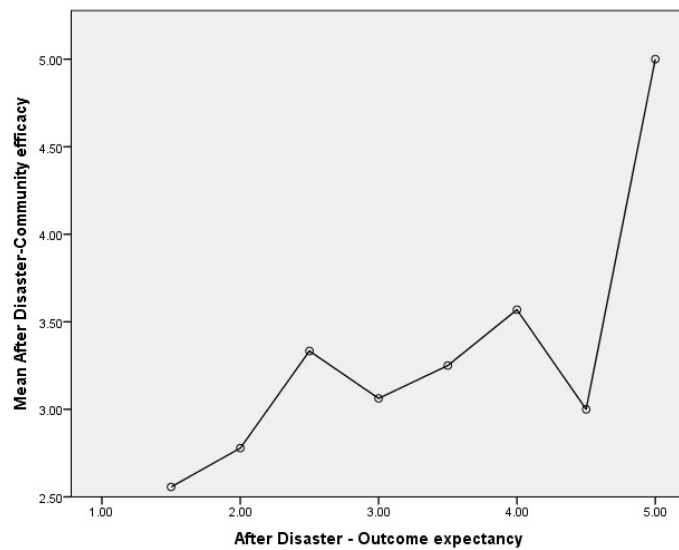
After-Disaster Improvisation/Inventiveness: Based on the results (rho = 0.581, $p \leq 0.000$ at 2-tailed, $n = 62$), a moderate positive correlation existed between improvisation/inventiveness and social resilience after disaster.
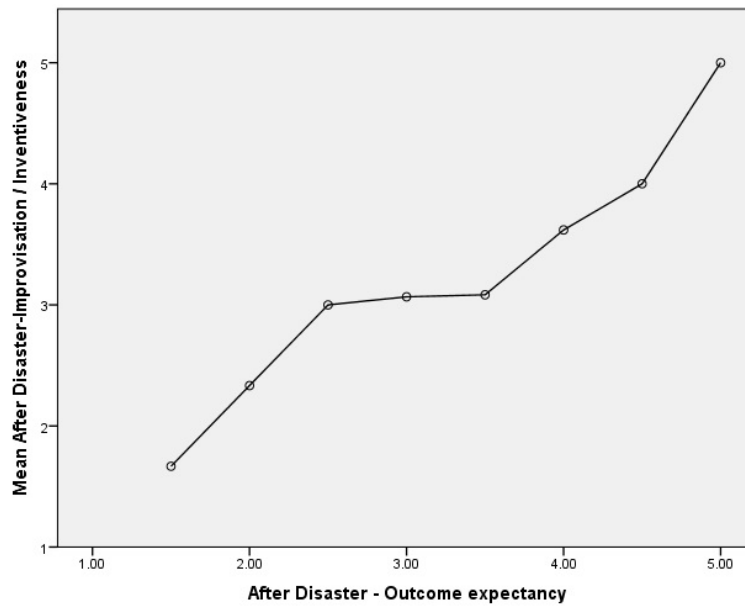
After-Disaster Coping Style: Based on the results (rho = 0.844, $p \leq 0.000$ at 2-tailed, $n = 65$), a very strong positive correlation existed between coping style and social resilience after disaster.
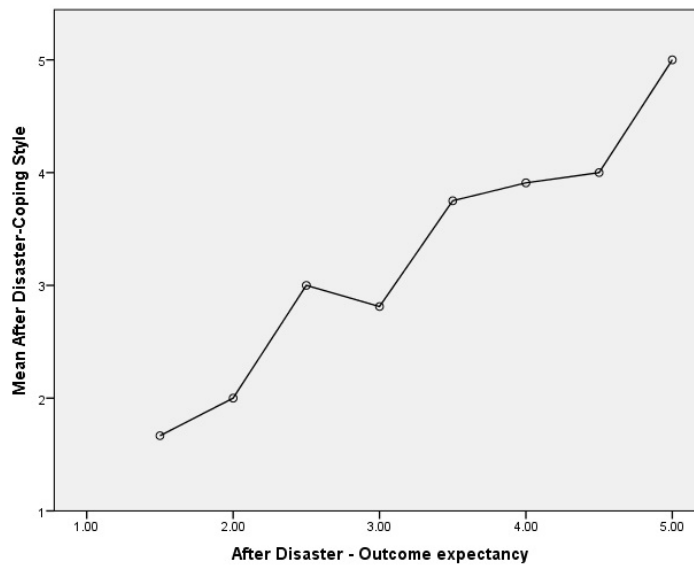
After-Disaster Leadership: Based on the results (rho = 0.506, $p \leq 0.000$ at 2-tailed, $n = 63$), a moderate positive correlation exists between leadership and social resilience after disaster.
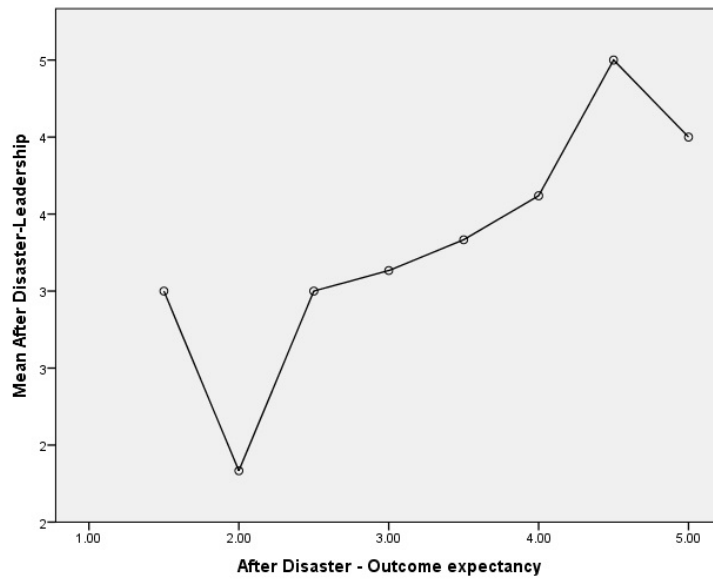
Finally, correlations between the social resilience indicator aggregates across all phases and outcome expectancy for the disaster (not trifurcated by phase) are provided in Tables 24 and 25. As presented in Table 23, all 14 of the disaster social resilience indicators were positively correlated with disaster outcome expectancy. Moreover, all correlations were statistically significant at the 0.01 level. This data reveals that there is, in fact, a positive statistically significant relationship between each of the social resilience indicators and outcome

4.5.1.4 All Phases of Disaster

The tables below show the correlation between all identified indicators and the outcome expectancy of social resilience overall.

Correlations

		All Phases Community Participation	All Phases Education	All Phases Exchange Information	All Phases Learning	All Phases Shared Information	All Phases Social Support	All Phases Trust	All Phases Sense of Community	All Phases Demographic Information	All Phases Improvisation / Inventiveness	All Phases Coping Style	All Phases Leadership	All Phases Coordination	All Phases Community Efficacy	All Phases Social Resilience
All Phases Social Resilience	Pearson Correlation	.668**	.482**	.578**	.555**	.742**	.539**	.452**	.554**	.466**	.556**	.726**	.592**	.582**	.456**	1
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000	.000	.000	.001	.000	.000	.000	.000	.000	
	n	69	65	64	64	66	65	63	64	49	62	67	68	67	64	70

**Correlation is significant at the 0.01 level (2-tailed).

*Correlation is significant at the 0.05 level (2-tailed).

Table 24. The correlation between all phase's indicators and outcome expectancy of all phase's social resilience

Table 25 provides the correlation coefficients for all phases of disaster social resilience indicators with the outcome expectancy of social resilience for the disaster, categorised by strength of outcome as strong or moderate, with all phases' shared information showing the highest correlation to disaster social resilience. The *p* value and ρ (rho) were calculated for each of these indicators, as presented in Table 24 and ranked here in Table 25 from the strongest correlation to the weakest correlation. Using the scale presented in Table 17, three social resilience indicators had a strong correlation with outcome expectancy and the remaining nine had a moderate relationship with the outcome expectancy. Thus, while each of the indicators had a positive statistically significant correlation with outcome expectancy in the disasters, accounting for all phases in aggregate, there were different levels of strength among the relationships.

Strength	Social Resilience Indicators	Correlation
Strong	All phases shared information	.742[**]
	All phases coping style	.726[**]
	All phases community participation	.668[**]
Moderate	All phases leadership	.592[**]
	All phases coordination	.582[**]
	All phases exchange information	.578[**]
	All phases improvisation / inventiveness	.556[**]
	All phases learning	.555[**]
	All phases sense of community	.554[**]
	All phases social support	.539[**]
	All phases education	.482[*]
	All phases demographic information	.466[**]
	All phases community efficacy	.456[**]
	All phases trust	.452[**]

Table 25. The correlation coefficients between indicators across all disaster phases and the outcome expectancy of social resilience

In general, strong positive correlation existed between community participation and social resilience (rho = 0.668, *p* ≤ 0.000 at 2-tailed, *n* = 69), shared information and social resilience (rho = 0.742, *p* ≤ 0.000 at 2-tailed, *n* = 66), and coping style and social resilience (rho = 0.726, *p* ≤ 0.000 at 2-tailed, *n* = 67).

A moderate positive correlation existed between education and social resilience (rho = 0.482, *p* ≤ 0.000 at 2-tailed, *n* = 65), exchange of information and social resilience (rho = 0.578, *p* ≤ 0.000 at 2-tailed, *n* = 64), learning and social resilience (rho = 0.555, *p* ≤

0.000 at 2-tailed, $n = 64$), social support and social resilience (rho $= 0.539$, $p \le 0.000$ at 2-tailed, $n = 65$), trust and social resilience (rho $= 0.452$, $p \le 0.000$ at 2-tailed, $n = 63$), sense of community and social resilience (rho $= 0.554$, $p \le 0.000$ at 2-tailed, $n = 64$), demographic information and social resilience (rho $= 0.466$, $p \le 0.001$ at 2-tailed, $n = 49$), improvisation/inventiveness and social resilience (rho $= 0.556$, $p \le 0.000$ at 2-tailed, $n = 62$), leadership and social resilience (rho $= 0.592$, $p \le 0.000$ at 2-tailed, $n = 68$), coordination and social resilience rho $= 0.582$, $p \le 0.000$ at 2-tailed, $n = 67$), and community efficacy and social resilience (rho $= 0.456$, $p \le 0.000$ at 2-tailed, $n = 64$).

4.6 Results and Discussion

The null hypothesis (H_0) and alternative hypothesis (H_1) of the significance test for correlation were expressed in the following ways, where ρ is the population correlation coefficient:

Two-tailed significance test:

H_0: $\rho = 0$ ('The population correlation coefficient is 0; there is no association'.)
H_1: $\rho \neq 0$ ('The population correlation coefficient is not 0; a non-zero correlation could exist'.)

One-tailed significance test:

H_0: $\rho = 0$ ('The population correlation coefficient is 0; there is no association'.)
H_1: $\rho > 0$ ('The population correlation coefficient is greater than 0; a positive correlation could exist'.)

 OR

H_1: $\rho < 0$ ('The population correlation coefficient is less than 0; a negative correlation could exist'.)

Following the generation and analysis of the statistics, the indicators were organised into a two-dimensional matrix representing social resilience indicators by disaster phase and level of impact to verify the proposed social resilience framework presented in the qualitative research section. The social resilience indicators were then subjected to

quantitative verification, as presented in this section. The proposed framework was then revised based on the strength of the indicator, determined by cross-referring the correlation coefficient to the scale presented in Table 17.

As presented in the revisited matrix below (see Table 26), some social resilience indicators—such as community efficacy and education—were only relevant in a single disaster phase, while other indicators—such as learning—were relevant in two of the three phases; however, most indicators were present across all three disaster phases. Moreover, it should be noted that for those indicators significant in more than one phase, many held different levels of significance in each of the phases. Leadership, for instance, was of high importance in the pre-disaster phase, of low importance in the response phase and of medium importance in the recovery phase.

Social Resilience Indicators			
High	Shared information Community participation Leadership Sense of community Demographic information Education	Shared information Community participation	Coping style Shared information Learning
Medium	Improvisation / inventiveness Exchange information Coping style Trust Social support Learning	Coping style Coordination Trust	Improvisation / inventiveness Social support Trust Sense of community Exchange information Leadership Community efficacy Community participation
Low		Exchange information Social support Leadership Sense of community	
	Pre-Disaster	Response	Recovery

Table 26. Social resilience indicators matrix

The framework of social resilience provided in Table 26 was then referenced back to the hypotheses of this research. This research failed to reject the **first hypothesis**—the 14 social resilience indicators are individually associated with social resilience—because all 14 indicators had a positive statistically significant correlation with social resilience. The **second hypothesis** is that every indicator in the framework has a different level of

impact on social resilience. I failed to reject this hypothesis based on the finding that the social resilience indicators had different levels of impact on social resilience. Moreover, these levels of impact could be used to improve the proposed framework developed in the qualitative research phase of this study. While the proposed framework was developed from the views of SES staff, the revised framework was developed based on the perception of the communities. Finally, the **third hypothesis** is that every phase of disaster has its own individual indicators that affect social resilience. I also failed to reject this hypothesis because the 14 indicators for each of the three disaster phases were the same as in the proposed framework and had a positive relationship with social resilience. Therefore, I failed to reject all three hypotheses based on the relationships identified in the survey data.

- ✓ ***Hypothesis 1:*** The results indicate that all 14 identified indicators had a positive and statistically significant correlation with social resilience: community efficacy, community participation, coordination, coping style, demographic information, education, exchange information, improvisation, leadership, learning, shared information, social support, sense of community and trust.
- ✓ ***Hypothesis 2:*** The results show that each indicator had a different level of impact on social resilience, from weak to very strong. There were slight changes in the level of impact for some of the indicators from the initial framework because of the initial framework being established on SES staffs' views, while the recent data shows communities' views on social resilience.
- ✓ ***Hypothesis 3:*** The results show that all identified indicators for each disaster phase were the same as the initial framework and had a positive impact on social resilience.

Since these relationships were all found to be statistically significant, they can be generalised to a broader framework and used to develop policies for improving and maintaining social resilience. Moreover, these indicators provide meaning to social resilience in each of the three disaster phases, while extant literature often approaches social resilience to disasters as a whole. Refining the indicators for each of the disaster phases allows approaches to be more targeted to the factors that are of greatest impact.

Beyond assessing the three specific hypotheses, the data analysis reveals seven findings that are important to the research and for advancing the current state of knowledge on

social resilience in disasters. **First,** the analysis indicates that all 14 social resilience indicators have a positive correlation with social resilience. **Second,** all social resilience indicators presented a relationship that was categorised as high or medium impact, with shared information, community participation, and coping style exhibiting the greatest impact on social resilience. **Third**, in alignment with Rohrmann (2000) and Ink (2006), the social resilience indicator of shared information is determined to have a significant impact on social resilience (Ink, 2006; Rohrmann, 2000). Shared information was determined to be the factor of greatest impact in the aggregated data. **Fourth,** coping style was determined to be the indicator with the second greatest overall impact, which aligns with Millers' (1999) finding that coping style has a strong influence on social resilience (Miller et al., 1999). **Fifth,** the data aligns with Paton et al.'s (2001) conclusion that community participation is a strong indicator of social resilience (Paton & Johnston, 2001). The results presented herein demonstrate that community participation has a high impact on social resilience in the pre- and post-disaster phases, as well as a medium impact in the during-disaster phase**. Sixth,** the research also aligns with that of Harland et al. (2005), which find that leadership is an important factor in social resilience. This research concludes that leadership is of moderate impact on social resilience overall, but has a high impact in the pre-disaster phase, a low impact during and a medium impact after the disaster. **Finally**, all pre- and post-disaster social resilience indicators were concluded to have a high or medium impact, which indicates that community stakeholders should concentrate on indicators in these phases to improve community social resilience.

Chapter 5: Social Network Enabled Social Resilience

5.1 Improving Social Resilience by Social Network as an Enabler

In the words of Magsino (2009, p. 9), 'A community's ability to respond to and recover from natural and human-caused disasters is in part dependent on the strength and effectiveness of its social networks'. Despite the increasing frequency and toll of disasters (Newkirk, 2001), the literature on resilience over-studies physical infrastructure while the critical role of social networks and their associated social capital is drastically understudied (Aldrich & Meyer, 2014). Social networks have unique rolls in both disaster resilience and disaster recovery. In disaster resilience, wealthier individuals and communities have greater access to resources in their social networks, while impoverished, minority and marginalised communities have fewer resources needed to be resilient within their networks. Communities that have a high degree of social capital and strong social networks are often more resilient to disasters and have faster recovery process in the event of a disaster (Jaeger et al., 2007). In post-disaster recovery, this access to network resources is also important, but the breakdown of social networks must also be considered (Varda, Forgette, Banks, & Contractor, 2009). Social networks are both important for resource allocation and strained by disasters because individuals often rely on their social networks with overwhelming need and desperation following disasters (Nakagawa & Shaw, 2004). In other words, disasters place extraneous strains on social networks as the demands of individuals are drastically altered. Social networks are also strained in disasters by the displacement of individuals (Forgette et al., 2009).

5.1.1 Social Networks in Recovery Efforts

Strong social networks have been repeatedly demonstrated as an essential component of disaster resilience and recovery. As a key tenet of social capital, strong social networks are able to mitigate impact and speed up the recovery process (Jaeger et al., 2007; Mukherji, 2014; Nakagawa & Shaw, 2004). Mukherji (2014) demonstrates that the effectiveness of recovery of different Indian communities affected by earthquakes was dependent on social networks that exhibited shared values, trust and social norms, which demonstrated the social capital needed for recovery through integrated action. In

post-disaster recovery efforts, disaster victims search for assistance in rebuilding their lives, and their strategies in these efforts will often be dependent on the resources available through their social networks and their broader community social infrastructure (Chamlee-Wright & Storr, 2011).

5.1.2 Flow of Resources Through Social Networks

Research has demonstrated that the structure of social networks can affect social resilience and recovery (Aldrich, 2012; Stewart, Glanville, & Bennett, 2014). One of the most important network resources following a disaster is human capital—there is a great need for individuals to commit their time and skills in recovery efforts. Networks with higher levels of density have greater levels of volunteerism in the event of a disaster (Stewart et al., 2014). Aldrich (2012) adds that this finding is true of networks of all socioeconomic status. Volunteerism is an essential component for ensuring the necessary labour force for recovery efforts.

Social networks also provide social support, including mental and physical health resources (Bland et al., 1997; Cohen, Underwood, & Gottlieb, 2000; Hurlbert, Beggs, & Haines, 2005). Shared values among network members have resulted in improved mental health outcomes (Hurlbert et al., 2005) and physical health outcomes (Seeman, 1996) following a disaster. Along these same lines, the extant literature provides that the lack of a strong social network and the associated lack of social capital can decrease social resilience and hinder recovery after a disaster because individuals without a strong social network are often excluded in the distribution of resources that flow through these networks (Aldrich, 2012).

5.1.3 Strain on Social Networks

Disasters are capable of having a pro-social impact in which communities form networks to work together in recovery efforts, but they are also capable of straining networks. In the example of Hurricane Katrina in the United States, impoverished and immigrant communities experienced a notable breakdown of their social networks, which resulted in a dissipated ability to evacuate in the midst of widespread looting, rioting and lawlessness. The disaster-related breakdown or substantial change of existing social networks can result in considerable damage to social infrastructures (Varda et al., 2009). Simply put, in non-disaster times, individuals rely on their

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networks to meet basic needs and when affected by a disaster, the networks are considerably strained by the overwhelming needs and the desperation of network members as individuals within the network seek assistance from other network actors (Messias, Barrington, & Lacy, 2012). Moreover, the demands placed on social networks exponentially increase with the severity of the disaster impact. Thus, as with other areas of impact, Forgette et al. (2009) find that larger disasters have a greater effect on social networks, which results in a longer post-disaster period before the social networks can recover.

Although social networks are widely recognised as an important factor in disaster resilience and recovery, not all social networks can be considered equally beneficial. The economic standing of network actors, for instance, has a definitive impact since wealthier communities have both greater resources to offer in the event of a disaster and they are less likely to be strained by a disaster. Although wealthier social networks are also affected by disasters (Forgette et al., 2009), individuals in these social networks are more often able to be self-reliant in recovery efforts and thus apply less strain on their social networks. In contrast, the social networks of impoverished and/or immigrant communities are less likely to be sustainable in the event of a disaster (Fothergill & Peek, 2004; Hurlbert et al., 2005). Maintaining the example of Hurricane Katrina, following the disaster, the residents of the lower-income Ninth Ward were essentially left to fend for themselves, which resulted in the looting and general lawlessness. Meanwhile and to the contrary, the wealthier neighbourhoods of New Orleans were quickly evacuated and had the resources to recovery more quickly. Individuals who evacuated from the lower Ninth Ward were less likely to return to this community than individuals who evacuated from more affluent communities. This further exacerbates the differences in the sustainability of these networks (Messias et al., 2012).

5.1.4 Social Networks and Social Resilience

While much of the literature on social networks and disasters addresses the recovery phase, social networks are also an important factor in social resilience. For instance, the ability of dense social networks to be less strained by disasters is a form of social resilience. Furthermore, the differential recovery efforts can be studied in the context of social network structure to draw conclusions on the structures that are more conducive to the forms of social capital needed for resilience (Varda et al., 2009). Communities

can be studied to identify potential marginalised communities or 'isolated survivors' for policy development that brings these groups or individuals into the broader community network. This is important for resilience resources that flow through social networks, such as information on evacuation (Varda et al., 2009). Social media networks are also increasingly being studied to understand their value in both resilience to and recovery from disasters (Dufty, 2012).

5.1.5 Application of Social Network Analysis to this Research

Because of the aforementioned factors demonstrating the role of social networks in disaster impact and recovery, social networks are a key consideration in the study of social resilience to and recovery from disaster. In reviewing the literature on social networks in disaster, I now draw parallels between my framework and the extant literature.

Through the research presented herein, I have concluded a positive statistically significant relationship between 14 social resilience indicators and outcome expectancy. While I have not sought factors relating to social networks through this study, these factors have naturally emerged as social resilience indicators. This finding is both empirical and aligned with the extant literature, since social capital is a key indicator of community resilience (Aldrich & Meyer, 2014). Thus, one would expect social networks to emerge as a key social resilience indicator because social networks are the patterns of social interaction along which social resilience is theorised to occur. Social vulnerability is that which is experienced through social, economic, and political systems and institutions (Pelling et al., 2004), and disasters both disrupt these systems and expose these vulnerabilities. Social resilience is, then, the ability of these systems to be minimally disrupted—to be adaptive to the shocks of disaster (Magsino, 2009). As such, even natural disasters are social in nature in that much of the impact and recovery is greatly affected by these social systems and their vulnerabilities (Pelling et al., 2004).

Although the postulation that social networks are key factors in social resilience, as demonstrated in the previous chapters of this research, is both empirical and supported by social studies of disaster impact and recovery (cf. Aldrich & Meyer, 2014; Dufty, 2012; Mukherji, 2014), further research is needed to scientifically test the validity of the relationship and the ability of social network analysis (SNA) to contribute to my

understanding of social resilience. Further assessment of the role of social networks and the application of social networks to the proposed model of social resilience can be undertaken by academics and practitioners to identify the strengths and weaknesses of social networks that are most and least conducive to the social impacts of disasters and thus exhibit the greatest social resilience. These characteristics can be used to develop best practices for fostering social resilience and addressing social vulnerabilities in communities prone to disasters. Magsino (2009, p. 4) notes that these characteristics are actually important for other community functions, but are especially important in the context of disasters because:

> Many of the same capacities and characteristics that allow a community to continue functioning during a disaster (e.g., being well informed, well networked, and possessing the ability to respond to situations with creativity and flexibility) are those that allow a community to thrive during normal times.

As social networks have emerged as a dominant theme of consideration with core tenets across many of the 14 social resilience indicators assessed within this research, which, as demonstrated herein, is well-supported by the literature (cf. Aldrich & Meyer; 2014; Dufty, 2012; Magsino, 2009; Mukherji, 2014), I am proposing the use of SNA in future studies of social resilience. Since SNA can be used to study the characteristics, compositions and structure of networks at different stages of disaster, it is a valuable tool for understanding how communities function and what the associated implications might be in the context of disasters (Ersing & Kost, 2012; Magsino, 2009).

Although the literature repeatedly addresses the value of SNA for studying disasters and the need for its increased use to address resiliency and recovery issues, there is a need for a more comprehensive model of incorporation that includes baseline data, validation techniques, an understanding of network dynamics and improved data-gathering techniques, and that accounts for non-citizen interaction. Such a model could, for instance, incorporate government and community organisation actors (Magsino, 2009). These methods are often omitted from disaster studies, despite their acknowledged importance. For instance, neither Stallings (2003) nor Dahlberg, Rubin and Vendelø's (2015) studies address SNA as a method for disaster research. Thus, although the need for applying SNA is recognised, there is a distinct gap in the literature directing researchers on the methods of SNA in the context of disasters, as well as in the

application of SNA metrics in studying disasters. Even the literature addressing the intersection of social networks and disasters rarely applies SNA as a method for quantitatively exploring this role that networks play in the various factors associated with resilience to and recovery from disaster.

5.1.6 Using SNA to Build on the Findings of this Research

As systematically outlined in the previous chapters of this research, I found the following relationships both to be of interest to social network research and to have a positive statistically significant correlation with social resilience:

- Community participation and social resilience (rho = 0.668, $p \leq 0.000$ at 2-tailed, $n = 69$)
- Shared information and social resilience (rho = 0.742, $p \leq 0.000$ at 2-tailed, $n = 66$)
- Exchange information and social resilience (rho = 0.578, $p \leq 0.000$ at 2-tailed, $n = 64$)
- Social support and social resilience (rho = 0.539, $p \leq 0.000$ at 2-tailed, $n = 65$)
- Sense of community and social resilience (rho = 0.554, $p \leq 0.000$ at 2-tailed, $n = 64$)
- Leadership and social resilience (rho = 0.592, $p \leq 0.000$ at 2-tailed, $n = 68$).

As an approach to investigate the complex data sets related to social relations, I propose the addition of SNA to the previously proposed model and outline the proposed methods for this application. SNA allows me to investigate further the relationships concluded to be both important and statistically significant—the role of community participation, shared information, exchange of information, social support, sense of community and leadership—to enhance the social resilience framework. I provide four areas in which SNA can be applied to the study of social resilience to advance the current model and state of the literature. First, SNA can be used to assess the implications of one's position within the network regarding one's disaster resilience and recovery. Second, SNA can be used to study the implications of network structure regarding disaster resilience and recovery. Third, SNA can be used to assess the implications of network composition regarding disaster resilience and recovery. Fourth, SNA can be used to compare the implications of one's local network to that of the

global network in reference to disaster resilience and recovery. Each of these four approaches will be further discussed in terms of their methods and the value they add to the overall framework developed within this research.

Information is crucial in disaster resilience and recovery. For this reason, I focused within each of these four SNA approaches on the social resilience indicator that exhibited the greatest correlation, shared information (rho = 0.742, $p \leq 0.000$ at 2-tailed, $n = 66$). The ability of disaster victims to prepare for and respond to events is heavily dependent 'on the type and amount of information available' among other factors (Comfort, Ko, & Zagorecki, 2004, p. 309). As shared information has been shown to have the highest impact on social resilience during all disaster phases within the framework developed in this study, it therefore plays a significant role within a community. This indicator could thus be one parameter for social network research to consider. Through analysing it, I can assess how information is shared and exchanged through social networks and the related differential impacts on social resilience. As the contagion theory of risk perception provides that perceptions of disaster risk are socially shared through network channels (Scherer & Cho, 2003), information that could be used to prepare for a disaster or mitigate disaster impact might flow through networks differently or reach actors differently depending on their position within the network. To develop the study of shared information using SNA in the context of disaster resilience and recovery, I propose four preliminary models for exploring the impact of social networks on social resilience. The models are detailed enough not only to provide direction for their implementation and to exhibit their value for the broader model, but also to be applied to study the other indicators of social resilience using the same design. Then the next step in this research would be to operationalise a more comprehensive model of social network parameters on social resilience and to test it in a real-world application as a solution to improve those indicators.

5.1.7 Overview of Social Network

By assessing the relationships that individuals share with each other, with organisations, with government agencies and with other non-human actors, researchers are able to draw conclusions on the role of these relationships in the broad social schema of the world in which we live. For the first time, in the 1930s, Jacob Moreno analysed social interactions in a small community from a psychological perspective and initiated this

concept by focusing on classrooms in schools (Moreno & Jennings, 1938). In traditional sociological studies, the attributes of individual actors have been the main concern of researchers. However, social network theory produces an alternative view, where the attributes of individuals are less important than their relationships with other actors within the network. This approach has been useful to explain many real-world phenomena (Freeman, White, & Romney, 1992). The advantage of SNA 'is traced to network structure as a proxy for the distribution of variably sticky information in a population. The network around a person indicates the person's access and control …' (Burt, Kilduff, & Tasselli, 2013). Since the 1930s, and more so since the 1970s, SNA has been an increasingly popular tool for investigating the relationships between individuals and how these relationships affect social phenomena, such as disasters (Magsino, 2009; Scott, 2012). While once limited to the social science disciplines, this method is now applied across many disciplines, including psychology, anthropology and mathematics, because of its ability to assess network behaviour (Brandes & Fleischer, 2005), as well as enabling the forecasting of network behaviour (Borgatti, 2005).

SNA is the process of mapping and measuring relationships among actors (Carrington, Scott, & Wasserman, 2005), which provides both a visual and mathematical analysis of network relation and is thus, of value to studies of social relations, as is social resilience. A social network is a social structure consisting of social actors and the ties between these actors. As Prell (2012, p. 1) states:

> This approach involves theoretical concepts, methods and analytical techniques to
> undercover the social relations that the individuals and groups together, the structure
> of those relations, and how relations and their structures influence (or are influenced
> by) social behaviour, attitudes, beliefs, and knowledge.

Network actors can be individuals or communities, and ties can be relationships, connections or interactions. Social network theory views social relationships in terms of individual actors within the networks and the relationships between the actors (D'Andrea, Ferri, & Grifoni, 2010).

Prior research demonstrates that social network theory plays a significant role in identifying and quantifying informal and hidden networks in complex and dynamic environments, as well as in recognising network properties such as the most influential

actors and the type of relationship among the actors (Mullen & Eduardo, 1991; Uddin & Hossain, 2009). In addition, social networks have been analysed to identify areas of strengths and weaknesses within a community, as well as to evaluate the performance of individuals, communities or the entire social network (Owen-Smith, Riccaboni, Pammolli, & Powell, 2002).

The relation between network actors is varied and can be studied based on the purpose of the research. In this sense, SNA is more of a method than a theory since theory can be applied to the design and used to develop research questions that are then tested using SNA. While social network theory posits that networks are expressive of relationships and can be studied to give meaning to social phenomena (Krause, Croft, & James, 2007), developing a model of shared information in social networks is also grounded in social capital theory. The central theme of social capital theory is that 'capital is captured in social relations and that its capture evokes structural constraints and opportunities as well as actions and choices on the part of the actors' (Lin, 2002a). I am, therefore, proposing the use of SNA for systematically capturing these social relations and using the metrics to make inference as to social resilience. SNA facilitates the examination of how community members interact with each other and the identification of informal connections within a community. These networks provide ways for individuals and, more broadly, communities to gather information and make informed decisions, leading to actions (Freeman, 1978, 1979).

In general, analysis of social networks is conducted by two approaches: (i) a socio-centric approach focusing on the broader network, or (ii) an egocentric approach focusing on an individual actor within the network (Chung Hossain, & Davis, 2005). In an egocentric approach, the node of interest is the ego (e.g., a single actor in the network on whom the study is focusing), and its immediate neighbours are the 'alters'; however, a socio-centric approach concentrates on the network more broadly (Chung & Hossain, 2009). For disaster research, each of these approaches has value, as it is important to understand social resilience at the individual and community level. For this reason, the four SNA approaches presented herein focus on both the individuals within the network and on the network as a whole.

5.2 Exploring Disaster Resilience Through Social Network Theories

Before presenting the proposed addition of social network methods to the study of social resilience, it is important to provide a baseline understanding of the theories that guide these considerations. To this effect, I briefly introduce social network theories that are applicable not only to future SNA studies, but also to understanding the data and social resilience framework presented within this research. I begin with a broad discussion of social network theory and social capital theory as justification for the inclusion of social network metrics into the social resilience framework. I then more narrowly focus on structural holes theory and tie strength theories and the application of these theories in research on disaster social resilience to understand the application of these metrics and their implications for social resilience.

Applying those theories to the community may enhance social resilience; however, testing the theories is required by future research. In other words, while this section introduces each of these theories and the relevance of their tenets for the proposed approaches and associated change to the framework, the approaches and subsequent statistical analysis would have to be enacted in the context of a disaster-affected community to provide more meaning to the theoretical application of social networks and related theories.

5.2.1 Social Network Theory and Social Capital Theory

To understand structural holes theory and tie strength theory, one must have a basic understanding of social network theory and social capital theory. Social network theory assumes that relationships between actors have meaning and that these relationships can be measured to understand the interaction among actors in the network (Kadushin, 2004a). In the context of disaster studies, these interactions are understood to have an impact on resilience to and recovery from disaster. Similar to social network theory, social capital theory also provides that social networks have meaning, but adds that these networks can be understood based on their impact on human development (Lin, 2002a). According to Reininger et al. (2013, p. 1):

> Examination of social capital and its relationship to disaster preparedness has grown
> in prominence partially due to worldwide need to effectively respond to terrorist
> attacks, viral epidemics, or natural disasters. Recent studies suggested that social

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capital may be related to a community's ability to plan for and respond to such disasters.

While the academic interest is in the role of social networks and social capital in disaster resilience and recovery, SNA is an innovative approach for quantitatively measuring the tenants of these theories.

5.2.1.1 Applying Social Capital Theory to Communities

Social capital is critical in disaster recovery. Community volunteerism is a function of social capital. Moreover, as Nakagawa and Shaw (2004, p. 5) argue, 'Social capital, which is defined as a function of trust, social norms, participation, and network, can play an important role in recovery'. Since Nakagawa and Shaw (2004) note that participation and networks are part of social capital and that social capital is important for recovery, I assert that volunteers, as participants in the recovery process, enhance the social capital of the community and thereby improve recovery outcomes in the event of a disaster and resilience in preparation for a future disaster. The direction of impact is multidirectional in that volunteers both provide and gain social capital through the process of volunteering, and multifaceted in that there are many aspects of volunteerism that foster social capital in regards to disaster resilience and recovery. As social capital is engrained in community structure and social networks, volunteerism in communities is often directly related to the concept of social capital (Lin, 2002b). This theory is inherent in all the social network approaches proposed in this chapter.

5.2.2 Structural Holes Theory

In 1973, Mark Granovetter demonstrated that one significant aspect of social structure is the presence of weak ties in social networks through its novelty to flow (Granovetter, 1973). Then, in 1992, Burt (1995) took Granovetter's argument a step further with the concept of structural holes. He focused on network position, in particular individuals' positions, rather than network structure and relations (Burt, 1995). A hole in the network indicates the absence of a connection or tie that could link unconnected clusters together. Individuals who connect these holes hold a valuable position for distributing information in the networks. His theory demonstrates that individuals receive more social benefits in terms of interacting with others and non-redundant and novel information if connected to others who are not well connected themselves, thus

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indicating the reasons that some individuals perform better than others (Abbasi, Chung, & Hossain, 2011).

Burt (1995) argues that the network is inefficient if the network size, or the number of contacts, is increased without considering the diversity reached by the contacts. Thus, the number of non-redundant contacts plays a significant role in the network because this group provides novel information, while redundant contacts provide the same information. In this theory, effectiveness and efficiency are two different concepts: 1) effectiveness indicates the average number of people reached per primary contact and is about the yield per primary contact; 2) efficiency denotes the total number of people reached with all primary contacts and is about the yield of the entire network. The constraint notion in this theory is based on an individual's time and energy in relation to other nodes (Burt, 1995). Constraint measures the extent to which an ego is connected to others who are connected to one another (Hanneman & Riddle, 2005) and it measures redundancy of contacts. Therefore, individuals with high constraint indices are unable to receive novel information due to redundant information from a connected group of individuals (Abbasi Chung, & Hossain, 2011). Previous studies have demonstrated that networks with high efficiency and low constraint indices enhance an individual's ability to produce novel information (Burt et al., 2013). All four social network approaches presented within this chapter test the role of social networks and the impact of access to social capital through these networks on social resilience.

5.2.2.1 Applying Structural Holes Theory to Communities

In crises, a hole in the network can be the absence of relations among emergency organisations and the public. Volunteers have a good position in the network structure to bridge these holes and disseminate the information between emergency organisations and the public to assist and help both. Volunteers attain an advantageous position that yields information and control benefits. They can be part of emergency organisations because they are trained for this and they have enough knowledge and efficient contact with emergency organisations to help others. Moreover, they are from the public, so they have good information about the public. In addition, they can add value to the network efficiency because efficiency is about the yield of information to the entire network. By increasing volunteers by a limited number, the efficiency of the network is improved. Further, the volunteers' community restricts connections to only a main

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node, such as one emergency organisation, which makes the network constraint decrease. In conclusion, high efficiency and low constraint networks are ideal network constructs for a volunteer's community to respond to disaster in a well-organised manner and assist both emergency organisations and the public to respond quickly, and exchange information appropriately, thus leading to enhanced social resilience. This theory will be revisited in the third social network approach proposed in this chapter.

5.2.3 Tie Strengths Theory

Also in 1973, Mark Granovetter established the theory of the strength of weak ties (Granovetter, 1973). His theory indicates that an individual attains new and novel information from weak ties rather than from strong ties in the social network because new information originates through weak ties, which serve as bridges to different clusters of people (Chung & Hossain, 2009). In contrast to Granovetter's theory, in 1992, Krackhardt (1992) presented the theory of the strength of strong ties, which asserts that strong ties are important in the generation of trust (Krackhardt, 1992). Afterwards, Levin and Cross (2004) found that strong ties, more than weak ties, lead to the receipt of useful knowledge for improving performance in dynamic and uncertain environments. They argue that weak ties provide access to novel and non-redundant information and facilitate useful information to be found; however, strong ties foster complex knowledge transfer, if knowledge is highly complex (Abbasi, Altmann, & Hossain, 2011).

5.2.3.1 Applying the Strength of Strong/Weak Ties Theory to Communities

Trust and the transfer of novel information are two primary social resilience indicators in complex networks, and uncertain situations and the strength of strong ties theory are based on the trust concept being present among nodes. Thus, applying both theories— the strength of strong and weak ties—facilitates communities to generate trust and build social resilience. The strength of strong ties theory shows that strong ties are important in the generation of trust. In dynamic situations, the receipt of useful knowledge and trust is key for improving performance and coordination, and for increasing resilience within communities. Prior studies have demonstrated that communities initially tend to rely on stronger ties for the resource and information demand in crises and only activate weaker ties when resources and information are insufficient (Kapucu, 2005). Thus,

communities depend on emergency organisations that have more knowledge and more convenient communication structures. If resources are insufficient, they can rely on volunteers and their respective community organisations.

Applying the strength of weak ties theory, rather than strong ties theory, to the volunteer community allows for the obtainment of new and novel information. Volunteers can be bridges to different clusters of people and provide access to non-redundant information. Weak ties provide novel and non-redundant information, which can lead to a quick response to disaster, increase community efficacy, improve community performance and leadership, and in the end, enhance social resilience. From the above theories, I concluded that volunteers have a significant role in social networks and stand in a unique position to enhance and improve social resilience. Therefore, the next step in this research was to concentrate on the role of volunteers in the network and explore how they facilitate the community to enhance social resilience.

Regarding the social networks of disaster victims, the second and fourth approaches proposed in this chapter test the strength of ties theories. The second approach will assess access to external networks (weak ties) and the fourth approach will assess differences between strong connections to a local network, referred to as a clique, and weaker networks to the broader network.

5.2.4 Towards Social Network: An Enabled Model for Social Resilience in Disaster

To examine the community network structure and their relationships in a crisis, it is necessary to combine both social network and social resilience perspectives. The former focuses on an understanding of the relationships between actors and the latter focuses on an understanding of the factors that are indicative of social resilience. Social network theory provides a basis for examining the network structure and allows a comparison to be made between network conditions and the state of social resilience; SNA includes the statistical evaluation of a network and not just a broad evaluation of the impact of a network. Simply put, one can study social networks simply by asking respondents about their network, but unless the data yields the mapping and quantitative assessment of these networks, then it is not true SNA.

This research proposes the use of SNA metrics for statistical analysis of the networks of communities and their constituent individuals to advance my understanding of these

networks in social resilience and recovery. Thus, in applying SNA to study the network functions of social resilience, I am advancing the proposed model of social resilience. Informed by the social network literature, I begin with the following research questions and associated hypotheses, which will be further discussed within this chapter, including methods for collecting and analysing the necessary data, as well as the proposed methods for using the statistical significance of the metrics to advance the social resilience framework:

Overarching question: What are the social network implications for social resilience?

Sub-question #1: What are the implications of one's network positionality on one's social resilience? H1: Individuals' centrality correlates to social resilience; H1a. Individuals' degree centrality correlates to social resilience; H1b. Individuals' closeness centrality correlates to social resilience; H1c. Individuals' betweenness centrality correlates to social resilience

Sub-question #2: What are the implications of network structure on social resilience? H2: Network structure correlates to social resilience; H2a. Network density correlates to social resilience

Sub-question #3: What are the implications of network composition on social resilience? H3: Network composition correlates to social resilience; H3a. The centrality of community leaders in the network correlates to network social resilience; H3b. The network connections to external networks correlate to network social resilience; H3c. The overall socioeconomic status of the network correlates to network social resilience; H4: Local network composition correlates to social resilience; H4a. One's access to community leaders correlates to one's social resilience; H4b. One's access to external networks correlates to one's social resilience; H4c. One's socioeconomic status correlates to one's social resilience

Sub-question #4: What are the implications of one's local network compared with that of one's global network for social resilience? H5: One's social resilience is more relative to one's local network than to the global network; H5a. One's clique is more predictive of one's social resilience than that of the global network; H5b. The

socioeconomic status of one's local network is more predictive of social resilience than the global network

A single SNA approach to measuring the networks would not be sufficient to advance my understanding of social resilience through the networks because both the literature and the proposed social resilience framework demonstrate that social networks are not monolithic. They can be understood in many different ways and have multiple aspects of their structure and composition that affect the composite resilience of the members, as well as the individual resilience of network actors. I now provide more details on the four approaches of SNA that can be applied to the study of social resilience to advance the current model and state of literature. These use SNA metrics as the independent variable and social resilience through shared information as the dependent variable. Approaches 1 and 4 are egocentric, while approaches two and three are socio-centric. Based on the results from the literature review and the previous chapters, shared information is considered a proxy for social capital. Thus, the overarching research question for these methods is: **What are the social network implications for social resilience?** In the context of disaster research, social capital can be measured through aspects of functions and constraints within networks that yield differential results (cf. Lin, 2002a), herein considered to be varying levels of resilience and recovery. After I present each of the four approaches to incorporating SNA methods and associated theories, I then discuss how the findings of these approaches can be incorporated into the model of social resilience.

5.2.4.1 Identifying the Network

To conduct these four studies, I would first need to collect the necessary SNA data. The four approaches presented all rely on the same data, but use it to address different aspects of social capital through social networks. The first step in collecting this data is to identify the network from which you intend to collect primary data. As noted by Magsino (2009), the characteristics that promote resilience and recovery are those that allow a community to thrive in non-disaster times. Thus, while it is not necessary to knowledge gathering that the network be affected by a disaster, if would be beneficial. In identifying a network, I provide two recommendations: 1) if a network is identified that has been affected by a disaster, it is important to collect cognitive longitudinal data for which the individuals in the network are asked to think back to their network prior to

the disaster to provide information on their post-disaster network and to provide information on their personal levels of resilience and recovery; and 2) it is important that the network be bounded for the purpose of identifying all individuals in the network. This entails defining who is and is not included in the network. While social settings generally do have natural boundaries, it would be important for sampling to determine our network actors prior to data collection. Next, I would have to identify the nature of the actors in the network. For instance, if I was interested in applying social network methods to one of my case studies, such as Wagga Wagga, I would note that the Wagga Wagga City has 64,748 residents and 24,825 households (City of Wagga Wagga, 2016). For most researchers, cost and time limitations would prevent data collection from so many actors, whether at the individual or household level. Thus, certain neighbourhoods or networks within the City of Wagga Wagga would need to be identified. One option is to compare two neighbourhoods based on a characteristic that distinguishes them. For instance, Kapooka has a population of 341 and a median income of $40,248 and Moorong has a similar sized population at 360, but a median income of $29,900 (Find the Best, 2016).

5.2.4.2 Data Collection

After the network has been identified, it is necessary to collect primary data on network relationships from the actors that comprise the network, unless this data is already available as a secondary data set. This is most commonly achieved by a survey instrument that asks respondents, as members of the network, either to identify others in the network based on a qualification or attribute, or to choose from among a list of network members those with whom they have a relationship, as defined by the survey instrument. The data collection must be able to provide the metrics outlined in Table 26, which will be more thoroughly introduced in the next section, as well as the associated hypotheses.

SNA Approach	Metric Level	Metric
Approach #1	Actor level	Degree centrality
		Betweenness centrality
		Closeness centrality
Approach #2	Network level	Density
Approach #3	Actor level	Access to community leaders
		Access to external networks
		Socioeconomic status
	Network level	Inclusion of community leaders
		Inclusion of access to external networks
		Socioeconomic status
Approach #4	Comparison of local and global network	Clique
		Socioeconomic status

Table 27. Metric outline

Data on social resilience will also need to be collected from each actor. This can be accomplished by deriving scales from the 14 social resilience indicators to generate an index of social resilience. Each actor can rate their perception of self-efficacy in terms of the 14 indicators and their responses can then be totalled to provide a social resilience score for each actor. This metric will be necessary to test the statistical significance of the hypotheses associated with each of the four SNA approaches.

Finally, to compare network metrics across the three phases of disaster, I propose collecting data in a community that has been affected by a disaster and asking respondents to reflect on their networks across the three phases of disaster. This will later allow the social network metrics from the four approaches that will be proposed in this chapter to be statistically tested and incorporated into the model proposed in the previous chapter.

5.2.4.3 Social Network Data Analysis

Once the data on relationships among actors in the network are collected, they can be entered into a SNA software program, such UCINET (Borgatti, Everett, & Freeman,

2002). UCINET is able to produce the data needed to address the research questions presented in the following four approaches, as well as to map the networks under different scenarios.

5.2.4.3.1 Implications of One's Position

First, SNA can be used to assess the implications of one's position within the network on one's disaster resilience and recovery. In assessing the research question—What are the implications of one's network positionality on one's social resilience?— I propose an SNA design that assesses the positionality of network members to assess its relationship with access to social capital, and thereby their social resilience. In this design, network positionality can be measured by actor centrality and can be hypothesised to equate to access to resources, including information. Centrality has a significant structural influence on the performance of a node in a crisis to enhance social resilience (Freeman, 1979). An individual or node can be central from both the local and global perspective. A node is locally central if it has a large direct neighbourhood of nodes, while it is globally central if it has a position of strategic significance in the overall structure of the network (Abbasi, Altmann, & Hossain, 2011). The centrality of one's position within the network can be measured by degree centrality, closeness centrality, or betweenness centrality (Prell, 2012).

Degree centrality refers to the number of relationships that the actor has within the number (Carrington et al., 2005; Prell, 2012). Thus, an actor that knows five people in the network has a higher degree of centrality than an actor that knows four people in the network. Closeness centrality refers to how close the actor is to the other actors in the network or the ability to reach all other actors in the network (Prell, 2012). Finally, betweenness centrality refers to the actors' ability to connect otherwise non-linked actors in the network and thus serve in a broker role by virtue of being situated in the pathway of connectedness between other actors (Prell, 2012). Betweenness (geothic path) centrality is strongly related to the number of shortest paths on which a node lies between all pairs of nodes in the network. When it is not possible to capture a global view of all connections or links of a network, such as in the case of a mobile network, emphasis is given to the ego network, which only considers the connections between a node and its neighbours, and the connections among its neighbours. A betweenness of ego network is referred to as ego-betweenness. In this research, to measure

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betweenness, I consider shared information indicators in all disaster phases. Relating this approach back to the sharing of information, these measures of centrality are of interest based on their hypothesised level of access to information that is capable of yielding greater resilience and recovery. Since individuals with more connections, either directly (degree centrality) or indirectly (closeness centrality), will have increased access to other actors (including any information these actors have to share), they are hypothesised to have greater resilience based on the finding that shared information is highly correlated with social resilience. Individuals that connect otherwise unconnected actors serve in a valuable role for brokering information, in that they are uniquely capable of providing information between the two networks that might not otherwise be circulated between the two. Moreover, these individuals are hypothesised to have greater social resilience based on both their value to others in the network and their access to unique information from the networks. Based on these assertions, I state the hypotheses of the SNA approach to studying the implications of one's network centrality on his/her social resilience as follows:

H1: Individuals' centrality correlates to social resilience.

> H1a. Individuals' degree centrality correlates to social resilience.

> H1b. Individuals' closeness centrality correlates to social resilience.

> H1c. Individuals' betweenness centrality correlates to social resilience.

To test these hypotheses, each of the three measures of centrality—degree centrality, closeness centrality and betweenness centrality—would then be correlated with the actor's social resilience score. This SNA approach, through conducting this correlation between SNA metrics of centrality and a composite social resilience score, seeks to assess the statistical significance of one's position within a network to one's social resilience.

To present a model of how SNA methods can be incorporated into the proposed framework of social resilience, I address the inclusion of shared information and exchange of information as independent variables of social resilience affected by social network factors, focusing on betweenness centrality and degree centrality. This demonstration is further discussed in Section 5.2.4.4, Future Preliminary Proposed

Model, and depicted in Figure 24. In acknowledging that this demonstration partially assesses the impact of social networks on social resilience, the remainder of the hypotheses are provided as direction for future research and are recommended for assessing shared information and exchange of information, as well as the other social resilience factors that can be hypothesised to be accommodated, promoted or hindered by social network structures.

5.2.4.3.2 Implications of Network Structure

Second, SNA can be used to study the implications of network structure on disaster resilience and recovery. In assessing the research question—What are the implications of network structure on social resilience?—we propose an SNA approach that assesses social resilience as the dependent variable and network density as the independent variable. Density refers to the degree to which the actors in the network are connected to each other. Denser networks have more connections and can be theorised to work more closely together. In regards to information, this means greater access to information for the members of the network. For instance, in a network of 100 individuals there are 4,950 possible undirected dyadic relationships. If the network has a density of 50%, then half of these relationships, or 2,475, are present in the network. Whereas the first SNA approach focuses on metrics associated with each individual actor in the network, this approach is a measure of the whole network. Networks with greater density are concluded to have higher levels of social capital (Aldrich, 2012). In the context of a disaster, networks with greater density are likely to have higher levels of volunteerism, which is essential for ensuring the necessary labour for recovery (Stewart et al., 2014). Moreover, networks with greater density are expected to have more social capital and thus more social resilience, as individuals in these networks are more likely to exhibit integrated behaviours towards social goals. Based on these assertions, I state the hypotheses of the SNA approach to studying the implications of network structure on social resilience as follows:

H2: Network structure correlates to social resilience.

      H2a. Network density correlates to social resilience.

As density is calculated at the network level, the density of a single network cannot be correlated to its social resilience. Unless this approach were applied across many

different networks of comparable network size (or a normalised centralisation measure is used), the correlation is not appropriate for analysing the relationship between density and resilience. An alternative option would be to identify clusters within a larger network and to compare the density measures of these smaller networks with their averaged social resilience score. This would allow researchers to test the above hypotheses only if enough sub-networks could be identified in the network to achieve a sample size large enough for statistical analysis. This SNA approach, through conducting this correlation between SNA metrics of density and a composite social resilience score, seeks to assess the statistical significance of network structure for social resilience.

5.2.4.3.3 Implications of Network Composition

Third, SNA can be used to assess the implications of network composition on disaster resilience and recovery. In assessing the research question—What are the implications of network composition on social resilience?—we propose an SNA approach that assesses social resilience as the dependent variable and the characteristics of the network (e.g., access to community leaders, access to outside networks, socioeconomic status of the network members) as the independent variables. According to Butler and Sayre (2012), the network presented in Figure 23 represents the ideal social network for resilience. Therefore, I propose an SNA approach that tests networks against this ideal network. Like the second approach, this approach focuses on the network as a whole to assess composition, but it can also be used to focus on both the individual level to assess individuals in power and on outside networks. This approach is also designed to test Burt's (1995) theory of network efficiency because it not only analyses the composition of the network beyond assessing the number of contacts, but it also considers the quality of contacts in addressing access to community leaders. Moreover, this approach accounts for constraint and redundancy of information by assessing access to novel information coming from external networks (Abbasi, Chung, & Hossain., 2011). Previous studies have demonstrated that a network with high efficiency and low constraint indices enhances an individual's ability to produce novel information (Burt et al., 2013).
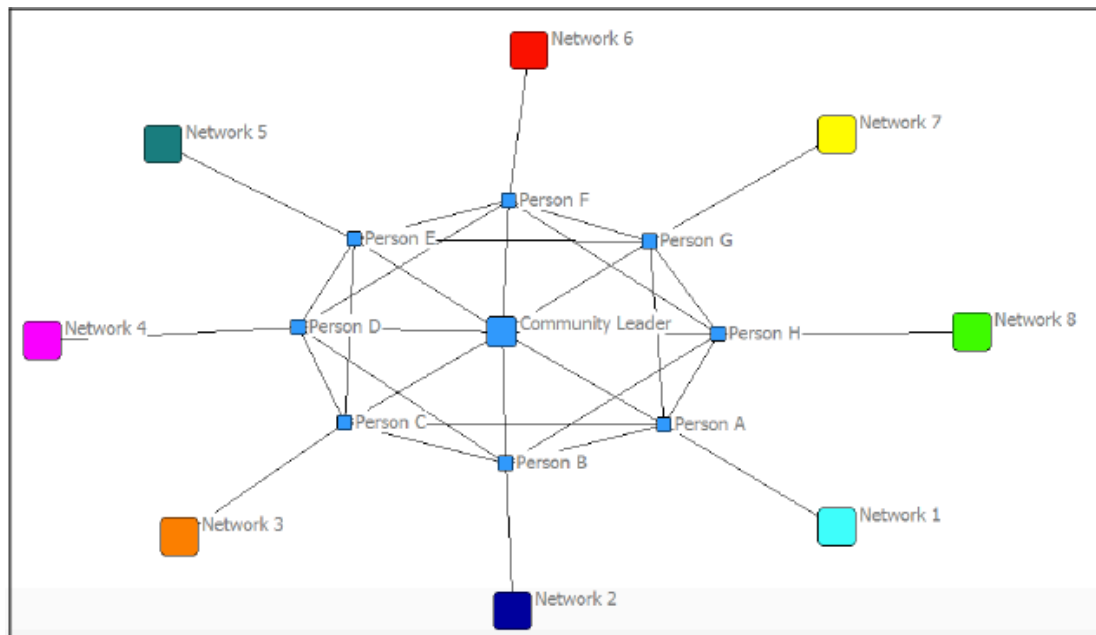
Figure 23. The ideal social network for resilience

The hypotheses for this approach are thus proposed at both the network and individual level. However, to test the network social resilience at the network level, I must repeat the same caveats of sample size introduced in the second approach. This renders the individual metrics more easily tested in reference to the hypotheses. At the network level, I hypothesise that:

H3: Network composition correlates to social resilience.

> H3a. The centrality of community leaders in the network correlates to network social resilience.

> H3b. The network connections to external networks correlate to network social resilience.

> H3c. The overall socioeconomic status of the network correlates to network social resilience.

Similar hypotheses can also be tested at the individual level by assessing one's local network rather than the global network structure. At the individual level, I hypothesise that:

H4: Local network composition correlates to social resilience.

> H4a. One's access to community leaders correlates to one's social resilience.

> H4b. One's access to external networks correlates to one's social resilience.

> H4c. One's socioeconomic status correlates to one's social resilience.

Hypothesis 4 could be tested using a single network as it looks at the metrics of individual actors in the network. However, Hypothesis 3 would require 1) the study and comparison of multiple similarly sized networks, or 2) the study of and comparison of multiple sub-networks of a larger network, or 3) the substitution of qualitative analysis of the network to assess the impact of composition on social resilience. This SNA approach, through conducting this correlation between SNA metrics of composition and social resilience scores at the network and/or individual level, seeks to assess the statistical significance of network composition for social resilience.

5.2.4.3.4 Implications of One's Local Network

Finally, SNA can be used to compare the implications of one's local network to that of the global network in reference to disaster resilience and recovery. Empirically, one position within the network cannot provide all the necessary data needed to understand differences in social resilience. While the first approach assesses centrality using degree centrality, betweenness centrality and closeness centrality, the second approach assesses network density, and the third approach assesses network composition using access to community leaders, external networks and socioeconomic status, this fourth approach assesses one's social resilience relative to the other actors in the network. The first three approaches thus correlate a network metric to social resilience. This approach, however, assesses one's social resilience within the network in comparison with others in the network. As not all individuals in the same network can be expected to have the same access to resources within the network, I hypothesise the following:

H5: One's social resilience is more relative to one's local network than to the global network.

> H5a. One's clique is more predictive of one's social resilience than that of the global network.

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H5b. The socioeconomic status of one's local network is more predictive of social resilience than is the socioeconomic status of the global network.

In Hypothesis 5a, clique is defined as 'a sub-set of a network in which the actors are more closely and intensely tied to one another than they are to the members of the network' (Hanneman & Riddle, 2005). These cliques are often based on homophily, which refers to shared characteristics such as education, race and values. To test Hypothesis 5a, I propose using K-plex metrics for identifying cliques within the network. The average social resilience of the cliques can then be calculated to develop metrics of more localised social resilience. By calculating both social resilience and socioeconomic levels for each of the K-plex groups in the Knoke reciprocity-symmetrised information networks, I can then assess differences in the cliques to determine whether the members of the clique are more similar to other members of their clique in terms of social resilience than to members of the global network. Analysis of variance is then proposed to test the statistical differences between the cliques. This SNA approach, through analysing the differences in social resilience scores at the clique level, seeks to assess the statistical significance of one's local network relative to the global network for social resilience.

5.2.4.4 Future Preliminarily Proposed Model

The four approaches proposed for the incorporation of SNA into the social resilience framework provide data on the impact of social networks on social resilience at multiple different levels of analysis. The next step is to incorporate the anticipated findings of the proposed approaches back into the social resilience framework. To this effect and for the purpose of demonstration, I focus on the social network aspects of exchange of information and shared information. These two factors are ideal for the purpose of demonstration as 1) these two factors have been demonstrated within this research to be highly correlated with social resilience and 2) the literature that supports the use of SNA is the study of information flow through networks. As highlighted by Haythornthwaite (1996, p. 323):

> SNA is an approach and set of techniques used to study the exchange of resources among actors (i.e., individuals, groups and organisations). One such resource is information. Regular patterns of information exchange reveal themselves as social

networks, with actors as nodes in the network and information exchange relationships as connectors between nodes.

Along these lines, I assess the connections between network actors as a measure of the ability to exchange and share information. Specifically, I propose betweenness centrality as a measure of shared information and degree centrality as a measure of exchange of information.

Shared Information has been defined throughout this study as the sharing of information, such as through social media, television and radio, and follows the one-to-many concept of mass communication. In the development of the framework presented in the previous chapter, the following statements were used to assess shared information and to subsequently assess the relationship between shared information and social resilience: 1) Pre-disaster: People in my area had access to social media and the internet before the disaster; 2) During the disaster: During the disaster, people in my area shared information about the disaster with their neighbours through different channels (social media, face-to-face, etc.); and 3) Post-disaster: People in my area have been actively involved in community groups and sporting, scouts/brownies, religious groups, etc.

Shared information, as demonstrated in these statements, flows through established social networks and is hypothesised to be measurable through betweenness centrality. To access this assertion, I have correlated these social network metrics as proxies of shared information to assess their value in developing a more comprehensive understanding and framework of social resilience.

Similarly, the exchange of information is also tested to demonstrate the value of SNA in the broader study of social resilience. Specifically, I define the exchange of information as the interchange of information among a community, herein referred to as network actors. While shared information is conceptualised as one-to-many, exchange of information is conceptualised as bidirectional and, as such, is hypothesised to be measured as the dyadic level in SNA. In the development of the framework presented in the previous chapter, the following statements were used to assess exchange of information and to subsequently assess the relationship between exchange of information and social resilience: 1) Pre-disaster: People in my area had met each other at different places, such as social clubs (RSL), service groups, sports teams, churches, library, or ethnic/ multicultural clubs; 2) During the disaster: People in my area

communicated and exchanged information with each other during the disaster; and 3) Post-disaster: People in my area discussed problems and issues caused by the disaster with their neighbours after the disaster.

Like shared information, these statements provide that the exchange of information also can be hypothesised to flow through social networks and be measured by degree centrality. To access this assertion, I have correlated this SNA metric of the exchange of information to assess its value in developing a more comprehensive understanding and framework of social resilience.

Figure 24 illustrates the development of a proposed model to explore the impact of social network centrality on social resilience in which social resilience is the dependent variable and social network variables are the independent variables. As 1) social networks can be measured based on the individual centrality and tie strength of the network actors, 2) centrality can be measured as betweenness, degree and closeness, and 3) social resilience is composed of outcome expectancy in all three phases of disaster, Figure 26 is put forth to visualise the relationships at hand in this example of the incorporation of SNA for advancing the model of social resilience. In this model, I depict the relationship between betweenness centrality (shared information) and degree centrality (exchange of information) as independent variables and outcome expectancy in terms of social resilience, which is tested using the correlation between the SNA metrics and the social resilience data. Finally, the model demonstrates that exchange of information and shared information have the same level of correlation with social resilience. In this model, social network metrics are limited to the exchange and sharing of information, whereas social resilience comprises all resilience indicators within community. Thus, I provide this example as a method for the incorporation of SNA metrics into the model and I direct future research towards replicating this approach to test the other social network elements. This model proposes that both individual centrality and tie strength parameters have an impact on resilience indicators.

In this study, I have only reviewed two independent variables (shared information and exchange information) and their impact on social resilience; however, to have a comprehensive model, researchers in future should consider all social network independent variables, including tie strength and centrality (betweenness, degreeness and closeness). In fact, centrality determines the relative importance of a node within

the network. In this research, I only focus on betweenness centrality and degree centrality as independent variables. Next, I examine how dependent variables are affected by independent variables. This proposed next step using SNA includes one hypothesis with two sub-hypotheses:

H1: Individuals' centrality correlates to social resilience.

   H1a. Individuals' degree centrality correlates to social resilience.

   H1b. Individuals' betweenness centrality correlates to social resilience.

In Hypothesis 1, I am essentially hypothesising that individuals who are central actors in their social network will have greater outcome expectancies in terms of social resilience. Next, Hypothesis 1a and Hypothesis 1b postulate this for two similar measures: degree centrality and betweenness centrality. Thus, to recognize networks, their participants and determining the importance of a node in the network is to evaluate nodes or individuals' location in the network through its centrality.

The centrality of individuals or nodes can be measured by their number of links (degree centrality), their proximity to all other individuals (closeness centrality) and the extent to which the individual is located among each pair of individuals (betweenness centrality) within a community. Therefore, I expect that the location of individuals in a network (called the nodes' centrality measure) who are involved in a response to a disaster could affect social resilience. Degree centrality highlights the node with the most links to other nodes in the network, reflected by having more direct contrast and adjacency than all other nodes in the network (Carrington et al., 2005). In this research, to measure degreeness, I considered the exchange of information indicator in all disaster phases.
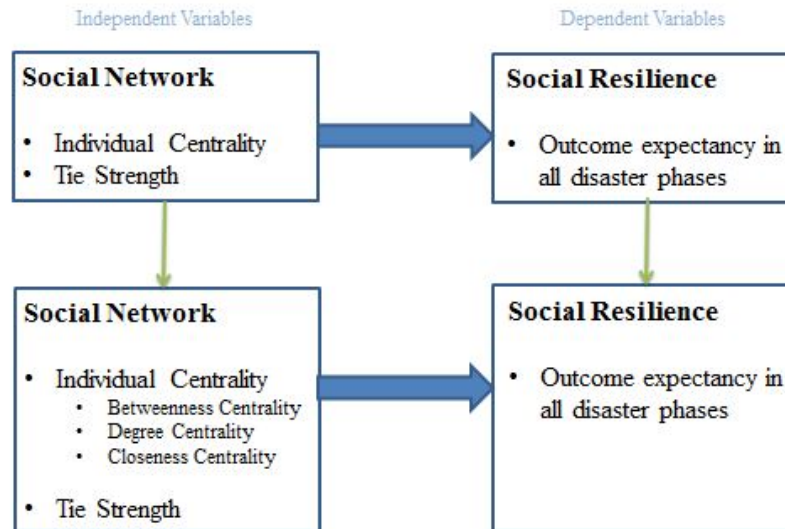
Figure 24. Social network proposed model

Once the SNA data have been collected using SNA methods, they can then be tested using ordinary least squares regression in which social resilience is the dependent variable and social network metrics are the independent variables, controlling for other variables known to affect social resilience. Finally, once the SNA metrics have been added to the proposed model based on the statistical analysis methods outlined herein, they will be need to be correlated to the other social resilience indicators in the same cell (i.e., high level of impact—pre-disaster), to control for colinearity. This step is conducted based on the underlying assumption that many of the social resilience indicators included in the proposed model prior to the addition of the social network are already based on social structures, and 'access' to these indicators is based on social networks. Thus, correlation will reveal whether any of the existing measures share a strong relationship with any of the added social network metrics.

In this study, I have demonstrated only how betweenness centrality (shared information) and degree centrality (exchange information) as independent variables affect social resilience. To produce a comprehensive model, future research should consider closeness centrality and tie strength as well, and find appropriate variables to measure all social network variables on social resilience.

5.2.5 Considerations for the Inclusion of Social Media

While this chapter has outlined the inclusion of SNA as a method of data collection and analysis and social network metrics as a form of data, it has yet to acknowledge the growing role of social media as a form of communication within social networks and as a tool for disaster resilience. While disaster victims have been historically limited to communication with other disaster victims by limited communication technology, social media is a form of peer-to-peer networks that allows individuals the opportunity to reach non-affected networks in the event of a disaster.

Social media has also been demonstrated to be a key instrument of communication at the community level for improving disaster resilience. Dufty (2012) outlines how social media can be used to improve resilience by its incorporation into the Australian National Strategy for Disaster Resilience. As of 2011, social media was the fourth most relied on source for disaster communication and common disaster-related uses include:

> … using the medium to conduct emergency communications and issue warnings; using social media to receive victim requests for assistance; monitoring user activities and postings to establish situational awareness; and using uploaded images to create damage estimates, among others. (Lindsay, 2011, p. 4)

Social media provides individuals with the ability to reach a large portion of their social network with one channel of communication. Although the proposed SNA additions to the social resilience model to not directly access social media usage, access or networks, many of these factors are accounted for in traditional SNA metrics. However, if needed, a measure of social media usage could be incorporated into the proposed model as an independent variable alongside the SNA metrics.

5.3 Chapter Summary

In chapters 3 and 4, I developed and proposed a model for social resilience to disasters, highlighting 14 social resilience indicators. Among these, I focused on two social resilience indicators that relate to social networks in the context of disasters: shared information and social resilience (rho = 0.742, $p \leq 0.000$ at 2-tailed, n=66) and exchange of information and social resilience (rho = 0.578, $p \leq 0.000$ at 2-tailed, n=64). The proposed model supports these indicators as statistically significant indicators of

social resilience and the literature supports that these indicators are indeed factors of social resilience. In addition, they are factors commonly accessed through social networks and associated social capital. In this chapter, I consequently proposed the application of SNA to advance the social resilience framework, including a model depicting the relationship between these two indicators and the factors of social resilience.

As systematically outlined in this chapter, I have proposed a five-step approach to improving the framework using SNA. **First**, identify the community/disaster/network. **Second,** collect the data from the identified network on networks in each of the three disaster phases. **Third**, analyse the data through four social network approaches. The four social network approaches were as follows: 1) impact of one's position within the network on one's social resilience, 2) impact of network structure on social resilience, 3) impact of network composition on social resilience, and 4) differences in the impact of local and global networks on social resilience. **Fourth**, use the p values of the statistically significant social network metrics to identify their respective levels of impact in the social resilience framework. **Fifth**, add the social network metrics to the framework in the appropriate phase and level of impact cell. This chapter has outlined the implementation of these five steps for future application to the study of social resilience to both improve the framework for social resilience and improve policy implications for generating actionable items from the framework aimed at improving community resilience.

To emphasise the ability of SNA to improve the social resilience framework, I focused on the sharing and exchange of information. Specifically, I demonstrated that betweenness centrality as a network measure of actor position can be substituted for shared information in understanding social resilience and that degree centrality as a network measure of the number of individuals with whom an actor has a relationship can be substituted for exchange of information in understanding social resilience. Based on this example, future research is charged with the further incorporation of SNA metrics into the framework of social resilience.

Chapter 6: Conclusion and Future Discussion

As both the frequency and impact of disasters is on an upward trajectory (Pollach, 2014), it is critical that factors of social resilience are better understood because this knowledge could be used to promote resilience and mitigate the societal impacts of future disasters. In other words, I study past disasters to plan for future disasters by identifying the indicators of social resilience. Based on identifying a gap in the literature on social resilience, this research has identified the need for a holistic framework to quantify social resilience for enhancing the ability of communities to withstand the system shocks commonly associated with disasters. Despite considerable research interest in community resilience to disasters, this research serves as the first published study of social resilience across the three phases of disaster (i.e., pre-disaster, response and recovery).

To fill this gap, this research has employed a sequential mixed methods study to advance the state of knowledge on holistic social resilience to disasters. The study has focused on Australia, which is particularly vulnerable to disasters, with the intention of improving the outcome of future disasters by studying the indicators of resilience in past disasters. The study began with a qualitative study to determine social resilience indicators across three case studies—Wagga Wagga, Kempsey and the Hunter Region and Central Coast. Through interviews and document review, the qualitative study produced 14 social resilience indicators and introduced a proposed framework of social resilience presenting the indicators by level of strength and phase of disaster from the SMEs' perspective. In the second phase of the study, I used a survey to assess the reliability of the proposed framework and test the proposed hypotheses through the perspectives of community members. Through these efforts in developing and testing this framework of social resilience, I seek to reduce the impact of disasters though the investment of enhancing communities and focusing on social resilience. Given the growing impact of disasters according to EM-DAT, this research has the ability of improving the lives of those who may be affected by future disasters.

This chapter draws conclusions for the development of a unified framework of the three disaster phases and concludes with considerations for future research. Specifically, I provide six questions that arise from the conclusions drawn from this study: 1) How

should investments to develop social resilience indicators be prioritised, evaluated and reported? 2) How would progress towards the development of these characteristics be assessed? 3) How can investments by governments, communities, business and individuals in disaster resilience be evaluated and reported? 4) How can future priorities for disaster resilience investments be determined? 5) Where are the areas of high and low disaster resilience in Australia? How could investments to develop disaster resilience be prioritised, evaluated and reported? and 6) How can SNA be used to improve the social resilience framework? Finally, I focus on the sixth question, relating to the role of social networks, to develop a proposal for future assessment of social resilience using SNA. Specifically, I conclude by drawing on the findings, focusing on the social resilience indicators of greatest importance to propose a social network approach to the study of social resilience. In focusing on four approaches to the inclusion of social network analysis and the systematic implementation of the SNA metrics as additional indictors of social resilience, I propose that the next step to advancing the framework presented herein is to assess the role of these factors in social resilience.

6.1 Conclusion

Conclusions are presented here for each phase of the research study. As this research employed a sequential design, the results from the first phase, qualitative research, were encompassed into the second phase, quantitative research. Thus, the final framework presented in the quantitative phase is the product of the mixed methods approach employed herein.

6.1.1 Qualitative Phase Conclusions.

Extant literature reveals that disaster resilience is a multifaceted concept, including cultural, economic, social, and environmental considerations. Moreover, each of these considerations has multiple layers and factors of consideration. Social resilience, for instance, occurs at the individual, community and organisational levels. Furthermore, these organisations and communities also have different scales to consider, such as international, federal, state, and local. Through a study of three case studies—1) the 2012 Wagga Wagga flood, 2) the 2009 Kempsey flood, and 3) the 2007 Hunter Region and Central Coast floods and storms—we have used qualitative data to outline a

proposed framework of social resilience within communities. This framework is built on the identification of 14 social resilience indicators (in alphabetical order): community efficacy; community participation; coordination; coping style; demographic information; education; exchange of information; improvisation; leadership; learning; shared information; social support; sense of community; and trust. These indicators have been identified through an assessment of similar studies in the literature and interviews with SMEs. The analysis was also used to determine that some social resilience indicators have a greater impact than others based on the number of times members of SMEs discussed the indicator in the narrative portion of the interview and the level of agreement given regarding the importance of the indicator based on Likert-scale questions in the interviews. This provided the first dimension of the framework: level of importance. Next, the indicators were assessed to provide the second dimension of the framework: phase of disaster. Here I found that the three phases of disaster each present unique social challenges and, as such, have unique resilience needs. The resulting proposed framework is presented in Figure 25.

Social Resilience Indicators		
High	Community Participation Education Exchange Information Learning Shared Information Social Support Sense of Community Trust	Community Participation Exchange Information Shared Information Social Support Sense of Community Trust	Community Participation Exchange Information Learning Shared Information Social Support Sense of Community Trust
Medium	Demographic Information	Coordination	Shared Information
Low	Improvisation / Inventiveness Coping Style Leadership	Coping Style Leadership	Improvisation / Inventiveness Coping Style Leadership
	Pre-Disaster	Response	Recovery

Figure 25. Proposed social resilience matrix

6.1.2 Quantitative Phase Conclusions.

Although the qualitative approach presented in the first phase was ideal for the identification of the social resilience indicators as it provided an in-depth baseline understanding of the phenomenon through case study analysis, the quantitative phase was then ideal for refining the proposed framework to allow it to be generalisable

beyond the three cases examined. Thus, the quantitative phase of the study was used to refine the framework postulated in the qualitative phase of the study.

Using correlation, the relationships between each of the 14 social resilience indicators and outcome expectancy in each of the three disaster phases, followed by disasters as a whole, were assessed. All correlations were found to be statistically significant based on an alpha of 0.05—they positively correlated with outcome expectancies in all three phases of disaster, as well as in aggregate. However, the level of impact of each indicator varied across the disaster phases. To account for these differences, a scale was constructed to refine the level of impact beyond simply stating that the relationship is positive and statistically significant. Using this method, the strength of each of the indicators for each phase of disaster based on the constructed scale of strength was ranked. The levels of strength for each of the social resilience indicators were then used to refine the framework proposed in the qualitative section of this study as follows:

Social Resilience Indicators			
	Pre-Disaster	Response	Recovery
High	Shared Information Community Participation Leadership Sense of Community Demographic Information Education	Shared Information Community Participation	Coping Style Shared Information Learning
Medium	Improvisation / Inventiveness Exchange Information Coping Style Trust Social Support Learning	Coping Style Coordination Trust	Improvisation / Inventiveness Social Support Trust Sense of Community Exchange Information Leadership Community efficacy Community Participation
Low		Exchange Information Social Support Leadership Sense of Community	

Figure 26. Finalised social resilience framework

The framework, a two-dimensional matrix, presents the social indicators of importance by level of impact (e.g., high, medium or low) and by phase of disaster (e.g., pre-disaster, response/during, and recovery/post). The temporal component is the first

attempt in the literature to differentiate the social resilience indicators unique to the different phases of disaster. The model is innovative, in that it is a new research direction and the first of its kind seeking to provide a framework of social resilience. The significance of the model is that it has the capability to improve the condition through its policy implications. Policymakers, thus, can use the framework to plan and allocate key resources to the social resilience indicator likely to have the greatest impact. Moreover, efforts can be targeted as needed in the different phases of the disaster. Thus, the framework provides an empirical basis, validated by both SMEs and community members with an in-depth knowledge of disasters, for community interventions.

As the significant output of this research study, the final framework presents indicators that are necessary for assessing how a community will cope with a disaster. In identifying these indicators before a disaster strikes, it is possible to minimise social damage and maximise the speed at which affected communities and individuals are able to return to their quality of life. Disasters are inevitable. They cannot be stopped and are occurring at greater frequencies and causing greater damage to communities, economies and the environment. Therefore, it is of growing importance to understand their impact and how this impact can be mitigated. In measuring perceptions of social resilience at multiple levels and using multiple methods, I have provided precision and advanced the current state of social resilience knowledge.

It is my hope that this framework not only serves as the baseline for future research on disaster resilience, but also that the framework is of value to emergency stakeholders in developing strategies for mitigating risk and improving response. The next section of this chapter, therefore, provides further discussion of the future considerations of this research.

6.1.3 SNA Proposal.

After the qualitative and quantitative assessments of the social resilience indicators were concluded and the social resilience framework was proposed, I then outlined a seven-step approach for the application of SNA to the study of disaster resilience. This included its justification in the literature, its value to the overall development of a holistic framework and the methods needed to employ its application. The SNA

discussion not only identifies the metrics of interest for social resilience, but also identifies associated hypotheses and methods for testing these hypotheses. Future research is charged with implementing the methods outlined in the social network chapter to advance the proposed framework of social resilience.

6.2 Limitations and Delimitations

As no research is without limitations and delimitations, there is an acknowledgement I must here make about the findings of this research. First, this framework has been developed specific to flood and storm and requires testing across other disaster types. Second, a limitation of all disaster research is that no two disasters are alike. Therefore, although the social indicators of three disasters have been robustly analysed to develop the social resilience framework, I must recognise that the framework will not be applicable to all disasters, given the unique nature of impact in each phase of disaster. However, the framework remains valuable as a contribution to the study and management of disasters as disasters cannot be predicted. Therefore, without knowing the future impact of disasters, only that they will occur, one cannot pre-determine the specifics of any disasters and, as a result, the lack of specific detail for future disaster resilience is a broad limitation of disaster studies and not specific to this research.

6.3 Future Discussion

As this research was exploratory in that it is the first study to model disaster social resilience holistically, it has presented numerous considerations for future research. I herein present six suggested directions for future research in the form of research questions that arose in the process of carrying out this study.

First, how should investments to develop social resilience indicators be prioritised, evaluated and reported? As this research has presented temporal and strength dimensions of the 14 indicators, I also suggest that these dimensions be used to guide resources allocation for disaster planning and response. For instance, the framework can be used to improve the factors needed for pre-disaster resilience in anticipation of a disaster, and it can be used to anticipate the sustainability of these factors for the response and recovery phases. However, more research is needed to understand the resources associated with each of the indicators and how this consideration fits into the

framework. I also suggest that this research tests the value and application of this framework across different forms of disasters, as natural and human-made disasters have been demonstrated to have different effects on social systems, revealing different vulnerabilities.

Second, how would progress towards the development of these characteristics be assessed? Along the same lines as the first question, to understand the framework truly, more depth would need to be provided to each of the indicators, including how to measure them and how to measure progress when seeking to advance these indicators. I recommend in-depth case studies of the advancement of the social resilience indicators, as well as proxy programmes for their promotion.

Third, how can investments by governments, communities, business and individuals in disaster resilience be evaluated and reported? If these stakeholders were to act on the proposed model as suggested, a system for monitoring implementation would be beneficial to ensure best practice. The framework has been developed to be generalisable across communities, but developing an evaluation and reporting system would allow for further refinement and assessment of the needs of communities. In the social network chapter, I proposed the development of a social resilience scale in which network actors were rated on each of the indicators of social resilience. Similarly, such a scale could be used to rate governments, communities, businesses and individuals to identify both strengths and weaknesses. Therefore, I recommend the development of a social resilience index metric based on the factors identified within this research.

Fourth, how can future priorities for disaster resilience investments be determined? If we have answered the previous three questions, then it follows that we would seek to use this information for identifying future priorities. Although no two disasters will have the exact same characteristics, we can certainly learn from those that have occurred to prepare for those that have not. The framework would have to be tested over many disasters over time before it has predictive properties in statistical terms, but this is something that could be accomplished and a step that must start with the proposed framework.

Next, building these characteristics of disaster resilient communities is seen as a shared responsibility among individuals, households, businesses, governments and

communities. As such, the fifth research question set proposed for future studies is: how could progress towards the development of these characteristics be assessed? Where are the areas of high and low disaster resilience in Australia? How could investments to develop disaster resilience be prioritised, evaluated and reported? Similar to the aforementioned social resilience index, more data is needed on how to measure the specifics of each of the indicators. Just as the social network approaches compared the statistical value of multiple metrics of the variables of interest, similar efforts can be undertaken for assessing the social resilience indicators.

Finally, the role of social networks in social resilience emerged within this research as a key theme and one that is deserving of further study. Many of the social resilience indicators that were highly correlated with social resilience are known to flow through and/or be affected by social networks and the social capital that is accessed through these relationships. For this reason, Chapter 5 of this study systematically outlined the process by which I propose social network data be collected and added to the study to strengthen my understanding of these factors. As such, the final proposed question for future research is: how can SNA be used to improve the social resilience framework? Indeed, additional post hoc analysis of the relationship between social networks and social resilience assists me in enhancing and improving resilience within community through strengthening indicators. Social networks, including community involvement and networks opened through volunteering, play an important role in resilience to and recovery from disasters. The research concludes that social networks play a multifaceted role in disaster resilience and recovery, and it therefore has provided four approaches, each with associated hypotheses, and a detailed process for the implementation of the data produced from these approached to be incorporated into the social resilience framework. Like the data collection and analysis in chapters 3 and 4, the social network data can be captured and analysed based on the three phases of disaster, as well as on the three categories for level of importance.

In the development of the proposed social resilience framework through both qualitative and quantitative measures, I have put forth the most comprehensive study of disaster social resilience to date. In assessing the social resilience indicators across multiple methods of data collection and analysis, I have ensured reliability by ensuring that the results derived are stable and consistent. SNA, as a third method of data collection and

analysis for building the social resilience framework would enhance the reliability of this study. Moreover, in grounding this research in the extant literature and by involving subject matter experts in the process, I have ensured the validity of the study. In providing six steps for further analysis, including the application of SNA, I am giving direction for improving the reliability and validity of this study, as these steps focus on the broader and more statistical application of the study of social resilience indicators. For instance, the external validity of the research will be improved by testing the framework against a larger number and wider variety of disasters, as this will determine the extent to which the framework can be generalised beyond the case disasters studied and even beyond natural disasters. The steps for further research align with the clearly defined goals and objectives of this study.

References

Abbasi, A., Altmann, J., & Hossain, L. (2011). Identifying the effects of co-authorship networks on the performance of scholars: A correlation and regression analysis of performance measures and social network analysis measures. *Journal of Informetrics*, 5(4), 494–607.

Abbasi, A., Chung, K. S. K., & Hossain, L. (2011). Egocentric analysis of co-authorship network structure, position and performance. *Information Processing & Management,* 48(4), 671-679.

Abesamis, N. P., Corrigan, C., Drew, M., Campbell, S., & Samonte, G. (2006). Social resilience: A literature review on building resilience into human marine communities in and around MPA networks. *MPA Networks Learning Partnership, Global Conservation Program, USAID.* Retrieved from http://www. reefresilience.org/pdf/Social_Resilience_Literature_Review. pdf

Adger, W. N. (2000). Social and ecological resilience: Are they related? *Progress in Human Geography, 24*, 347–364.

Adger, W. N. (2006). Vulnerability. *Global Environmental Change, 16*, 268–281.

Adger, W. N., Lorenzoni, I., & O'Brien, K. L. (2009). Adaptation now. In N. W. Adger, I. Lorenzoni, & K. L. O'Brien (Eds.), *Adapting to climate change: Thresholds, values, governance* (1st ed.) (pp. 1–22). Cambridge: Cambridge University Press.

Ahern, J., & Galea, S. (2006). Social context and depression after a disaster: The role of income inequality. *Journal of Epidemiology and Community Health, 60*, 766–770.

Ahmed, R., Seedat, M., Van Niekerk, A., & Bulbulia, S. (2004). Discerning community resilience in disadvantaged communities in the context of violence and injury prevention. *South African Journal of Psychology, 34*, 386–408.

Aldrich, D. P. (2012). *Building resilience: Social capital in post-disaster recovery.* Chicago: The University of Chicago Press.

Aldrich, D. P., & Meyer, M. A. (2014). Social capital and community resilience. *American Behavioral Scientist*, 59(2), 254-269, doi: 0002764214550299.

Alexander, D. E., & Alex, D. (1993). *Natural disasters*. New York: Springer-Verlag New York.

Alexander, D. E. (2013). Resilience and disaster risk reduction: An etymological journey. *Natural Hazards and Earth System Science, 13*, 2707–2716.

Aliaga, M., & Gunderson, B. (2005). *Interactive statistics* (3rd ed.). United States: Pearson Education (US).

Alliance, R. (2007). *Assessing resilience in social-ecological systems: a workbook for scientists.* Available from World Wide Web: http://www. resalliance. org [cited 22th June 2008].

Alwang, J., Siegel, P. B., & Jorgensen, S. L. (2001). *Vulnerability: A view from different disciplines* (Vol. 115). Social protection discussion paper series.

Anderson, C. (2010). Presenting and evaluating qualitative research. *American Journal of Pharmaceutical Education, 74*, 141.

Anderson, M. B. (1985). A reconceptualization of the linkages between disasters and development. *Disasters, 9*, 46–51.

Anthony, E. (1974). The syndrome of the psychologically invulnerable child. In E. J. Anthony & C. Koupernik (Eds.), *The child in his family: V. 3: Children at psychiatric risk* (pp. 201–230). New York: Wiley Publishers.

Argote, L. (1982). Input uncertainty and organizational coordination in hospital emergency units. *Administrative Science Quarterly*, *27*(3), 420-434. doi:10.2307/2392320

Armour, G. (2010). Communities communicating with formal and informal systems: Being more resilient in times of need. *Bulletin of the American Society for Information Science and Technology*, 36, 34–38.

Arnberg, F. K., Hultman, C. M., Michel, P. O., & Lundin, T. (2012). Social support moderates post-traumatic stress and general distress after disaster. *Journal of Traumatic Stress, 25*, 721–727.

Asghar, S., Alahakoon, D., & Churilov, L. (2006). A comprehensive conceptual model for disaster management. *Journal of Humanitarian Assistance, 1360*, 1–15.

Australian Bureau of Statistics. (2008). *Census help: About the census*. Australian Bureau of Statistics. Retrieved from http://www.abs.gov.au/websitedbs/censushome.nsf/home/2016

Australian Bureau of Statistics. (2011). *Census help: About the census*. Australian Bureau of Statistics. Retrieved from http://www.abs.gov.au/websitedbs/censushome.nsf/home/2008

Babbie, E. (2015). *The practice of social research*. Nelson Education.

Bachman, R., & Schutt, R. K. (2013). *The practice of research in criminology and criminal justice.* United States of America. Thousand Oaks, CA: SAGE Publications.

Bachrach, K. M., & Zautra, A. J. (1985). Coping with a community stressor: The threat of a hazardous waste facility. *Journal of Health and Social Behavior*, 26(2), 127–141. doi:10.2307/2136602

Bahadur, A., & Doczi, J. (2016). *Unlocking resilience through autonomous innovation* (Working Paper). London, England: ODI.

Ballesteros, L. (2011). What determines a disaster? Retrieved from https://luisballesteros.wordpress.com/2008/09/11/what-determines-a-disaster/

Bandura, A. (2002). Growing primacy of human agency in adaptation and change in the electronic era. *European Psychologist, 7*, 2.

Barnes, P., Goonetilleke, A., Correa-Velez, I., McMichael, C., & Conteh, A. (2014). Levels of social trust among men from refugee backgrounds after the 2011 Queensland floods. *International Journal of Disaster Resilience in the Built Environment, 5*, 318–328.

Barrera, M., Jr., (1986). Distinctions between social support concepts, measures, and models. *American Journal of Community Psychology, 14*, 413–445.

Barton, A. H. (1969). *Communities in disaster: A sociological analysis of collective stress situations*. Garden City, NY: Doubleday.

Bass, B. M., & Stogdill, R. M. M. (1990). *Handbook of leadership: Theory, research, and managerial applications* (3rd ed.). New York: Collier Macmillan.

Beauvais, C., & Jenson, J. (2002). *Social cohesion: Updating the state of the research*, Retrieved October 21, 2016, from CPRN, http://www.cprn.org/doc.cfm?doc=167&l=en.

Benight, C. C. (2004). Collective efficacy following a series of natural disasters. *Anxiety, Stress & Coping, 17*(4), 401–420. doi:10.1080/10615800512331328768.

Benight, C. C., & Bandura, A. (2004). Social cognitive theory of posttraumatic recovery: The role of perceived self-efficacy. *Behaviour Research and Therapy*, *42*(10), 1129–1148. doi:10.1016/j.brat.2003.08.008

Berg, B. L., Lune, H., & Lune, H. (2004). *Qualitative research methods for the social sciences.* Boston, MA: Pearson.

Berkes, F., Colding, J., & Folke, C. (Eds.). (2002). *Navigating social-ecological systems: Building resilience for complexity and change*. Cambridge: Cambridge University Press.

Berkes, F., & Folke, C. (2001). Back to the future: Ecosystem dynamics and local knowledge. In L. H. Gunderson & C. S. Holling (Eds.), *Panarchy: Understanding transformations in human and natural systems* (pp. 121–146). Washington, DC: Island Press.

Berkes, F., & Ross, H. (2013). Community resilience: Toward an integrated approach. *Society & Natural Resources, 26*, 5–20.

Berkes, F., & Turner, N. J. (2006). Knowledge, learning and the evolution of conservation practice for social-ecological system resilience. *Human Ecology, 34*, 479–494.

Bjørnskov, C. (2007). Determinants of generalized trust: A cross-country comparison. *Public choice, 130*, 1–21.

Blaikie, P., Cannon, T., Davis, I., & Wisner, B. (2004). *At risk: Natural hazards, people's vulnerability and disasters* (2nd ed.). London: Taylor & Francis.

Blanchard-Boehm, R. D. (1998). Understanding public response to increased risk from natural hazards: Application of the hazards risk communication framework. *International Journal of Mass Emergencies and Disasters, 16*, 247–278.

Bland, S. H., O'Leary, E. S., Farinaro, E., Jossa, F., Krogh, V., Violanti, J. M., & Trevisan, M. (1997). Social network disturbances and psychological distress following earthquake evacuation. *Journal of Nervous and Mental Disease, 185*, 188–195.

Bohle, H. G., Downing, T. E., & Watts, M. J. (1994). Climate change and social vulnerability: Toward a sociology and geography of food insecurity. *Global Environmental Change, 4*, 37–48.

Bollen, K., & Lennox, R. 1991. Conventional wisdom on measurement: A structural equation perspective. *Psychological Bulletin, 110(2)*, 305-314. doi:10.1037/0033-2909.110.2.305

Bollen, K. A., & Ting, K. (2000). A tetrad test for causal indicators. *Psychological Methods*, *5*(1), 3–22. doi:10.1037//1082-989x.5.1.3

Bonanno, G. A., Galea, S., Bucciarelli, A., & Vlahov, D. (2007). What predicts psychological resilience after disaster? The role of demographics, resources, and life stress. *Journal of Consulting and Clinical Psychology*, *75*(5), 671–682. doi:10.1037/0022-006x.75.5.671

Booth, J. A., & Richard, P. B. (1998). Civil society, political capital, and democratization in Central America. *Journal of Politics, 60*, 780–800.

Borgatti, S. (2005). Centrality and network flow. *Social Networks, 27*, 55–71.

Borgatti, S. P., Everett, M. G., & Freeman, L. C. (2002). *Ucinet for Windows: Software for social network analysis*. Harvard, MA: Analytic Technologies.

Borsboom, D., Mellenbergh, G. J., & van Heerden, J. (2003). The theoretical status of latent variables. *Psychological Review*, *110*(2), 203–219. doi:10.1037/0033-295x.110.2.203

Bourdieu, P. (1986). The Forms of capital. In J. G. Richardson (Ed.), *Handbook of theory and research for the sociology of education*. New York, NY: Greenwood Press.

Bournay, E. (2007). *Trends in natural disasters*. Retrieved September 21, 2016, from GRID-Arendal, http://www.grida.no/graphicslib/detail/trends-in-natural-disasters_a899

Bowling, A. (2014). *Research methods in health: Investigating health and health services*. Maidenhead, United Kingdom: Open University Press.

Boyce, J. K. (2000). Let them eat risk? Wealth, rights and disaster vulnerability. *Disasters, 24*, 254–261.

Brandes, U., & Fleischer, D. (2005). Centrality measures based on current flow. In *Lecture Notes in Computer Science* (pp. 533–544). doi:10.1007/978-3-540-31856-9_44

Breton, M. (2001). Neighborhood resiliency. *Journal of Community Practice, 9*, 21–36.

Bright, C. F. (2016). *Conceptualizing deviance: A cross-cultural social network approach to comparing relational and attribute data*. United States: Lexington Books.

Britton, L., Wright, M., & Ball, D. (2000). The use of co-ordination theory to improve service quality in executive search. *Service Industries Journal, 20*, 85–102.

Bronfman, N. C., Vázquez, E. L., Gutiérrez, V. V., & Cifuentes, L. A. (2008). Trust, acceptance and knowledge of technological and environmental hazards in Chile. *Journal of Risk Research, 11*, 755–773.

Brown, D. & Kulig, J. (1996/1997). The concept of resilience: Theoretical lesson from community research. *Health and Canadian Society*, 4(1), 29-50.

Bruneau, M., Chang, S. E., Eguchi, R. T., Lee, G. C., O'Rourke, T. D., Reinhorn, A. M., . . . Von Winterfeldt, D. (2003). A framework to quantitatively assess and enhance the seismic resilience of communities. *Earthquake Spectra, 19*, 733.

Bryman, A., & Cramer, D. (1994). *Quantitative data analysis for social scientists* (Rev. ed.). Taylor & Frances.

Bryman, A., & Cramer, D. (2001). *Quantitative data analysis with SPSS for windows: A guide for social scientists: Release 10*. Philadelphia, PA: Routledge.

Buckle, P., Mars, G., & Smale, S. (2000). New approaches to assessing vulnerability and resilience. *Australian Journal of Emergency Management, 15*, 8-14.

Buikstra, E., Rogers-Clark, C., Ross, H., Hegney, D., King, C., Baker, P., & Mclachlan, K. (2011). Ego-resilience and psychological wellness in rural communities. In K. M. Gow & M. J. Celinski (Eds.), *Continuity versus creative response to challenge: The primacy of resilence and resourcefulness in life and therapy* (pp. 273–290). United States: Nova Science Publishers.

Burack, J., Blidner, A., Flores, H., & Fitch, T. (2007). Constructions and deconstructions of risk, resilience and wellbeing: A model for understanding the development of Aboriginal adolescents. *Australasian Psychiatry, 15*, S18–S23.

Burt, R. S. (1995). *Structural holes: The social structure of competition*. Cambridge, MA: Harvard University Press.

Burt, R. S., Kilduff, M., & Tasselli, S. (2013). Social network analysis: Foundations and frontiers on advantage. *Annual Review of Psychology, 64*, 527–547.

Butler, D. L., & Sayre, E. A. 2012. *Resilience and restoration after a large-scale disaster: An analysis of the BP Deepwater Horizon oil spill*. Report prepared for the Southeast Regional Research Initiative, SERRI Report.

Cagney, K. A., Glass, T. A., Skarupski, K. A., Barnes, L. L., Schwartz, B. S., & De Leon, C. F. M. (2009). Neighborhood-level cohesion and disorder: Measurement and validation in two older adult urban populations. *Journals of Gerontology Series B: Psychological Sciences and Social Sciences, 64*, 415–424.

Carr, L. J. (1932). Disaster and the sequence-pattern concept of social change. *American Journal of Sociology*, *38*(2), 207–218. doi:10.1086/216030

Carrington, P. J., Scott, J., & Wasserman, S. (Eds.). (2005). *Models and methods in social network analysis*. Cambridge: Cambridge University Press.

Chamlee‑ Wright, E., & Storr, V. H. (2011). Social capital as collective narratives and post‑ disaster community recovery. *Sociological Review, 59*, 266–282.

Chandra, A., Acosta, J., Stern, S., & Ch, A. (2011). *Building community resilience to disasters: A way forward to enhance national health security*. Santa Monica, CA: RAND.

Chang, K. (2010). Community cohesion after a natural disaster: Insights from a Carlisle flood. *Disasters, 34*, 289–302.

Chang, K., & Chen, M. (2006). The interrelationship among the openness of group boundary, group performance and membership-turnover. *Chinese Journal of Psychology, 48*, 411.

Chang, S. E., & Shinozuka, M. (2004). Measuring improvements in the disaster resilience of communities. *Earthquake Spectra, 20*, 739–755.

Chappell, W. F., Forgette, R. G., Swanson, D. A., & Van Boening, M. V. (2007). Determinants of government aid to Katrina survivors: Evidence from survey data. *Southern Economic Journal*, *74*(2), 344–362. doi:10.2307/20111971

Cherry, K. E., Sampson, L., Nezat, P. F., Cacamo, A., Marks, L. D., & Galea, S. (2015). Long-term psychological outcomes in older adults after disaster: Relationships to religiosity and social support. *Aging & Mental Health, 19*, 430–443.

Christenson, J. A., & Robinson, J. W. (1980). *Community development in America*. Ames IA: Iowa State University Press.

Chung, K. S. K., Hossain, L., & Davis, J. (2005, November). Exploring sociocentric and egocentric approaches for social network analysis. In *Proceedings of the 2nd international conference on knowledge management in Asia Pacific* (pp. 1-8).

Chung, K. S. K., & Hossain, L. (2009). Measuring performance of knowledge-intensive workgroups through social networks. *Project Management Journal*, *40*(2), 34–58. doi:10.1002/pmj.20115

Churchill, G. A. (1979). A paradigm for developing better measures of marketing constructs. *Journal of Marketing Research*, *16*(1), 64. doi:10.2307/3150876

City of Wagga Wagga. (2016). *Wagga Wagga City population, households and dwellings*. Retrieved from http://forecast.id.com.au/wagga-wagga/population-households-dwellings

Clarke, A. T. (2006). Coping with interpersonal stress and psychosocial health among children and adolescents: A meta-analysis. *Journal of Youth and Adolescence, 35*, 10–23.

Clauss-Ehlers, C. S., & Levi, L. L. (2002). Violence and community, terms in conflict: An ecological approach to resilience. *Journal of Social Distress and the Homeless, 11*, 265–278.

Cohen, J. (1988). Statistical power analysis for the behavioral sciences (2nd ed.). Hillsdale, NJ: Erlbaum.

Cohen, S., Underwood, L. G., & Gottlieb, B. H. (2000). *Social support measurement and intervention: A guide for health and social scientists*. Oxford: Oxford University Press.

Coleman, J. S. (1994). *Foundations of social theory*. Cambridge, MA: Belknap Press of Harvard University Press.

Coltman, T., Devinney, T. M., Midgley, D. F., & Venaik, S. (2008). Formative versus reflective measurement models: Two applications of formative measurement. *Journal of Business Research, 61*, 1250–1262.

Comfort, L. K. (1999). *Shared risk: Complex systems in seismic response*. Amsterdam: Emerald Group Publishing.

Comfort, L. K., Dunn, M., Johnson, D., & Skertich, R. (2004). Coordination in complex systems: Increasing efficiency in disaster mitigation and response. *International Journal of Emergency Management, 2*, 62–80.

Comfort, L. K., Ko, K., & Zagorecki, A. (2004). Coordination in rapidly evolving disaster response systems. *American Behavioral Scientist, 48*, 295–313.

Comfort, L. K., Oh, N., Ertan, G., & Scheinert, S. (2009). Designing adaptive systems for disaster mitigation and response: The role of structure. In L. K. Comfort, A. Boin, & C. C. Demchak (Eds.), *Designing resilience: Preparing for extreme events* (pp. 39–40). Pittsburgh, PA: University of Pittsburgh Press.

Comfort, L. K., Sungu, Y., Johnson, D., & Dunn, M. (2001). Complex systems in crisis: Anticipation and resilience in dynamic environments. *Journal of Contingencies and Crisis Management, 9*, 144–158.

Connelly, L. (2009). Survey methods. *Medsurg nursing: official journal of the Academy of Medical-Surgical Nurses., 18*(2), 114–5.

Cook, J. D., & Bickman, L. (1990). Social support and psychological symptomatology following a natural disaster. *Journal of Traumatic Stress, 3*, 541–556.

Cooper, W. H., Donnelly, J. M., & Johnson, R. (2011). *Japan's 2011 earthquake and tsunami: Economic effects and implications for the United States*. Retrieved from https://www.fas.org/sgp/crs/row/R41702.pdf

Corbin, J., & Strauss, A. (2008). *Basics of qualitative research: Techniques and procedures for developing grounded theory*. Sage.

Coutu, D. L. (2002). How resilience works. *Harvard Business Review, 80*, 46–56.

Cox, H. M., & Holmes, C. A. (2000). Loss, healing, and the power of place. *Human Studies, 23*, 63–78.

Creamer, M. (1994). Community recovery from trauma. In R. Watts & D. De L Horne (Eds.), *Coping with trauma: The victim and the helper* (pp. 37–52). Brisbane, QLD: Australian Academic Press.

CRESWELL, J. W. (2007). *Qualitative enquiry and research design: Choosing among five approaches.* US: Sage publications Ltd.

Creswell, J. W. (2013). *Research design: Qualitative, quantitative, and mixed methods approaches*. Los Angeles, CA, United States: Sage Publications (CA).

Cronbach, L. J. (1951). Coefficient alpha and the internal structure of tests. *Psychometrika, 16*, 297–334.

Crowston, K., Rubleske, J., & Howison, J. (2006). Coordination theory and its application in HCI. In P. Zhang & D. Galletta (Eds.), *Human-computer interaction and management information systems: Foundations* (pp. 120–140). United States: Sharpe, M. E.

Cumming, G., Barnes, G., Perz, S., Schmink, M., Sieving, K., Southworth, J., . . . Van Holt, T. (2005). An exploratory framework for the empirical measurement of resilience. *Ecosystems, 8*, 975–987.

Cuthill, M., Ross, H., Maclean, K., Owens, K., Witt, B., & King, C. (2008). Reporting social outcomes of development: An analysis of diverse approaches. *International Journal of Interdisciplinary Social Sciences, 3*, 145–157.

Cutter, S. L., Barnes, L., Berry, M., Burton, C., Evans, E., Tate, E., & Webb, J. (2008). A place-based model for understanding community resilience to natural disasters. *Global Environmental Change, 18*, 598–606.

Cutter, S. L., Boruff, B. J., & Shirley, W. L. (2003). Social vulnerability to environmental hazards. *Social Science Quarterly, 84*, 242–261.

Cutter, S. L., Burton, C. G., & Emrich, C. T. (2010). Disaster resilience indicators for benchmarking baseline conditions. *Journal of Homeland Security and Emergency Management*, *7*(1). doi:10.2202/1547-7355.1732

Cutter, S. L., Emrich, C. T., Webb, J. J., & Morath, D. (2009). Social vulnerability to climate variability hazards: A review of the literature. *Final Report to Oxfam America*, *5*, 1–44.

Cyganik, K. A. (2003). Disaster preparedness in Virginia Hospital Center—Arlington after Sept 11, 2001. *Disaster Management & Response, 1*, 80–86.

D'Andrea, A., Ferri, F., & Grifoni, P. (2010). An overview of methods for virtual social networks analysis. In *Computational Social Network Analysis* (pp. 3–25). London: Springer Science + Business Media.

Dahlberg, R., Rubin, O., & Vendelo, M. T. (Eds.). (2015). *Disaster research: Multidisciplinary and international perspectives*. London, United Kingdom: Routledge.

Dasgupta, A., & Beard, V. A. (2007). Community driven development, collective action and elite capture in Indonesia. *Development and Change, 38*, 229–249.

Davis, I. (2000). *Cities of chaos*. New Delhi, India: Oxford University Press.

Davis, I., Hosseini, M., & Izadkhah, Y. O. (2003). Public awareness and the development of a safety culture: Key elements in disaster risk reduction. Retrieved July 17, 2016, from CIVILICA, http://www.civilica.com/Printable-SEE04_DM11=Public-Awareness-and-the-Development-of-a-Safety-Culture-Key-Elements-in-Disaster-Risk-Reduction.html

De Vaus, D. A. (2001). *Research design in social research*. Thousand Oaks, CA: SAGE Publications.

Demchak, C. C. (2006). *Embracing surprise in resilient complex critical infrastructures: Rapid crisis response lessons from military organizations and the atrium model.* Paper presented at SEMA/ECMA Conference on Future Challenges for Crisis Management in Europe, Stockholm, Sweden.

Denzin, N. K., & Lincoln, Y. S. (Eds.). (1994). *Handbook of qualitative research* (6th ed.). Thousand Oaks, CA: Sage Publications.

Denzin, N. K., & Lincoln, Y. S. 2005. *The Sage handbook of qualitative research*. Thousand Oaks: Sage Publications.

Diamantopoulos, A. (2006). The error term in formative measurement models: Interpretation and modeling implications. *Journal of Modelling in Management, 1*, 7–17.

Director, C., & Sehdev, M. (2009). Community resilience: Models, metaphors and measures. *Journal de la Santé Autochtone*.

Dolfman, M., & Bergman, B. (2007). The effects of Hurricane Katrina on the New Orleans economy. *Monthly Labor Review*, *130*(6), 3-17.

Dufty, N. (2012). Using social media to build community disaster resilience. *The Australian Journal of Emergency Management (peer reviewed)*, *27*(1), 40–51. Retrieved from http://works.bepress.com/neil_dufty/8/

Dunkel-Schetter, C., & Bennett, T. L. (1990). Differentiating the cognitive and behavioral aspects of social support. In B. R. Sarason, I. G. Sarason, & G. Pierce (Eds.), *Social support: An Interactional view* (pp. 267–296). New York: John Wiley & Sons.

Dynes, R. R. (1970). Organizational involvement and changes in community structure in disaster. *American Behavioral Scientist, 13*, 430–439.

Edelstein, M. R., & Wandersman, A. (1987). Community dynamics in coping with toxic contaminants. In I. Altman & A. Wandersman (Eds.), *Neighborhood and community environments* (pp. 69–112). Boston, MA: Springer US.

Edwards, J. R., & Bagozzi, R. P. (2000). On the nature and direction of relationships between constructs and measures. *Psychological Methods, 5*, 155.

Enemark, C. (2006). Pandemic pending. *Australian Journal of International Affairs, 60*, 43–49.

Erikson, K. T. (1976). Loss of communality at Buffalo Creek. *American Journal of Psychiatry, 133*, 302–305.

Ersing, R. L., & Kost, K. A. (Eds.). (2012). *Surviving disaster: The role of social networks*. Chicago, IL: Lyceum Books Inc., U.S.

Espluga, J., Prades, A., Gamero, N., & Solà, R. (2009). El papel de la "confianza" en los conflictos socioambientales. *PolíTica Y Sociedad, 46*(1), 255-273. doi:10.5209/POSO.23054

Evans, L., & Oehler-Stinnett, J. (2006). Children and natural disasters: A primer for school psychologists. *School Psychology International, 27*, 33–55.

Fazey, I., Fazey, J. A., Fischer, J., Sherren, K., Warren, J., Noss, R. F., & Dovers, S. R. (2007). Adaptive capacity and learning to learn as leverage for social-ecological resilience. *Frontiers in Ecology and the Environment, 5*, 375–380.

Ferketich, S. (1991). Focus on psychometrics. Aspects of item analysis. *Research in Nursing & Health, 14*, 165–168.

Festinger, L., & Schachter, S. (1950). *Social pressures in informal groups: A study of human factors in housing*. United States: Stanford University Press.

Find the Best. Compare suburbs of Wagga Wagga. Retrieved November 21, 2016, from GRAPHIQ, http://cities.findthebest.com.au/d/c/Wagga-Wagga

Fink, A. (2002). *The survey kit* (2nd ed.). Thousand Oaks, CA: Sage.

Foldy, E. G., Goldman, L., & Ospina, S. (2008). Sensegiving and the role of cognitive shifts in the work of leadership. *Leadership Quarterly, 19*, 514–529.

Folke, C. (2003). Freshwater for resilience: A shift in thinking. *Philosophical Transactions of the Royal Society of London B: Biological Sciences, 358*, 2027–2036.

Folke, C., Carpenter, S., Elmqvist, T., Gunderson, L., Holling, C. S., & Walker, B. (2002). Resilience and sustainable development: Building adaptive capacity in a world of transformations. *AMBIO: A Journal of the Human Environment, 31*, 437–440.

Folke, C., Hahn, T., Olsson, P., & Norberg, J. (2005). Adaptive governance of social-ecological systems. *Annual Review of Environment and Resources*, *30*(1), 441–473. doi:10.1146/annurev.energy.30.050504.144511

Folkman, S. (1984). Personal control and stress and coping processes: A theoretical analysis. *Journal of Personality and Social Psychology, 46*, 839.

Folkman, S., & Lazarus, R. S. (1980). An analysis of coping in a middle-aged community sample. *Journal of Health and Social Behavior*, *21*(3), 219. doi:10.2307/2136617

Forgette, R., & Boening, M. (2009). *Measuring and modeling community resilience: SERP and DyME*. Paper pesented at the 2009 Ghosts of Katrina Conference. Gulfport, MS, June 6-7, 2009.

Forgette, R., Dettrey, B., Van Boening, M., & Swanson, D. A. (2009). Before, now, and after: Assessing Hurricane Katrina relief. *Population Research and Policy Review, 28*, 31–44.

Fothergill, A., & Peek, L. A. (2004). Poverty and disasters in the United States: A review of recent sociological findings. *Natural Hazards, 32*, 89–110.

Frankenberg, E., Sikoki, B., Sumantri, C., Suriastini, W., & Thomas, D. (2013). Education, vulnerability, and resilience after a natural disaster. *Ecology and Society: A Journal of Integrative Science for Resilience and Sustainability, 18*(2), 16–27. doi:10.5751/es-05377-180216

Frankfort-Nachmias, C., & Nachmias, D. (2007). *Research methods in the social sciences*. Macmillan.

Freeman, L. C. (1978). Centrality in social networks conceptual clarification. *Social Networks*, *1*(3), 215–239. doi:10.1016/0378-8733(78)90021-7

Freeman, L. C. (1979). Centrality in social networks conceptual clarification. *Social Networks, 1*, 215–239.

Freeman, L. C., White, D. R., & Romney, A. K. (1992). *Research methods in social network analysis*. New Brunswick, NJ: Transaction Publishers.

Fritz, C. E., & Williams, H. B. (1957). The human being in disasters: A research perspective. *Annals of the American Academy of Political and Social Science, 309*, 42–51.

Furedi, F. (2007). The changing meaning of disaster. *Area, 39*, 482–489.

Ganor, M., & Ben-Lavy, Y. (2003). Community resilience: Lessons derived from Gilo under fire. *Journal of Jewish Communal Service, 79*, 105–108.

Gephart, R. P. (1984). Making sense of organizationally based environmental disasters. *Journal of Management, 10*, 205–225.

Gist, M. E., & Mitchell, T. R. (1992). Self-efficacy: A theoretical analysis of its determinants and malleability. *Academy of Management Review, 17*, 183–211.

Given, L. M. (2008a). *Qualitative Research Methods*. Thousand Oaks, CA: Sage Publications.

Given, L. M. (2008b). *The sage encyclopedia of qualitative research methods*. Thousand Oaks, CA: Sage Publications.

Gladstein, D. L., & Reilly, N. P. (1985). Group decision making under threat: The tycoon game. *Academy of Management Journal, 28*, 613–627.

Glass, T. A., & Schoch-Spana, M. (2002). Bioterrorism and the people: How to vaccinate a city against panic. *Clinical Infectious Diseases, 34*, 217–223.

Gommes, R., Guerny, J. D., Nachtergaele, F., Brinkman, R., & Low, P. 2005. Potential impacts of sea-level rise on populations and agriculture. *Climate Change and Africa*, 191–203.

Goodman, R. M., Speers, M. A., Mcleroy, K., Fawcett, S., Kegler, M., Parker, E., Smith, S. R., … Wallerstein, N. (1998). Identifying and defining the dimensions of community capacity to provide a basis for measurement. *Health Education & Behavior, 25*, 258–278.

Gorard, S. (2013). *Research design: Creating robust approaches for the social sciences* Thousand Oaks, CA: Sage Publications.

Granovetter, M. (1973). The strength of weak ties. *American Journal of Sociology, 78*, 1360.

Gray, J. G. (1958). *The warriors: Reflections on men in battle*. University of Nebraska Press.

Griffin, R. J., Neuwirth, K., Dunwoody, S., & Giese, J. (2004). Information sufficiency and risk communication. *Media Psychology, 6*, 23–61.

Grove, S., & Burns, N. (2005). *The practice of nursing research: Conduct, critique, and utilization* (5th ed.). United Kingdom: Saunders (W.B.) Co.

Guerra, C., Cumsille, P., & Martínez, M. L. (2014). Post-traumatic stress symptoms in adolescents exposed to an earthquake: Association with self-efficacy, perceived magnitude, and fear. *International Journal of Clinical and Health Psychology, 14*, 202–207.

Guha-Sapir, D., Below, R., & Hoyois. Ph., (2016). *EM-DAT: International Disaster Database* [Online]. Université Catholique de Louvain—Brussels—Belgium. Retrieved from http://www.emdat.be

Gusfield, J. R. (1975). *Community: A critical response*. New York, NY: Harper & Row.

Haas, E. J., Kates, R. W., Bowden, M. J., & Amaral, D. (1977). *Haas: Reconstruction following disaster* (2nd ed.). Cambridge, MA: MIT Publishers.

Handmer, J. W., & Dovers, S. R. (1996). A typology of resilience: Rethinking institutions for sustainable development. *Organization & Environment, 9*, 482–511.

Hannah, S. T., Uhl-Bien, M., Avolio, B. J., & Cavarretta, F. L. (2009). A framework for examining leadership in extreme contexts. *Leadership Quarterly, 20*, 897–919.

Hanneman, R. A., & Riddle, M. (2005). *Introduction to social network methods.* Riverside, CA: University of California.

Harland, L., Harrison, W., Jones, J. R., & Reiter-Palmon, R. (2005). Leadership behaviors and subordinate resilience. *Journal of Leadership & Organizational Studies, 11*, 2–14.

Harrald, J. R. (2006). Agility and discipline: Critical success factors for disaster response. *Annals of the American Academy of Political and Social Science, 604*, 256–272.

Harrald, J. R., & Stoddart, L. (1998). Scenario based identification and structuring of information needs for the response to complex international crises. In *Proceedings of the Fifth Annual Conference of the Emergency Management Society* (pp. 295–306). Washington, DC, 295-306.

Harwell, M. R. (2011). Research design in qualitative/quantitative/mixed methods. In C. Conrad & C. Serlin (Eds.), *The SAGE handbook for research in education: Pursuing ideas as the keystone of exemplary inquiry* (2nd ed., pp. 147–163) Thousand Oaks, CA: Sage.

Haythornthwaite, C. (1996). Social network analysis: An approach and technique for the study of information exchange. *Library & Information Science Research, 18*, 323–342.

Healy, S. M. E. (1947). Le Play's contribution to sociology: His method. *The American Catholic Sociological Review*, *8*(2), 97–110. doi:10.2307/3707549

Hegney, D., Ross, H., & Baker, P. (2008). *Building resilience in rural communities - Toolkit*. Toowoomba, Qld.: Centre for Rural and Remote Area Health, University of Southern Queensland.

Hewitt, K. (1983). *Interpretations of calamity from the viewpoint of human ecology*. Australia: Allen & Unwin.

Hikichi, H., Aida, J., Tsuboya, T., Kondo, K., & Kawachi, I. (2016). Can community social cohesion prevent posttraumatic stress disorder in the aftermath of a disaster? A natural experiment from the 2011 Tohoku earthquake and tsunami. *American Journal of Epidemiology*, kwv335.

Hogan, B. E., Linden, W., & Najarian, B. (2002). Social support interventions: Do they work? *Clinical Psychology Review, 22*, 381–440.

Holling, C. S. (1973). Resilience and stability of ecological systems. *Annual Review of Ecology and Systematics*, *4*(1), 1–23. doi:10.1146/annurev.es.04.110173.000245

Holling, C. S., & Gunderson, L. H. (2002). Resilience and adaptive cycles. In C. S. Holling (Ed.), *Panarchy synopsis: Understanding transformations in human and natural systems* (pp. 25–62). Washington: Island Press.

Hommerich, C. (2012). Trust and subjective well‑ being after the great east Japan earthquake, tsunami and nuclear meltdown: Preliminary results. *International Journal of Japanese Sociology, 21*, 46–64.

Howell, M., & Prevenier, W. (2001). *An introduction to historical methods*. Ithaca, NY: Cornell University Press.

Hupcey, J. E. (1998). Social support: Assessing conceptual coherence. *Qualitative Health Research, 8*, 304–318.

Hurlbert, J. S., Beggs, J. J., & Haines, V. (2005). *Bridges over troubled waters: What are the optimal networks for Katrina's victims?* New York, NY: Social Science Research Council.

Ink, D. (2006). An analysis of the House Select Committee and White House reports on Hurricane Katrina. *Public Administration Review, 66*, 800–807.

Insurance council of Australia. (2016). Catastrophe events and the community. Retrieved November 21, 2016, from insurance council of Australia, http://www.insurancecouncil.com.au/issue-submissions/issues/catastrophe-events

Izadkhah, Y. O., & Hosseini, M. (2005). Towards resilient communities in developing countries through education of children for disaster preparedness. *International Journal of Emergency Management, 2*, 138–148.

Jablonski, J. (2013). Online library: Campus guides. Research Methods Information. Research Study Design.

Jack, B., & Clarke, A. M. (1998). The purpose and use of surveys in research. *Professional Nurse (London, England), 14*, 176–179.

Jacobs, J. (2015). The death and life of great American cities. In S. Fainstein & J. DeFilippis (Eds.), *Readings in planning theory* (3rd ed.) (pp. 94–109). Malden, MA: Wiley-Blackwell (an imprint of John Wiley & Sons Ltd).

Jaeger, P. T., Shneiderman, B., Fleischmann, K. R., Preece, J., Qu, Y., & Wu, P. F. (2007). Community response grids: E-government, social networks, and effective emergency management. *Telecommunications Policy, 31*, 592–604.

Jarvis, C. B., Mackenzie, S. B., & Podsakoff, P. M. (2003). A critical review of construct indicators and measurement model misspecification in marketing and consumer research. *Journal of Consumer Research, 30*, 199–218.

Jensen, J. (1998). *Mapping social cohesion* (CPRN Study No. F 03). Ottawa, Canada: Renouf Publishing Co. Ltd.

Jewkes, R., & Murcott, A. (1996). Meanings of community. *Social Science & Medicine, 43*, 555–563.

Joerin, J., Shaw, R., Takeuchi, Y., & Krishnamurthy, R. (2012). Assessing community resilience to climate-related disasters in Chennai, India. *International Journal of Disaster Risk Reduction, 1*, 44–54.

Johnson, R. B., Onwuegbuzie, A. J., & Turner, L. A. (2007). Toward a definition of mixed methods research. *Journal of Mixed Methods Research, 1*, 112–133.

Jupp, V. (2006). *The Sage dictionary of social research methods.* Thousand Oaks, CA: Sage Publications.

Kadushin, C. (2004a). *Introduction to social network theory* (Unpublished manuscript).

Kadushin, C. (2004b). Too much investment in social capital? *Social Networks, 26*, 75–90.

Kaniasty, K., & Norris, F. (1999). The experience of disaster: Individuals and communities sharing trauma. In B. Lubin & R. Gist (Eds.), *Response to disaster: Psychosocial, community, and ecological approaches* (pp. 25–61). Philadelphia: Taylor & Francis.

Kaniasty, K., & Norris, F. H. (2008). Longitudinal linkages between perceived social support and posttraumatic stress symptoms: Sequential roles of social causation and social selection. *Journal of Traumatic Stress, 21*, 274–281.

Kapucu, N. (2005). Interorganizational coordination in dynamic context: Networks in emergency response management. *Connections, 26*, 33–48.

Kapucu, N. (2008). Collaborative emergency management: Better community organising, better public preparedness and response. *Disasters, 32*, 239–262.

Kawachi, I., & Berkman, L. (2000). Social cohesion, social capital, and health. In L. F. Berkman & I. Kawachi (Eds.), *Social epidemiology* (pp. 174–190). New York: Oxford University Press.

Keck, M., & Sakdapolrak, P. (2013). What is social resilience? Lessons learned and ways forward. *Erdkunde*, *67*(1), 5–19. doi:10.3112/erdkunde.2013.01.02

Keller, S. I. (1991). Beyond the ruling class: strategic elites in modern society. *Transaction Publishers.*

Kelly, C. (1999). Simplifying disasters: Developing a model for complex non-linear events. *Australian Journal of Emergency Management, 14*(1), 25–27.

Kerlinger, F. N. (1986). *Foundations of behavioral research*. Fort Worth, TX: Holt, Rinehart and Winston.

Kerlinger, F. N. (2011). *Foundations of behavioral research*. New York, NY: Holt, Rinehart, and Winston.

Khalili, S., Harre, M., & Morley, P. (2015). A temporal framework of social resilience indicators of communities to flood, case studies: Wagga Wagga and Kempsey, NSW, Australia. *International Journal of Disaster Risk Reduction, 13*, 248–254.

Khalili, S., Harre, M., & Morley, P. (2016). A temporal social resilience framework of communities to disasters in Australia. *PLOS Currents: Disasters.* Manuscript submitted for publication.

Kirmayer, L. J., Whitley, R., Dandeneau, S. F., & Isaac, C. (2009). Community Resilience: Models, metaphors and measures. *Journal of Aboriginal Health*, *5*(1), 62–71.

Klein, R. J. T., Nicholls, R. J., & Thomalla, F. (2003). Resilience to natural hazards: How useful is this concept? *Global Environmental Change Part B: Environmental Hazards, 5*, 35–45.

Kline, P. (2013). *The handbook of psychological testing* (2nd ed.). London: Taylor & Francis.

Krackhardt, D. (1992). The strength of strong ties: The importance of philos in organizations. In R. G. Eccles & N. Nohria (Eds.), *Networks and organizations: Structure, form, and action* (pp. 216–239). Boston, MA: Harvard Business School Press.

Krause, J., Croft, D., & James, R. (2007). Social network theory in the behavioural sciences: Potential applications. *Behavioral Ecology and Sociobiology, 62*, 15–27.

Kreps, G. A. (1991). Organizing for emergency management. In W. L. Waugh & K. Tierney (Eds.), *Emergency management: Principles and practice for local government* (2nd ed.) (pp. 30–54). Washington, D.C.: International City/County Management Association (ICMA).

Lalonde, C. (2011). Managing crises through organisational development: A conceptual framework. *Disasters, 35*, 443–464.

Lavrakas, P. J. (2008). *Encyclopedia of survey research methods*. London: Sage Publications.

Lazarus, R. S. (1966). *Psychological stress and the coping process*. New York: McGraw-Hill.

Lazarus, R. S., & Folkman, S. (1984). *Stress, appraisal, and coping* (6th ed.). New York: Springer Pub. Co.

Leaning, J., & Guha-Sapir, D. (2013). Natural disasters, armed conflict, and public health. *New England Journal of Medicine, 369*, 1836–1842.

Lebel, L., Anderies, J. M., Campbell, B., Folke, C., Hatfield-Dodds, S., Hughes, T. P., & Wilson, J. (2006). Governance and the capacity to manage resilience in regional social-ecological systems. *Ecology and Society*, *11*(1). doi:10.5751/es-01606-110119

Leedy, P. D., Ormrod, J. E., Newby, T. J., & Ertmer, P. A. (2005). *Practical research: Planning and designing* (6th ed.). Hemel Hempstead, United Kingdom: Prentice Hall.

Levin, D. Z., & Cross, R. (2004). The strength of weak ties you can trust: The mediating role of trust in effective knowledge transfer. *Management Science, 50*, 1477–1490.

Lin, N. (2002a). *Social capital: A theory of social structure and action*. Cambridge: Cambridge University Press.

Lin, N., & Smith, J. (2002b). *Social capital: A theory of social structure and action*. Cambridge, U.K.: Cambridge University Press.

Lin, Z. (2002c). The dynamics of inter-organizational ties during crises: Empirical evidence and computational analysis. *Simulation Modelling Practice and Theory*, *10*(5-7), 387–415. doi:10.1016/s1569-190x(02)00083-7

Lindsay, B. R. (2011). *Social media and disasters: Current uses, future options, and policy considerations*. Washington, DC: Congressional Research Service.

Loeffler, D., Christiansen, D., Tracy, M., Secret, M., Ersing, R., Fairchild, S., & Sutphen, R. (2004). Social capital for social work: Toward a definition and conceptual framework. *Social Development Issues, 26*, 22–38.

Longstaff, P. H., & Yang, S.-U. (2008). Communication management and trust: Their role in building resilience to "surprises" such as natural disasters, pandemic flu, and terrorism. *Ecology and Society*, *13*(1), 3–8. doi:10.5751/es-02232-130103

Longstaff, P. H. (2005). *Security, resilience, and communication in unpredictable environments such as terrorism, natural disasters, and complex technology.* Syracuse, New York: Author

López-Marrero, T., & Tschakert, P. (2011). From theory to practice: Building more resilient communities in flood-prone areas. *Environment and Urbanization, 23*, 229–249.

Lorenz, D. F. (2013). The diversity of resilience: Contributions from a social science perspective. *Natural Hazards, 67*, 7–24.

Luers, A. L., Lobell, D. B., Sklar, L. S., Addams, C. L., & Matson, P. A. (2003). A method for quantifying vulnerability, applied to the agricultural system of the Yaqui Valley, Mexico. *Global Environmental Change, 13*, 255–267.

Lunneborg, C. E. (1979). Book review: Psychometric Theory: Second Edition Jum C. Nunnally New York: McGraw-Hill, 1978. *Applied Psychological Measurement, 3*, 279–280.

Luszczynska, A., Benight, C. C., & Cieslak, R. (2009). Self-efficacy and health-related outcomes of collective trauma: A systematic review. *European Psychologist, 14*, 51–62.

Maclean, K., Cuthill, M., & Ross, H. (2014). Six attributes of social resilience. *Journal of Environmental Planning and Management, 57*, 144–156.

Magsino, S. L. (2009). *Applications of social network analysis for building community disaster resilience: Workshop summary*. Washington, D.C.: National Academies Press.

Maguire, B., & Hagan, P. (2007). Disasters and communities: Understanding social resilience. *The Australian Journal of Emergency Management*, *22*(2), 16–20.

Malone, T. W., & Crowston, K. (1988). *What is coordination theory and how can it help design cooperative work systems?* Paper presented at the 1990 ACM conference on Computer-supported cooperative work, Los Angeles, California. doi:10.1145/99332.99367

Malone, T. W., & Crowston, K. (1994). The interdisciplinary study of coordination. *ACM Computing Surveys (CSUR), 26*, 87–119.

Malone, T. W., & Rockart, J. F. (1991). Computers, networks and the corporation. *Scientific American*, *265*(3), 128–136. doi:10.1038/scientificamerican0991-128

Mann, C. (2003). Observational research methods. Research design II: Cohort, cross sectional, and case-control studies. *Emergency Medicine Journal, 20*, 54–60.

Manzo, L. C., & Perkins, D. D. (2006). Finding common ground: The importance of place attachment to community participation and planning. *Journal of Planning Literature, 20*, 335–350.

Mason, M. (2010). Sample size and saturation in PhD studies using qualitative interviews. *Forum Qualitative Sozialforschung/Forum: Qualitative Social Research*, *11*(3), Art. 8. Retrieved from http://nbn-resolving.de/urn:nbn:de:0114-fqs100387

Masten, A. S. (2001). Ordinary magic: Resilience processes in development. *American Psychologist, 56*, 227.

Mathbor, G. M. (2007). Enhancement of community preparedness for natural disasters: The role of social work in building social capital for sustainable disaster relief and management. *International Social Work, 50*, 357–369.

Mayer, R. C., Davis, J. H., & Schoorman, F. D. (1995). An integrative model of organizational trust. *Academy of Management Review, 20*, 709–734.

McConnell, A., & Drennan, L. (2006). Mission impossible? Planning and preparing for crisis. *Journal of Contingencies and Crisis Management, 14*, 59–70.

McDaniels, T., Chang, S., Peterson, K., Mikawoz, J., & Reed, D. (2007). Empirical framework for characterizing infrastructure failure interdependencies. *Journal of Infrastructure Systems, 13*, 175–184.

McDonald, R. (2003). *Introduction to natural and man-made disasters and their effects on buildings*. United Kingdom: Architectural Press.

McLaughlin, H. (2011). *Understanding social work research* (2nd ed.). Thousand Oaks, CA: SAGE Publications.

McMillan, D. W., & Chavis, D. M. (1986). Sense of community: A definition and theory. *Journal of Community Psychology, 14*, 6–23.

McNiff, J., & Whitehead, J. (2014). *Doing and writing action research*. Thousand Oaks, CA: SAGE Publications.

Mendonca, D., Beroggi, G. E., & Wallace, W. A. (2001). Decision support for improvisation during emergency response operations. *International Journal of Emergency Management, 1*, 30–38.

Merriam, S. B., Tisdell, E. J., & Ivonne, P. (2015). *Qualitative research: A guide to design and implementation*. United States: John Wiley & Sons.

Messias, D. K. H., Barrington, C., & Lacy, E. (2012). Latino social network dynamics and the Hurricane Katrina disaster. *Disasters, 36*, 101–121.

Miles, M. B., & Huberman, M. A. (1984). *Qualitative data analysis: A sourcebook of new methods* (9th ed.). United States: Sage Publications.

Mileti, D. S. (1999). *Disasters by design: A reassessment of natural hazards in the United States*. Washington, D.C.: Henry (Joseph) Press.

Mileti, D. S. (1991). *The eruption of Nevado del Ruiz volcano, Colombia, south America, November 13, 1985*. Washington, D.C.: National Academies Press.

Miller, F., H. Osbahr, E. Boyd, F. Thomalla, S. Bharwani, G. Ziervogel, B. Walker, J. Birkmann, S. Van der Leeuw, J. Rockström, J. Hinkel, T. Downing, C. Folke, and D. Nelson 2010. Resilience and vulnerability: complementary or conflicting concepts?. *Ecology and Society 15*(3): Art 11. Retrieved from http://www.ecologyandsociety.org/vol15/iss3/art11/

Miller, M., Paton, D., & Johnston, D. (1999). Community vulnerability to volcanic hazard consequences. *Disaster Prevention and Management, 8*, 255–260.

Mills, R. (2009). *Encyclopedia of case study research*. Thousand Oaks, CA: SAGE Publications.

Mitchell, J. K., Devine, N., & Jagger, K. (1989). A Contextual model of natural hazard. *Geographical Review*, *79*(4), 391–409. doi:10.2307/215114

Moore, S., Daniel, M., Linnan, L., Campbell, M., Benedict, S., & Meier, A. (2004). After Hurricane Floyd passed: Investigating the social determinants of disaster preparedness and recovery. *Family & Community Health, 27*, 204–217.

Moreno, J. L., & Jennings, H. H. (1938). Statistics of social configurations. *Sociometry*, *1*(3/4), 342–374. doi:10.2307/2785588

Morgan, G., & Smircich, L. (1980). The case for qualitative research. *Academy of Management Review, 5*, 491–500.

Morris, S. K., & Nguyen, C. K. (2008). A review of the cluster survey sampling method in humanitarian emergencies. *Public Health Nursing, 25*, 370–374.

Moxley, R. S., & Pulley, M. (2004). Hardships. In E. Van Velsor, C. D. McCauley, & M. N. Ruderman (Eds.), *The center for creative leadership handbook of leadership development* (2nd ed.) (pp. 183–203). San Francisco: Wiley, John & Sons.

Mukherji, A. (2014). Post-disaster housing recovery: The promise and peril of social capital. *Journal of Civil Society, 10*, 119–143.

Mullen, B., & Eduardo, J. (1991). Effects of communication network structure: Components of positional centrality 1. *Social Networks, 13*, 169–185.

Myers, K. N. (1993). *Total contingency planning for disasters: Managing risk - minimizing loss - ensuring business continuity*. New York: John Wiley & Sons.

Nakagawa, Y., & Shaw, R. (2004). Social capital: A missing link to disaster recovery. *International Journal of Mass Emergencies and Disasters, 22*, 5–34.

Neal, D. M. (1997). Reconsidering the phases of disasters. *International Journal of Mass Emergencies and Disasters, 15*, 239–264.

Nellemann, C., Hain, S. G., & Alder, J. (2008). *In Dead water: Merging of climate change with pollution, over-harvest, and infestations in the world's fishing grounds*. Arendal, Norway: United Nations Environment Programme, GRID-Arendal.

Newkirk, R. T. (2001). The increasing cost of disasters in developed countries: A challenge to local planning and government. *Journal of Contingencies and Crisis Management, 9*, 159–170.

Newport, J. K., & Jawahar, G. G. (2003). Community participation and public awareness in disaster mitigation. *Disaster Prevention and Management: An International Journal, 12*, 33–36.

Norland, E. V. T. (1990). Controlling error in evaluation instruments. *Journal of Extension, 28*, 1–35.

Norris, F. H., Baker, C. K., Murphy, A. D., & Kaniasty, K. (2005). Social support mobilization and deterioration after Mexico's 1999 flood: Effects of context, gender, and time. *American Journal of Community Psychology, 36*, 15–28.

Norris, F. H., & Elrod, C. L. (2006). Psychosocial consequences of disaster. In F. H. Norris, M. J. Friedman, & S. Galea (Eds.), *Methods for disaster mental health research* (pp. 20–42). New York: Guilford Publications.

Norris, F. H., & Kaniasty, K. (1996). Received and perceived social support in times of stress: A test of the social support deterioration deterrence model. *Journal of Personality and Social Psychology*, *71*(3), 498–511. doi:10.1037//0022-3514.71.3.498

Norris, F. H., Stevens, S. P., Pfefferbaum, B., Wyche, K. F., & Pfefferbaum, R. L. (2008). Community resilience as a metaphor, theory, set of capacities, and strategy for disaster readiness. *American Journal of Community Psychology, 41*, 127–150.

Obrist, B., Pfeiffer, C., & Henley, R. (2010). Multi‑ layered social resilience: A new approach in mitigation research. *Progress in Development Studies, 10*, 283–293.

Odgers, C. L., Moffitt, T. E., Tach, L. M., Sampson, R. J., Taylor, A., Matthews, C. L., & Caspi, A. (2009). The protective effects of neighborhood collective efficacy on British children growing up in deprivation: A developmental analysis. *Developmental Psychology*, *45*(4), 942–957. doi:10.1037/a0016162

Oliver-Smith, A. (1999). *What is a disaster? Anthropological perspectives on a persistent question*. New York, NY: Routledge.

Oliver-Smith, A., Cutter, S. L., Warner, K., Corendea, C., & Yuzva, K. (2012). *Addressing loss and damage in the context of social vulnerability and resilience*. Policy Brief 7. Bonn: United Nations University Institute for Environment and Human Security (UNU-EHS).

Olsson, P. (2003). Building capacity for resilience in social-ecological systems.

Ormrod, J. E. (2000). *Educational psychology: Developing learners*. Upper Saddle River, NJ: Merrill.

Osti, R. (2004). Forms of community participation and agencies' role for the implementation of water-induced disaster management: Protecting and enhancing the poor. *Disaster Prevention and Management: An International Journal, 13*, 6–12.

Owen-Smith, J., Riccaboni, M., Pammolli, F., & Powell, W. W. (2002). A comparison of U.S. And European university-industry relations in the life sciences. *Management Science*, *48*(1), 24–43. doi:10.1287/mnsc.48.1.24.14275

Paton, D., & Johnston, D. (2001). Disasters and communities: Vulnerability, resilience and preparedness. *Disaster Prevention and Management, 10*, 270–277.

Paton, D., & Johnston, D. (2006). *Disaster resilience: An integrated approach*. Springfield, IL: Thomas, Charles C. Publisher.

Paton, D., Millar, M., & Johnston, D. (2001). Community resilience to volcanic hazard consequences. *Natural Hazards, 24*, 157–169.

Patton, M. Q. (1990). Qualitative evaluation and research methods. *CA: SAGE Publications, inc.*

Peacock, W. G., & Morrow, B. H. (Eds.). (1997). *Hurricane Andrew: Ethnicity, gender and the sociology of disasters*. London, United Kingdom: Routledge.

Pelling, M., Maskrey, A., Ruiz, P., Hall, L., Peduzzi, P., Dao, Q.-H., . . . Kluser, S. (2004). R*educing disaster risk, a challenge for development, a global report*. New York, NY: United Nations Development Programme.

Perkins, D. D., Florin, P., Rich, R. C., Wandersman, A., & Chavis, D. M. (1990). Participation and the social and physical environment of residential blocks: Crime and community context. *American Journal of Community Psychology, 18*, 83–115.

Perkins, D. D., Hughey, J., & Speer, P. W. (2002). Community psychology perspectives on social capital theory and community development practice. *Community Development, 33*, 33–52.

Perkins, D. D., & Long, D. A. (2002). Neighborhood sense of community and social capital. In *The Plenum Series in Social/Clinical Psychology* (pp. 291–318). New York: Springer Science.

Perrow, C., Y, the, & Perrow, P. C. (2011). *Normal accidents: Living with high risk technologies*. Princeton, NJ: Princeton University Press.

Perry, R. W. (2007). What is a disaster? In H. Rodriguez, E. Quarantelli, & R. Dynes (Eds.), *Handbooks of Sociology and Social Research* (pp. 1–15). New York: Springer Science.

Petal, M., & Izadkhah, Y. O. (2008). Concept note: Formal and informal education for disaster risk reduction. *Proceedings of the International Conference on School Safety, Islamabad, Pakistan*.

Pfefferbaum, B. J., Reissman, D. B., Pfefferbaum, R. L., Klomp, R. W., & Gurwitch, R. H. (2007). Building resilience to mass trauma events. In L. S. Doll, S. E. Bonzo, D. A. Sleet, & J. A. Mercy (Eds.), *Handbook of Injury and Violence Prevention* (pp. 347–358). New York: Springer Science + Business Media.

Plano Clark, V. L., & Creswell, J. W. (2008). *The mixed methods reader*. Thousand Oaks, CA: Sage.

Plummer, R., & Armitage, D. (2007). A resilience-based framework for evaluating adaptive co-management: Linking ecology, economics and society in a complex world. *Ecological Economics, 61*, 62–74.

Polgar, S., & Thomas, S. A. (2013). *Introduction to research in the health sciences* (6th ed.). Edinburgh: Churchill Livingstone.

Polhill, G., Sutherland, L.-A., & Gotts, N. M. (2010). Using qualitative evidence to enhance an agent-based Modelling system for studying land use change. *Journal of Artificial Societies and Social Simulation*, *13*(2), 10–25. doi:10.18564/jasss.1563

Pollach, G. (2014). Natural disasters, armed conflict, and public health. *New England Journal of Medicine, 370*, 782–782.

Pooley, J. A., Cohen, L., O'Connor, M., & Taylor, M. (2013). Posttraumatic stress and posttraumatic growth and their relationship to coping and self-efficacy in northwest Australian cyclone communities. *Psychological Trauma: Theory, Research, Practice, and Policy*, *5*(4), 392–399. doi:10.1037/a0028046

Porfiriev, B. N. (1996). Social aftermath and organizational response to a major disaster: The case of the 1995 Sakhalin earthquake in Russia. *Journal of Contingencies and Crisis Management, 4*, 218–227.

Prell, C. (2012). *Social network analysis: History, theory and methodology*. Los Angeles: SAGE Publications.

Prince, S. H. (1920). *Catastrophe and social change, based upon a sociological study of the Halifax disaster, issues 212-214*. New York: Columbia University.

Putnam, R. D. (1993). The prosperous community. *American Prospect, 4*, 35–42.

Quarantelli, E. L. (2002). The role of the mass communication system in natural and technological disasters and possible extrapolation to terrorism situations. *Risk management (Bas)*, *4*(4), 7–21. doi:10.1057/palgrave.rm.8240130

Quarantelli, E. L. (1986). Planning and management for the prevention and mitigation of natural disasters, especially in a metropolitan context: Initial questions and issues which need to be addressed. Retrieved November 21, 2016, from University of Delaware Library, http://udspace.udel.edu/handle/19716/488

Quarantelli, E. L. (Ed.). (2005). *What is a disaster? A Dozen perspectives on the question*. London: Taylor & Francis.

Quarantelli, E. L., & Dynes, R. R. (1977). Response to social crisis and disaster. *Annual Review of Sociology, 3*(1), 23–49. doi:10.1146/annurev.so.03.080177.000323

Rattray, J., & Jones, M. C. (2007). Essential elements of survey design and development. *Journal of Clinical Nursing, 16*, 234–243.

Reininger, B. M., Rahbar, M. H., Lee, M., Chen, Z., Alam, S. R., Pope, J., & Adams, B. (2013). Social capital and disaster preparedness among low income Mexican Americans in a disaster prone area. *Social Science & Medicine, 83*, 50–60.

Riad, J. K., Norris, F. H., & Ruback, R. B. (1999). Predicting evacuation in two major disasters: Risk perception, social influence, and access to resources. *Journal of Applied Social Psychology, 29*, 918–934.

Richardson, G. E. (2002). The metatheory of resilience and resiliency. *Journal of Clinical Psychology, 58*, 307–321.

Rohrmann, B. (2000). Critical assessment of information on bushfire preparedness for residents. *Australian Journal of Emergency Management, 15*(1), 14-19.

Rose, A. (2004). Defining and measuring economic resilience to disasters. *Disaster Prevention and Management, 13*, 307–314.

Rossiter, J. R. (2005). Reminder: A horse is a horse. *International Journal of Research in Marketing, 22*, 23–25.

Roy, M. H. (2001). Small group communication and performance: Do cognitive flexibility and context matter? *Management Decision, 39*, 323–330.

Rutter, M. (1987). Psychosocial resilience and protective mechanisms. *American Journal of Orthopsychiatry, 57*(3), 316–331. doi:10.1111/j.1939-0025.1987.tb03541.x

Saegert, S., & Winkel, G. (2004). Crime, social capital, and community participation. *American Journal of Community Psychology, 34*, 219–233.

Salkind, N. J., & Rasmussen, K. (2006). *Encyclopedia of measurement and statistics*. Thousand Oaks, CA: SAGE Publications.

Salloum, A., & Lewis, M. L. (2010). An exploratory study of African American parent-child coping strategies post-hurricane Katrina. *Traumatology, 16*(1), 31–41. doi:10.1177/1534765609348240

Sampson, R. J., Raudenbush, S. W., & Earls, F. (1997). Neighborhoods and violent crime: A multilevel study of collective efficacy. *Science, 277*, 918–924.

Saul, J. L. J. (2004). Facilitating family and community resilience in response to major disaster. In M. McGoldrick & F. Walsh (Eds.), *Living beyond loss: Death in the family, Second edition* (2nd ed.) (pp. 285–309). New York: Norton, W. W. & Company.

Schell, C. (1992). *The value of the case study as a research strategy*. Manchester, England: University of Manchester, Manchester Business School.

Scherer, C. W., & Cho, H. (2003). A social network contagion theory of risk perception. *Risk Analysis, 23*, 261–267.

Schwarzer, R., & Warner, L. M. (2013). Perceived self-efficacy and its relationship to resilience. In S. Prince-Embury & D. H. Saklofske (Eds.), *Resilience in Children, Adolescents, and Adults* (pp. 139–150). New York: Springer Science + Business Media.

Scott, J. (2012). *Social network analysis*. Sage.

Seeman, T. E. (1996). Social ties and health: The benefits of social integration. *Annals of Epidemiology, 6*, 442–451.

Seifert, C. (2007). Improving disaster management through structured flexibility among frontline responders. In D. E. Gibbons (Ed.), *Communicable crises: Prevention, response, and recovery in the global arena. Research in public management* (p. 83). Charlotte, NC: Information Age Publishing.

Shaluf, I. M. (2007). An overview on the technological disasters. *Disaster Prevention and Management, 16*, 380–390.

Shiwaku, K., & Shaw, R. (2008). Proactive co-learning: A new paradigm in disaster education. *Disaster Prevention and Management: An International Journal, 17*, 183–198.

Shrivastava, P., Mitroff, I. I., Miller, D., & Miclani, A. (1988). Understanding industrial crises. *Journal of Management Studies, 25*, 285–303.

Shuttleworth, M. (2008). Quantitative research design - proving cause and effect. Retrieved October 22, 2016, from Explorable, https://explorable.com/quantitative-research-design

Siah, C. Y. (2005). All that glitters is not gold: Examining the perils and obstacles in collecting data on the Internet. *International Negotiation, 10*, 115–130.

Skerratt, S., & Steiner, A. (2013). Working with communities-of-place: Complexities of empowerment. *Local Economy*, *28*(3), 320–338. doi:10.1177/0269094212474241

Smith, L. E., Bernal, D. R., Schwartz, B. S., Whitt, C. L., Christman, S. T., Donnelly, S., . . . Kish, J. (2014). Coping with vicarious trauma in the aftermath of a natural disaster. *Journal of Multicultural Counseling and Development, 42*, 2–12.

Snowden, L. R. (2005). Racial, cultural and ethnic disparities in health and mental health: Toward theory and research at community levels. *American Journal of Community Psychology, 35*, 1–8.

Solomon, S. D., Bravo, M., Rubio-Stipec, M., & Canino, G. (1993). Effect of family role on response to disaster. *Journal of Traumatic Stress, 6*, 255–269.

Soy, S. K. (1997). *The case study as a research method* (Unpublished paper). Austin, TX: University of Texas.

Stallings, R. A. (2003). *Methods of disaster research*. Philadelphia: Xlibris Corporation.

Stewart, K., Glanville, J. L., & Bennett, D. A. (2014). Exploring spatiotemporal and social network factors in community response to a major flood disaster. *Professional Geographer, 66*, 421–435.

Strauss, A. (1990). J., Corbin, (1990). *Basics of qualitative research. grounded theory procedures and techniques*. Newbury Park, CA: Sage.

Sweet, S. (1998). The effect of a natural disaster on social cohesion: A longitudinal study. *International Journal of Mass Emergencies and Disasters, 16*, 321–331.

Tartaglia, S. (2006). A preliminary study for a new model of sense of community. *Journal of Community Psychology, 34*, 25–36.

Tashakkori, A., & Creswell, J. W. (2007). Editorial: The new era of mixed methods. *Journal of Mixed Methods Research, 1*, 3–7.

Tedeschi, R. G., & Calhoun, L. G. (1995). *Trauma and transformation: Growing in the aftermath of suffering*. Thousand Oaks, CA: SAGE Publications.

Tierney, K. J. (2003). *Conceptualizing and measuring organizational and community resilience: Lessons from the emergency response following the September 11, 2001 attack on the World Trade Center* (Preliminary Papers no. 329). Newark, DE: University of Delaware Library. Retrieved from http://udspace.udel.edu/handle/19716/735

Tierney, K., & Bruneau, M. (2007). Conceptualizing and measuring resilience: A key to disaster loss reduction. *TR News*. Retrieved from http://www.trb.org/Main/Blurbs/158992.aspx

Timulak, L., & McElvaney, R. (2013). Qualitative meta-analysis of insight events in psychotherapy. *Counselling Psychology Quarterly, 26*, 131–150.

Tobin, G. A. (1999). Sustainability and community resilience: The holy grail of hazards planning? *Global Environmental Change Part B: Environmental Hazards, 1*, 13–25.

Tobin, G. A., & Whiteford, L. M. (2002). Community resilience and volcano hazard: The eruption of Tungurahua and evacuation of the faldas in Ecuador. *Disasters, 26*, 28–48.

Toya, H., & Skidmore, M. (2014). Do natural disasters enhance societal trust? *Kyklos, 67*, 255–279.

Tse, S., & Liew, T. (2004). New Zealand experiences: How is community resilience manifested in Asian communities? *eCOMMUNITY: International Journal of Mental Health & Addiction*, 2(1), . Retrieved from http://hdl.handle.net/1880/47866

Tyler, K. A. (2006). The impact of support received and support provision on changes in perceived social support among older adults. *International Journal of Aging and Human Development, 62*, 21–38.

Uddin, M. S., & Hossain, L. (2009). *Towards coordination preparedness of soft-target Organisation*. Proceedings of the 8th International Conference, EGOV 2009, Linz, Austria (pp 54-64). doi:10.1007/978-3-642-03516-6_5

United Nations Office for Disaster Risk Reduction [UNISDR]. (2015). Australia Disaster & Risk Profile: Basic Country Statistics and Indicators (2014). Retrieved May 14, 2016, from PreventionWeb, http://www.preventionweb.net/english/countries/statistics/?cid=9

Ursano, R. J., Mckibben, J. B., Reissman, D. B., Liu, X., Wang, L., Sampson, R. J., & Fullerton, C. S. (2014). Posttraumatic stress disorder and community collective efficacy following the (2004) Florida hurricanes. *PloS one, 9*, e88467.

Vaeth, P. A., Ramisetty-Mikler, S., & Caetano, R. (2009). Depression among couples in the United States in the context of intimate partner violence. *Journal of Interpersonal Violence*, 25(5), 771–790. doi:10.1177/0886260509336957

Van de Ven, A. H., Delbecq, A. L., & Koenig Jr, R. (1976). Determinants of coordination modes within organizations. *American Sociological Review*, *41*(2), 322–338. doi:10.2307/2094477

Van Vugt, M. (2001). Community identification moderating the impact of financial incentives in a natural social dilemma: Water conservation. *Personality and Social Psychology Bulletin, 27*, 1440–1449.

Varda, D. M., Forgette, R., Banks, D., & Contractor, N. (2009). Social network methodology in the study of disasters: Issues and insights prompted by post-Katrina research. *Population Research and Policy Review, 28*, 11–29.

Vezzali, L., Cadamuro, A., Versari, A., Giovannini, D., & Trifiletti, E. (2015). Feeling like a group after a natural disaster: Common ingroup identity and relations with outgroup victims among majority and minority young children. *British Journal of Social Psychology, 54*, 519–538.

Vogt, P. W., Gardner, D. C., & Haeffele, L. M. (2012). *When to use what research design*. New York, NY: Guilford Publications.

Voss, M. (2008). The vulnerable can't speak. An integrative vulnerability approach to disaster and climate change research. *Behemoth A Journal on Civilisation, 1*, 39–56.

Wachinger, G., Renn, O., Begg, C., & Kuhlicke, C. (2013). The risk perception paradox—Implications for governance and communication of natural hazards. *Risk Analysis, 33*, 1049–1065.

Walker, B., Gunderson, L., Kinzig, A., Folke, C., Carpenter, S., & Schultz, L. (2006). A handful of Heuristics and some propositions for understanding resilience in social-ecological systems. *Ecology and Society*, *11*(1), . doi:10.5751/es-01530-110113

Waller, M. A. (2001). Resilience in ecosystemic context: Evolution of the concept. *American Journal of Orthopsychiatry*, *71*(3), 290–297. doi:10.1037//0002-9432.71.3.290

Walsh, F. (2015). *Strengthening family resilience* (3rd ed.). New York, NY, United States: Guilford Publications.

Wandersman, A., & Florin, P. (2000). Citizen participation and community organizations. In J. Rappaport & E. Seidman (Eds.), *Handbook of Community Psychology* (pp. 247–272). New York: Springer Science + Business Media.

Webb, G. (2004). Role improvising during crisis situations. *International Journal of Emergency Management, 2*, 47–61.

Weick, K. E. (1995). *Sensemaking in organizations*. Thousand Oaks: Sage Publications.

Weick, K. E., Sutcliffe, K. M., & Obstfeld, D. (2008). Organizing for high reliability: Processes of collective mindfulness. *Crisis Management, 3*, 81–123.

White, G. F., & Haas, E. J. (1975). *White: Assessment if research of research of natural hazards*. Cambridge, MA: MIT Press.

Whittle, R., Medd, W., Deeming, H., Kashefi, E., Mort, M., Walker, G., & Watson, N. (2010). *After the rain-learning the lessons from flood recovery in Hull* (Final project report for Flood, Vulnerability and Urban Resilience: A real-time study of local recovery following the floods of June 2007 in Hull).Lancaster, UK: Lancaster University.

Wiersma, W. (2013). *The validity of surveys: Online and offline*. Oxford Internet Institute. Retrieved from http://wybowiersma.net/pub/essays/Wiersma,Wybo,The_validity_of_surveys_online_and_offline.pdf.

Wildavsky, A. (Ed.). (1984). *Trial without error: Anticipation versus resilience as strategies for risk reduction*. Australia: Centre for Independent Studies.

Wisdom, J., & Creswell, J. (2013). *Mixed methods: Integrating quantitative and qualitative data collection and analysis while studying patient-centered medical home models*. Rockville, Maryland: Agency for Healthcare Research and Quality.

Yin, R. K. (1993). *Applications of case study research*. San Francisco, CA, United States: Sage Publications.

Yin, R. K. (2003). *Case study research: Design and methods* (3rd ed.). Thousand Oaks, CA: Sage Publications.

Zhou, H., Wang, J., Wan, J., & Jia, H. (2010). Resilience to natural hazards: A geographic perspective. *Natural Hazards, 53*, 21–41.

Zimmerer, K. S., & Bassett, T. J. (2003). *Political ecology: An integrative approach to geography and environment-development studies*. New York, USA, Guilford Press.

Appendices

Appendix A: Resilience Definition

Paton et al. (2000)

Resilience describes an active process of self-righting, learned resourcefulness and growth—the ability to function psychologically at a level far greater than expected given the individual's capabilities and previous experiences.

Carpenter et al. (2001)

Ecosystem resilience is the capacity of an ecosystem to tolerate disturbance without collapsing into a qualitatively different state that is controlled by a different set of processes. A resilient ecosystem can withstand shocks and rebuild itself when necessary. Resilience in social systems has the added capacity of humans to anticipate and plan for the future.

UN/ISDR (2002)

The capacity of a system, community or society potentially exposed to hazards to adapt, by resisting or changing in order to reach and maintain an acceptable level of functioning and structure. This is determined by the degree to which the social system is capable of organizing itself to increase this capacity for learning from past disasters for better future protection and to improve risk reduction measures.

Bruneau et al. (2003)

An analysis of seismic resilience and apply the concept at four levels: (1) technical, physical systems perform when subjected to earthquake forces; (2) organizational, the ability to respond to emergencies and carry out critical functions; (3) social, the capacity to reduce the negative social consequences of loss of critical services; and (4) economic, the capacity to reduce both direct and indirect economic losses Resilience has four dimensions: (1) robustness, strength to withstand a given level of stress without loss of function; (2) redundancy, the extent to which elements, systems that are substitutable; and (3) resourcefulness, the capacity to identify problems, establish priorities, and mobilize resources; (4) rapidity, the capacity to meet priorities and achieve goals in a timely manner A resilient system has: (1) reduced probability of failures; (2) reduced consequences from failures; and (3) reduced time to recovery.

Kendra and Wachtendorf (2003)

The ability to respond to singular or unique events.

Cardona (2003)

The capacity of the damaged ecosystem or community to absorb negative impacts and recover from these.

Rockstro¨m (2003)

Strategies of social resilience building include manageable strategies, such as institutional development, land reform, land tenure, diversification, marketing, human capacity building, and unmanageable ones, such as relief food, cereal banks, social networks, virtual water imports

Rose (2004, 2007)

Resilience includes inherent resilience (ability under normal circumstances) and adaptive resilience (ability in crisis situations due to ingenuity or extra effort).

Aguirre (2006)

A resilient social entity absorbs, responds and recovers from the shock; and improvises and innovates in response to disturbances.

Maguire and Hagan (2007)

In broad terms, social resilience is the capacity of a social entity (e.g., a group or community) to bounce back or respond positively to adversity.

Kang et al. (2007)

Resilience is the ability of the system to recover once hazard has occurred and measure resilience by the duration of an unsatisfactory condition.

Adger (2000)

The ability of communities to withstand external shocks to their social infrastructure.

Brown (1996)

Community The ability to recover from or adjust easily to misfortune or sustained life stress.

Ganor (2003)

The ability of individuals and communities to deal with a state of continuous, long term stress; the ability to find unknown inner strengths and resources in order to cope effectively; the measure of adaptation and flexibility.

Appendix B: Social Resilience Qualitative Survey

Interviewee Name: Date:

Interviewee Position: Interviewer:

Case Study:

☐ March 2012 - Wagga Wagga Flood

☐ May 2009 - Kempsey Flood

☐ June 2007 - Hunter Region and Central Coast storm

The aim of this research is enhancing the social resilience within a community to natural disaster such as flood and storm.

Social resilience refers to the ability of a community to withstand external social shock in ways that minimize social disruption and enhancing social capacity to resist disaster losses.

Section A- Social Resilience / Social Resilience Indicators:

1. Have you involved in SES/council responses for <<above case study>>?

☐ Yes ☐ No

2. If yes, what was your role at that time?

3. For each indicators please tell me how much you agree or disagree its impact on social resilience and why?

Indicators	Strongly Disagree	Disagree	Neither Agree nor disagree	Agree	Strongly Agree	Don't know	Reason
Community Participation Involvements in community							
Education Level of Knowledge about flood							
Exchange information Interchange information among community							
Learning Learning from previous disasters							
Shared information such as Social Media, TV, Radio							
Social Support Support from neighbourhood							
Sense of community Feeling of belonging to community or place							
Trust Trust to neighbourhood							
Coordination Coordination among community							
Demographic information such as age, gender, socioeconomic status(income), health, historical, education, cultural(religious belief) or populations with special needs							
Community efficacy Community belief in their own capabilities of performing and completing jobs							
Improvisation							

Community creativity and innovative to devise a solution for increasing resilience								
Coping Style Adaptive capacity and Developing strategy								
Leadership Leadership within community								

4. What other indicators or parameters involved in making communities more resilient that not mentioned in above question?

5. Did/Do you measure resilience in the community?
   a. If yes, how did/do you measure it?

   b. If yes, did/do you consider disaster phases like pre-disaster, response and recovery once measuring resilience? And why?

Section B- General Process:

6. Did/Do you have any plan or program for increasing resilience within a community?
   a. If yes, please explain it?
   b. If yes, did/do you consider disaster phases like pre-disaster, response and recovery once making a plan for increasing resilience? And why?

7. How the SES/council involved/involve in the community's responses? How did/does the involvement start, progress and finish?
   a. How does the process start once disaster happen?
   b. Is there more than one way the process could start?
   c. How does the process get from point A to point B?
   d. Where else might the process go and why?
   e. What are input / output for the process?

8. What organizations or communities were/are involved in the process? How did/does the involvement start, progress and finish?
   a. Who are the key people and what are their roles? What are their areas of work?
   b. Who is responsible for managing, coordinating resources and information?

Section C- Resource Management:

9. Is there any plan/standard for managing resources and information within communities?

10. How information is added, process and distributed within a community or relevant parties?

11. How volunteers are ordered and mobilize within a community?

12. Who is responsible for managing and coordinating resources (volunteers) or information?
    a. Who/which organizations are responsible for command centre?
    b. Which organization involved in making decision at command centre?
13. Any other comments?

Appendix C: Interview Transcripts

Andrew Edward:

R: Our research is about community resilience from the social perspective. In this study, community resilience is the community capacity to jump back to previous situation of life quality and sometimes go beyond the situation and becomes better situation than before, through innovation and improvising within a community. As resilience is a very huge topic and multi-disciplinary context, it is beyond one research that's why in this study; we only focus on social perspective of community resilience. So we would like to know your organization role to develop and improve resilience within a community and the procedures in SES to achieve this goal. Can you please specify 2 or 3 disasters or major incidents that you have comprehensive information about the disaster loss and your program to improve resilience? Appreciate if you can nominate 2-3 key people and introduce me to them at the end of our meeting in order to continuing my research.

I: So, concerning community resilience, we have an area inside our organization called community engagement, and the community engagement area is set up basically to look at how they can engage.

Structure – we have a handful of people in our head office in Wollongong doing community engagement, and what we've been doing over the last few years is actually imbedding, community engagement officers into our regional offices around the state, so they can provide direct support and engagement with their local communities, to get them closer to the communities.

They are there to do a couple of things: 1 to raise awareness about our organization, but primarily to understand how we can get information to members of the community about what the threats are in the areas, usually flood and storm threats. And what they can do to prepare themselves in case a flood comes and what they can do around recovery.

We talk to them about a bunch of toolkits we have in place that we can use. Looking at some software they can use if business and homeowners. They can prepare their homes. We talk about getting emergency kits ready.

R: Does it include demographic information? And any relevant information about community and disaster are included?

I: The software we are using is tied to individual community members so they can log into something that's online and they will work their way through that to have a tailor made emergency kit.

R: Sound those data would be very helpful for us.

I: We can look at any of the recent major floods that have gone on as examples of what to do/not to do around community resilience. But one that I think would be worth having a look at and we have some papers and studies and they were particularly focusing on the town of Kempsey on the mid north coast. Kempsey has been prone to a lot of flooding disasters about 10 years ago. Particularly with Kempsey and the way that floods, it has potential for the central business district to go under water. All the businesses are severely impacted and have a massive knock-on effect to the economy and can also cause social stress within the community. All the different types of issues that can arise around that.

Looking at Kempsey was a catalyst, mainly focusing on economics, to help businesses prepare for disaster. I can give you those papers. If you would like, I can put you in contact with our manager of community engagement. He would probably be a primary person to go talk to about what we've been doing: Andrew Richards. See how you go with him, I can also put you in touch with someone else within the organization.

We can also look at Wagga Wagga, with the biggest recent floods. With Wagga, there were some major areas in the townships. It was 12 months ago. A couple of the big issues with the flood was that there hadn't been a major flood in probably 40 years. And the demographics of the town had changed. People were probably saying "not in my backyard.. I've lived here for 20 years and never seen this happen".

R: Is that a potential region for flooding?

I: Yes, and it's consistent across the entire state. Not just there. Because there are usually significant time periods between major floods, the communities forget what they are likely to be impacted by. Old people get old and move away. You have a large amount of growth in the community and people move in there, so when you try to explain the impact, they don't believe you.

R: Is that the most important component in terms of resilience?

I: I think the government can do a lot more in that space, but it's highly political. It is trust, and we are lucky that we are a trusted organization in what we do. But it probably goes further. Local government has a very good idea, as we do, about what impacts floods might be. If we look at storms we know there are likely to be more impact on some areas than other, and insurance companies know this and base their premiums on where you live. So, that can be something that is worthwhile. Depends on where you want to take it.

R: would you please describe a situation that disaster happens and your organization procedure to face with it? How does the process starts, and how you go from point A to B and how you coordinate with other organizations and volunteers, alternatively if you have a workflow diagram that I can have a look at that, it gives me an idea of the process.

I: Andrew Richards and his team – before there is any disaster, we ideally want to have Joe Block citizen understand the risk they have to their family and property so that they can be

prepared for it. Our job is to do ourselves out of a job. If we can set society up that way, it would be wonderful. In reality it doesn't happen.

In Andrew, his team, what they try to do is get out to community events, anywhere were they can engage with the public. Could be fairs, at specific events, so they can tell people about risk in their area and preparation. As well as using our channels including social media to engage. To be honest, I think there are a couple of major barriers. That is society and itself in general has lost its ability to be resilient because of the way we live our lives now.

There is not as much community spirit in the Australian culture as there used to be. We actually have to tell people instead of it happening naturally. There is also a big issue around education.

When I was a child, we used to get visits in schools within schools from the fire brigade. They would bring around their red truck so we could learn how to prepare ourselves for disasters. Ring 000 and tell mom and dad. And that just doesn't happen anymore because our curriculums are full of well-made things that are maybe not the central things that we need to build our society upon. They are our future society, and it is a fundamental problem that it doesn't exist.

R: what do you think about education and its impact on resilience? Have you had any group education program for any community?

I: It doesn't happen, in my opinion. I was really lucky and went to a Senate inquiry a few years ago and said they needed to do more of that. I gave my 5 cents worth to raise that. We do group education to schools and children about what we do, but it's not enough.

R: Do you have any individual education program for communities

I: We do, do that. Those online toolkits that we talked about.

R: what do you think about community efficacy or collective self-efficacy among the community? Are those parameters can impact on social resilience? Do you think volunteers assist to help the public increase their skills?

I: It does happen, but nothing like what it used to. It can. What it needs is a change in thinking as well. What I mean by sorting ourselves out of a job: With Andrew's small team and budget, society seems to like the SES trucks with their lights on and responding to things and that costs a lot of money. If we could shift the investment from that into education, it would be a long-term investment, but it would mean a reduction in what we need to do to respond.

I like to look at it in the anti smoking debate. In the 1970s in Australia, there was massive community education put out to educate young people, including mass advertising campaigns, to raise the awareness of the harms of smoking and to reduce the incidence of people smoking. We saw a large decrease in the levels of smoking and smoking related disease. Because this investment in education had a payback in 20 years time. It's the same with emergency management. Investing in education and preparation of our communities now rather than the response. we still need the response there… but if we flip the equation and frame it differently it means we have to respond less.

To go into more depth – what we try to do with our volunteers is to get good upstanding members of our community to our organization. Hopefully they bring their networks already to our organization to be able to push that information out. Hopefully they don't have to go and

build the networks. If we can get a good upstanding business man who might also be a member of the chamber of commerce in their community that already has a network in place so that they can talk to their people and friends about preparation.

R: do you have any program to train volunteers and increase their ability?

I: Yes. Our organization is like a tech college. We are a registered training organization, so we issue certificates of competencies. We run lots of training. It is all focused around the response stuff, but it's not about how to communicate and engage with people. So there is work we're doing now around engagement, but in the grand scheme it is very small compared to teaching people how to respond – to use chainsaws and jumping off cliffs and use ropes and that type of things.   So that's the argument that we could put more money into education as opposed to skill response is a big change in thinking. There are only a few of us that think like that.

The other thing is the social network stuff. We have twitter and YouTube and Facebook. We will use any channel that we can before, during or after an emergency to connect with a community. On a nice day like today, we wont have a lot of stuff happening. When there is no major disaster, we will issue information about preparedness – don't forget to clean your gutters out, and pay attention to these notices. We will also use events taking place around us.

A few years ago, we were doing some work with NRMA insurance and they paid for us to light the opera house up with orange lights to use that as a community relations event in Sydney to raise awareness with people. Any time we can use an event to push out information, we will do that whatever the medium.

R: What do you think about community participation and its impact on resilience? For example if community participate in local meeting, it would be affected on social resilience?

I: Yes. It has to have an impact. If you educate them and make them aware, then you're going to get a benefit out of that.   And the benefit should be community resilience, and they understand their risks.

R: Do you think social support impact on resilience and how much?

I: yes, definitely. So if you have a close community that knows each other.. and I'm really lucky that I live in a neighbourhood that knows each other very well and look out for each other as well, so if something happens, we'll just pop our head out and make sure they are alright, so we don't have to ring up anyone unless there's a major problem.

R: do you think your organization can assist in this topic?

I: Yes, it could.   But it would mean changing our thinking in investing in community preparation and engagement.   And that's where we are going, but it's a long slow journey. I think what we would be looking at is the way that society has shifted and what do we need to do to shift our business model as well. An example, not related to my organization, but to fire and rescue and how they operate: we see very few house fires that occur, not as many as 50 years ago. Much of that is due to material design and building codes and standards, plus all of our housing has fire alarms and smoke alarms. There is talk now of all new buildings, of putting sprinkler systems into them. If that was to occur, the requirement for fire and rescue to respond to house on fire would reduce more. So what that would mean is a huge opportunity for them to

change the focus from response to engagement. But it would also mean that the requirement for the resources to go into that organization might be doing another job.

R: What do you think about coping style and its impact on social resilience?

I: It's the same thing. If they understand and we ask them to evacuate, they will be prepared to evacuate. They will have everything they need to prepare. How to lift things off the ground, or sandbag their house. At least if they understand what the impact is likely to be, then the level of resilience and community preparedness goes up.

When you are talking about hundreds of houses going under water, you can only do so much. You're also talking about significant psychological trauma that might occur apart from economic damage.

And we don't' do this, but from a community perspective that society provides the appropriate resources to support people from the psychological perspective, whether it be through counseling or whatever it may be.

Psychological injury is huge and ongoing, in all areas of society. There are probably some deeper-rooted issues. It doesn't have enough interaction.

R: how about trust and its impact.

I: Yeah, it's essential. Surveys are run all the time about trusted professions, and you'll always see emergency services pop out in the top levels of those b/c people do trust us. The critical thing with that is making sure you maintain that trust and don't break it. That's also about organizational reputation. A lot of it is psychological as well. There are a few components.

If we have a major thunderstorm that goes through an area, the quicker that we can put something over the top of their roof, the less damage will get done b/c it will be sealed again. Generally, with a large storm, there will be lots of water causing damage and the quicker we can get around and put a tarp on a roof, you can see a massive reduction in the economic loss. Insurance companies have done many studies on this.

The other component in having a rapid response, and we try to do this in partnership with all emergency services when there is a major disaster, that we put as many people into the field as we can, b/c if the community sees us out there responding, then psychologically it sends a strong message. That we are here and looking after them.

R: can you please explain about the process in SES when any disaster happens? And how you coordinate with the other emergency organizations, and do you have any specific program to communicate with them before, during, after the disaster?

I: We work really closely with the bureau of meteorology; they work out all the weather predictions for us. We take whatever they say as being truthful. The difference being, we get a lot of additional support from the bureau of meteorology than what the general public gets. You can go online and look at what the weather is going to do, but we have is direct access to all their senior people, senior forecasters, senior hydrologist, and if we know that something is going to happen then we will have advanced warning by many days potentially.

Initially we will start teleconferencing with the bureau talking to them about the likely impacts.

R: So your expertise mostly about the flooding and the storm.

I: Flooding, storm, and tsunami, plus we do a lot of other things around road rescues. You don't get as much advanced warning on a storm, but we can get likelihood predictions 24-48 hrs. in advance. We will talk with the bureau around all of that. Floods are a lot more known quantities. When we get this info we will talk to them about the likely impacts. They will tell us "we think there is going to minor, moderate, or major flood." When they start getting more information, when the rain starts falling, and they see how much water is carrying in encatchments, we will get predictions on height levels. Initially it will only be categorized as minor moderate or major. The real things we are interested in are moderate or major floods because they cause the most damage.

We will immediately start to engage with our local regional offices to go through the plans in place. We have 17 regional offices and they are coordinating point for volunteers. I can give you a map. If it's going to be a major flood, say in Wagga… We will talk to that regional office, pull your plans out and make sure things are up to date. Part of all of that will be to notify their local community through different channels – radio is common, fax machines, phone trees. We use all sorts of old technology mechanisms because they work. It's not all just Facebook.

We would have that conversation with them. Based on what they would say to us, we may decide to put other areas on alert in the states, the ones next door to Wagga. We might ask for them to send resources – people and vehicles, but not all at once.

R: Does SES responsible to mobilize resources?

I: A lot of that is done centrally from where we are in Wollongong. We will ask the other regions to see what they can supply and when, and they will come back 3 or 4 hours later and see what they can give up.

R: Is this all done over the phone?

I: Some, but a lot of it is written communication. We would have a conversation on the phone via teleconference and it will be backed up by instructions, what is required. We would send that to the local area. Down in the local area, the volunteer sub units would talk to the senior volunteers, who can you give to us to help out? And at a state level we would be preparing our own plans. Our own media engagement plan, television, media plan. We would be standing up a bunch of resources. It's really about preparing and doing that well in advance. We will decide how many people we need to be dedicated; we will put people on shifts, and make sure we ensure we aren't working people too hard and too long.

So we might then come back 24 hours later and have another teleconference with the bureau. And they might say, yes, it's definitely happening in 6 hours time. But b/c we've done all this preplanning work, we will be prepared. We will be increasing out messages out to the community about the likely impact of the disaster. By that time the preparedness messages are probably too late.

R: how do you deal with demographic information and impact on resilience?

I: The demographic data that we base ourselves on comes largely from the bureau of statistics, but we also get a lot of additional data through various channels in the NSW government. From that we can draw a circle on a map and know how many people are likely to live there. It's

reasonable data, but it's probably not granular. It's enough for us to make the broad decisions about whether we will evacuate the community.

What I mean by granular or not fine: I can tell you there is a house there, and I can make some assumptions about how many people live there based on what the Bureau of statistics will give us.

R: Can you see in the system that how many people need special requirements?

I: We do not have to the detail information on people that have special needs. If you asked me how many people are on dialysis machines in this community I wouldn't be able to tell you.

R: Do you have any information about community economic situation?

I: Only what we would get through the census data.

R: do you think demographic information can impact on resilience. For example, if the family has the highest income, their resilience is different from the family that has the lowest income.

I: Definitively and I think that's a fine assumption to draw. If you're in a higher socioeconomic area, you should have a higher level of resilience, you are generally more educated. There is a definite correlation b/w the two. It's not just in a disaster. It covers all facets of a society. Where my children go, they are at a public school but it might as well be a private one b/c the socioeconomics of the area that I live in is quite high compared to all the neighbourhoods that are around us that are a lot lower. We are living in a newer subdivision. You need to be careful when looking at the socioeconomic data as well b/c it doesn't tell you how much debt they are in.

R: what happened 24 hour before disaster in SES

I: The same thing we were talking about, what's the likelihood of the disaster going to be and they might revise it and say it will be worse, or not so bad. We will push out communications to the community at our level and the local level. We will be putting resources in place ready to respond, and that response may be that we need to evacuate part of the community. We will be getting ourselves and others like the fire brigades or chambers of commerce to coordinate at the local level to get them to go out and door knock the houses we need to evacuate.

R: How do you coordinate with other organization or within your team?

I: It's all highly coordinated. I talk about this in the class that I run as well. How we do it here in NSW is probably the best in the world. Even better than any of the other states. We've seen terrible disasters in Queensland. We have the appropriate legislation in place that clearly defines who's in command of a disaster when it occurs. If we have a flood disaster, we have people taking command of that. Everyone else will fall underneath us. We get to tell them what to do.

R: is there any relevant documentation exist for that?

I: I can show you all the legislation and all the plans are available on the web. All of this stuff is in the public domain. www.emergency.nsw.gov.au If you go to that website, here I'll show you.

R: how do you organize resources in your team and also with the other emergency organizations

I: We will go to them prior, we will say, we would like you to give us these resources, or we will ask them what can you give to us and can you let us know within 24 hours? We will have a reasonable idea of resourcing capabilities.

If you go to this website and go to publications, the key things that you need to look at is the legislation and policies. That puts in the overarching legislation, the state emergency rescue management act. It establishes a lot of things to occur. The key thing is the NSW state emergency plan – straight out of the legislation, it says the way the emergencies are going to be managed. A lot of it is actually done through personal networks believe it or not. This legislation puts the formal network and process in place.

Let's keep the Wagga example. We are getting resources; we would also go to rural fire service and ask them for 50 people to help us out. We would send that request over in writing. We might ask them to give us a person in our office, and we do this with the major emergency services. So instead of having to send an email or phone, we would just talk to them directly.

Underneath that plan, there is the specific disaster management plan. There is a way that flooding is managed across the entire states. It details how we respond to aviation emergencies, bush fires counter terrorism.

We have got all of this in the public domain. How we will manage the different phases of a disaster and how we will recover from it. We have the liaison offices as well. I wouldn't underestimate the importance of the informal networks. The key thing is the relationship you build with the counterpart in other agencies.

I have great relationships with my counterparts. If I ring them, they know it's important. There is a lot of trust that is not establishes easily. It comes with time and effort.

R: for the communication, do you normally follow the predefined plan or through the informal network.

I: Both, you have both channels that are available to you. You have the formal process you need to go through and you also have an informal network. Combining both of them is extremely powerful. The leadership aspect of it all is important. Knowing how to use the leadership is key

Looking at that example. We have these people. The other thing on the coordination: how do we know where to send the trucks to? Because we're the people that are in control of the emergency, we will delegate to the other services where to send their resources having the overall control.

Sometimes duplication does occur, but that's generally b/c the member of the public may ring us up and ring someone else up and put the same request in through different contact centers.

R: Do you have any integrated system? Last time I met you, you showed me the application that all request has been saved there.

I: Not yet, not to the level it needs to be. We are doing a lot of work around that at the moment. What we rely on is the public to do the right thing. The issue is that the software is not talking to each other b/w the government agencies.

R: It's specifically for SES.

I: Yes. We can take stuff out and give it to other organizations but it's a very cumbersome process.

R: I remember you told me about the vip application among different organization?

I: We are still working on it. It can be slow progressing at times.

R: what happens after sending your resources to different regions?

I: Let's say the rain started falling and we have evacuated as much as possible and the floodwaters are starting to come up. We would be looking at having to rescue people, which is a very dangerous job. So someone could ring us and say they are stuck, and we will need to send someone there in a boat to get them out. We would be moving to a proper response or rescue stage. They would call us and we would coordinate it through our computer system. Depending on the nature of the flood and how long it may go for, we could have isolated communities, to organize food supply for example.

we probably leave the resources in place and then when the flood waters are going down, we want to make sure we have enough to do the job, whether it's building sandbag walls or whatever it may be. We would be looking at transitioning from the emergency response to the recovery. When the recovery happens we give that to another government agency, and that's more about the rebuilding of the community. We might help in that providing labor and helping people's houses out, but we would also start to demobilize.

The agency that's doing the recovery might request other agencies for support. For us the flood is over and we no longer have control.

R: Most of your volunteers belong to the local community. So during or after disaster, they prefer to help their family first then the other people. How do you organize this?

I: We let them organize it the way they want at the local level. We trust them with millions of dollars worth of equipment. Generally most of the people volunteering with us are very giving and will go help others before helping themselves. You always see the stories about the bushfires – you see that bush fighters are helping save someone else's house while their house burns.

When we need more resources, we'll go to other agencies. And the local volunteers know their communities and they will even sometimes go to local sporting clubs to ask for resources. Obviously you need to be careful who you're asking to do what.

When we start going through all of those channels, when they run out… that's when you look at going to the military. And that's the last resort. I can't think of the last time we used the military in NSW. They get used a lot in Queensland.

Down at the Wagga disaster, b/c there is a large army base, we do get the boys to go out and fill up sandbags. And we do use their aircraft because there is not a lot of civilian aircraft that can do that.

R: Are you be in command if you get military assistance?

I: Yes, just at the local level. The military are not trained to respond to this, they are trained to fight wars.

R: can you please send me all relevant documents such as all workflow and documentations about two case studies, wagga wagga and Kempsey? Also appreciate it if you introduce me to Andrew Richards.

I: I will put you in touch with Andrew. I can probably put you in touch with another of our managers that looks after operational management.

Andrew

R: Our research is about community resilience from the social perspective. In this study, community resilience is the community capacity to jump back to previous situation of life quality and sometimes go beyond the situation and becomes better situation than before, through innovation and improvising within a community. As resilience is a very huge topic and multi-disciplinary context, it is beyond one research that's why in this study; we only focus on social perspective of community resilience. So we would like to know your organization role specially your team's role to develop and improve resilience within a community and the procedures in SES to achieve this goal. Do you have any existing program to improve resilience? Can you please describe your team's role once disaster happens (Wagga wagga and Kempsey) from the start point?

I: Yes, we have what's called incident management at region, local, and state. Depending on how big the disaster is depends on how many of those we activate. So if it's a very local disaster, then it might only be managed by the local team. If it was right across a region, then the region would stand up, and if it started becoming quite significant, then state level teams would stand up as well.

State operations centre, that's downstairs, not sure whether you've been.

R: Yes. Do you have any specific database for flood intelligence, right?

I: Operations centre with lots of screens. That's right, there's a database but there's also people. There are intelligence officers and those sorts of things and there are plans and all of those sorts of things that help us paint us picture about what is potentially going to happen as a result of a flood or what have you

R: Does it mean there is pre-defined plan that you ask community to follow the instruction

I: You can get some advice from the bureau, they tend to sort of say, I'm talking about a flood, here okay? They give us some heights, we think the river is going to reach this high at 5pm for instance, and then what the SES intelligence people do, is they interpret that, and say, well at that height, what is that going to mean for the community out there, what impacts are likely to happen, what do these people need to do? Do they need to pull all their pumps up from the river, what actions do they need to take? Maybe it's so big that they need to evacuate and get out of the area.

R: So this plan is from the bureau not from SES

I: the bureau gives us the estimation on the river heights and the time and the predicted heights and so on and SES interprets that data as to what that then means for the community. So that's kinda where the intelligence officers come into play, and they will say at 5meters, it might affect Wollongong, it might affect Shell harbour, or other suburbs, it might affect Richmond or different suburbs on the river system. So people within those suburbs are then identified and we can determine a strategy for getting into contact with them and letting them know what they need to do.

R: How do you inform community?

I: we will talk backwards and forwards wit the region and backwards and forwards with local people

R: how the information distributed within a community?

I: From the operation centre, the data transferred to 17 regions, and ask them to pass it to local community. Yes, that can happen from the region, but it can also happen from here from the state operations.

R: Are there any other way to inform community and pass the information to them? For example social media

I: there are lots of different t ways. It all depends on the nature of the disaster and what we want them to do. So some of it is via TV media, some via radio, some via social media, some via sending information to networks in the community or key leaders to disseminate within their respective communities, some is knocking on doors in an evacuation scenario. There are many ways we communicate with the public, it all depends on what we are asking them to do and the scale and the risk of the disaster. So let me paint this picture for you. If it were a very small disaster, and all we needed people to do was maybe pull some pumps up from the river or make sure their livestock or horses or cattle were removed from the agricultural areas that are on the river banks, maybe that's something we would put out via the media. But when it starts to get to stage where we are evacuating communities and we are saying excuse me, we need you to move from your house in Cheswick up the hill or away from the river, then that could result in, depending on how big the community, could be a knock on the door which is one method we use, or it could an emergency alert to your phone via text on your mobile phone, or a call on your landline phone. There are many different ways that we communicate with people. Some of them are the one on one type of communication where we need them to take an action urgently and others are the broadcast style of communication, others are using those networks and partnerships and those sorts of things to disseminate information within the community. It all gets tailored I guess to the nature of situation and event and community.

R: How do you categorize the community network?

I: We tend to try and explore community networks when there is not a flood. It is very hard to develop a network and relationships when there is a flood. So, a lot of the time, on days like today when it is sunny out, we are going out to communities and introducing ourselves. We do this in a number of different ways. All communities are very different. You have types of communities associated with a place, associated with an interest group, with religious groups. You have communities associate with all different things and they don't interact in a streamlined way. Someone out there may trust their community leader a lot more than they

trust the NSW SES or the police or whoever. It's important to explore those networks and partnerships in a way that we can get info out to people in a disaster in the best possible way.

I'll give you an example of how this has happened in our organization on the mid north coast. Following a flood up there, there were people that expressed concerns as a result of something that happened in their community and we listened to their concerns and formed a group as a result of that, that could then work on some of these concerns and also act as a means to getting the info out to their networks and understanding a bit more about how it all works in a flood. Often these issues arise because some people expect this and get that. There is a community expectation that the SES is going to come and knock on the door, but some times that's not always the case. As I explained earlier, it will depend on the approach or the communication method that we take in a disaster. For us to be able to go and talk to these people and explain that gives everybody a shared understanding of how this thing works. Similarly the SES starts to understand what those people want and expect and how they act and their expectations. We as an organization can work better with those communities to meet their needs and explore their needs.

R: Are the community's demographic information such as income, number of people, gender available for you?

I: We do have demographic information. It tends to be more along the lines of things that can affect people in a natural disaster situation. So, whilst income a determiner of social capital and issues, in a sociological sense, from a the SES perspective, we are looking more at whether they speak English for example, as most of our communications are in English. Using some of those networks, let's say it's the Iranian network in the Chizek, and they prefer to speak their native language. We would aim to connect with the community leader in Chizek to help translate that message from English into Persian. It is very difficult for us to have 101 different translations that we put out to the community. Obviously resources are fairly limited. By connecting in with communities and with leaders, there is that sense of shared ownership and responsibility for the disaster, and we can work with communities to help them help us.

R: Can you explain how SES involves other organizations like police and ambulances?

I: I can give you a little of an overview, but you should probably speak to Scott Hankle, as he would be best to answer this. My understanding, because I tend to work in this environment, but I haven't done a lot at region command centre. My understanding of it is that there are local emergency management committees that are set up that have all the different services on them – fire police, SES, ambulance all the emergency services. Within that group, they help one another to help manage a disaster. SES does not always have the resources that can deal with a localized disaster. Sometimes we even need to call on help from other emergency services or we need to get our people into the area. So, it will usually be in that incident management team, they will have a number of Liaison Offices from different emergency service organizations that they can use to tap into those resources in the different agencies.

R: Let's switch into social resilience concept as you are the subject matter expert of it. In your point of view, what are the social resilience indicators and their level of impact? Also please tell me your thoughts about vulnerability and marginalized community in economy, social, politic and its impact on social resilience. Do you agree, strongly agree or not agree?

I agree to some extent, but I think it's more complicated than just having vulnerability the opposite of resilience and those being the only factors in community resilience. I think you talk about individual vulnerability, collective vulnerability, and they're very different concepts. I might consider myself resilient in one sense, but I might be very vulnerable in another. I may be strong and able to do things and be active. I have the ability, a car to get away, but I may not be very connected in my community. Or I may not participate. I think there are a lot of factors that play a part, not just physical factors. Not just mental factors, not just socio economic factors. I think there is also this notion of how well a community works together. The social fabric, or social capital, or different things that help a community to work together in a disaster. For me, we see this across the state in different ways. There are areas that do not have floods very often. Maybe once every 20 years, or 50 years. These communities are not exposed or have the practice of responding to a natural disaster, working together in that sense. We see sometimes in metro Sydney, neighbours that have never met one another. People that live high in an apt block don't know the people next door to them, only connect with people in the city when they go to work, have connections maybe with a close group of friends when they come home, but in terms of their sense of community, really when it comes to a natural disaster, are a lot more vulnerable in a sense. They are not used to working together to respond to something locally. We were talking before about different networks

Communities, in a geographical area, communities in an interest group, communities in beliefs and religious groups, we talked about online communities. We are seeing societies these days that are connected to people that aren't in their geographical area. So when a disaster strikes, if they aren't connected in that area with people around them, then it is a lot more difficult to work together as a team to combat this disaster. To feel part of that community spirit, social fabric, social capital. To feel part of that. A helps people to deal with this situation.

Sanaz, I know you very well, you're my neighbour and I can talk to you, explore some of the issues that are happening. I bounce ideas off you and we come to a collective decision about what we are going to do. To me that really helps people make decisions, to cope with the traumatic situation, to cope with the stress. There are lots of factors that are at play in vulnerability, and there are demographic factors that we can find on the ABS statistics that play a big part. It doesn't measure social capital and sense of community. I know they try to piece together things to have a socio-economic index, but it never quite captures what that sense of community and working together means.

It's been a big challenge for us in my particular field to measure that, right? To say, "I know from experience that certain communities work quite well together, but I also know that certain communities don't' know what to do when things happens".

Some of what I've talked about is the frequency of disasters; antler one that we manage is tsunamis. Australia hasn't seen a major tsunami in recorded history, going back 150 years. We saw one hit Indonesia a while ago, so we know what happened by the news reports. We saw one hit Japan. We know what happened because of the news reports, but there is a very strong sense in Australia that it will never happen "to me". Or what they call apathy.

People saying I'm not going to be affected, I don't really need to prepare, and that tends to relate to the frequency of disasters. For instance, we have a high frequency of disasters up near Queensland border. We find a lot of the communities up there; their resilience, their ability to bounce back from a disaster or destruction in their life. They have an ability to bounce back.

How do they get that ? I guess it comes from having experiences to how they work together as a community in that disaster. How they manage their trauma, their land, their properties, so that they are not building in flood plains. They are not building in areas in areas prone to natural disasters. Having their whole house and lifestyle wiped out and start again.

They are starting to realize that the flood plains flood every 5 years or 3 years. They have become experienced with knowing exactly what to do. Moving their cattle up to the top of the hill, it's kind of like a routine. Their neighbours know what to do, they talk about floods, and they have communication as front of mind. Whereas western Sydney, we have 100,000s of people that live on a flood plain around the Hawkesbury River. It is a major risk for NSW; it is the biggest risk in NSW. Why? Because of so many people. And because those people don't have any experience of a very big flood. The last one in that area is 50-80 years ago. The photos are quite devastating from that community.

Social capital plays a part there, if there is no kind of concept of what can happen, and then people don't really have it as a priority in their life. To form these networks, to build that social capital to reduce their vulnerability to increase their resilience.

R: Do you mean that exchange of information and communication within community has strong impact on social resilience?

I: I guess that's one part of it, the ability to share that information. There is also a process of knowing what you need to do. I've talked about that by the moving of the livestock and those sorts of things.

Is it just communicating amongst them? Let me draw you a picture. Here's a community. Lets say they need to talk amongst themselves. Peer to peer networking going on. Hopefully those start to interconnect as well. The aim of an emergency service is to live up here or down here and try to tap into these social networks. The information needs to come from the emergency service to someone that influences others within their community.

This communication needs to be clear, timely, and all sorts of things. This person needs to have a relationship with a person here. Let's say you ware that person Sanaz, and it's the first time we've ever met or communicated. Maybe we don't have the same kind of trust as if we've met 5 times. That's an important part of the link. These people knowing what to do, so if it gets out to that community… they are the clear actions that need to take place. There are a few links in that chain. One is the social capital, the communities talking to themselves. Another is the relationship b/w the emergency service and the community leader. Another is the information that flows down, back, across those sorts of things, so that A. we're giving people the right info but it's not a just a one way street. It should be a 2 way street so the communities are giving info back to the emergency service. You may be able to look out your window and see the flood coming up the Hawkesbury River and it's coming up your property. As an emergency service, I might not be able to get there b/c of road closure. There is a benefit of having a 2-way conversation.

R: How are volunteers assisting your organization? Can this node be volunteers?

I: Could be. That's the beauty of having a volunteer agency; these people are part of that community. But often in a crisis, they are pulled out of their community and they are asked to respond to the disaster. For us, whilst the volunteers in a lot of senses, in a non flood situation

are great, but the flood comes and the volunteer, we tell them we need to start pulling people out as well as be a part of the community. Their ability to be the person that communicates with their neighbours and peers is reduced because of that expectation that they will be part of that disaster. They are very important for us, they are very important for communicating with their communities outside the event time. We try to help our volunteers participate in their local community and facilitate discussions. I think this has a big impact on the success of community response.

R: Do you think that education; shared information within a community, or having special program or training can be helpful for increasing resilience within a community? And how much effected?

I: Yes, we are talking about a relationship between the emergency service and the community leader. The role I see for education in that context is to speak to the community leader about what to expect and what might be coming in a disaster. Education is a good way of trying to, for example communities practicing a lot up in the north of NSW, they get frequent disaster and practice. When there are infrequent disasters, people don't get the opportunity to practice or understand what's going to happen. That's where education and engagement comes into play to prime these communities so threat when a flood does come, they know what to do.

R: Do you think community participation can impact on social resilience? And how much you agree with it?

I: Yeah, I think it helps to a degree, but there are lots of different elements that play a part. Participating and being connected in your community and communicating with one another helps people in some of those situations where you need to talk to another person to confirm your idea of what to do. It also helps people talk to one another post disaster, so the concept of recovery from a disaster. This is getting into psychology, but to share with another person your grief, helps people come to terms with it and get another perspective. For example, I've just been through a disaster and I've lost a lot of things. By sharing that information with someone like yourself, I'm able to see that you understand and collectively you two get stronger. Collectively as a community you get stronger. Having people all feel a similar kind of feeling helps people start to rebuild. People that have connected help one another. So, let's say I have some skills – that I can hammer in nails on a house, someone else can do plumbing, together as a community we have lots of different skills and assets that we can share. If it's just me on my own and I'm not connected, then I can't tap into those other skills, assets, resources. I think you're right in that recovery process it plays a big part. The connected ness for us, in a disaster, while it's happening, allows people to talk with one another, come to a collective decision and act. There is social theory out there, whereby a lot of people will do nothing until there is momentum in a community. Let's say I want to evacuate all of Chizek, and only one person goes and the rest of the community is going to go ahh, okay. 2 people go, 10 people, go, 50 people go, oh I better do something go, 1,000 people go I really gotta do something. So having that connectedness allows people to A. understand and interpret a situation and determine their actions collectively. People like to bounce off ideas.

Who do you call when you have a problem? Your husband, your sister, your mom? You call your mom and say there is a disaster here, what do I do? If that person is in the same community as you, being in a similar situation, that helps. I think that's what I'm getting at. When we typically evacuate communities we will get people that go early, maybe it's the mothers that

have kids that have a high concept of risk, that have a low risk tolerance that go, "oh my kids, I better keep them safe, I'll move early". Whereas the blokes, "it'll be alright mate, it's only a flood" will tend to wait until it gets really bad and then it's too late. People get stuck in those sorts of situations. For us it's important for us to have education and engagement so that we can explore why we ask people to leave the community when we do. Not to ignore a warning, hang out and wait till water comes to your door.

It all works together to build resilience, because if you don't get in that dangerous situation in the first place, then there is less need for you to go through the psychological trauma, the recovery. All of those associated flow-on affects that get yourself in a dangerous situation. Say you pack up early or you sit in your house and prepare and lift stuff off the floor to minimize the damage around my house, I then move up to the hills early enough, I'm not there when the disaster comes. There's nothing I can really do about it anyway, and then you come back, you are only then dealing with the mop-up. The impact on your life is a lot less. The opposite, someone stays there, they get trapped they haven't prepared their house, they lose all of their belongings and the impact on that person is much greater. It really helps resilience to be able to prepare, prevent, so you're able to move away from the situation, not getting into the danger of psychological trauma. And then when you come back you're more resilient and can get back on your feet quicker.

Even for businesses if they lift their stuff off the floor, it has massive savings for them in the long run.

R: Do you think social support within a community can impact on social resilience? And how much you agree with it?

I: what do you mean by social support? Money?

R: not necessarily money, any sympathetic or help from the community?

I: From SES perspective, I think the biggest inroads that we can have on resilience is in that early stage, so we're not exposing them to the danger and trauma. Minimizing that damage wherever we can by doing things first. That prevention rather than cure. I think what you're talking about is the cure side of the house. What can the government do?

SES, what we can do to help that, is get more people prepared. To go out there and engage, educate and interact. What governments can do in the after stage, I think communities land recovery is a very big factor to build resilience again. It's been shown that if I am a government and I hand out a hundred million dollars to a community to get better, I really should be asking the community members where they want to invest that money to build the community back to where it was, not to say as a government this is where I will and won't invest without involving the community.

People should determine how they want their community to rebuild.

R: What do you think about helping within a community? This help can be anything for example one does hammering and one does plumbing.

I: I think that is a very big key to recovery. People helping one another, rather than being reliant on someone else to help them. Being dependent and empowered and able to help themselves really helps people's mental state. We are all connecting in the process, we are sharing and feel

better collectively and I think those are things that help rebuild a community. And once you've been through that process you're a stronger community after. You talk about resilience as being able to bounce back or get to that state before. In some senses, you forge relationships and new partnerships that never existed before, so you're better off than before in some senses. That's very important to recognize and happens when you start connecting between members.

R: what are your thoughts about improvisation and innovation and their impact on social resilience?

I: Australia is a very innovative society. In Queensland, many of the houses are up on stilts. The house is up here, there is a lot breeze that blows underneath, why? Because it's a hot environment and air flows under the house and also to protect from floods. It's also for snakes and spiders, so there are many reasons why people make those innovations. You see in Queensland, they are hit by cyclones all the time, that many of the houses don't look high and tall but look more flat and low so that when a cyclone comes they don't loose their roof.

Some innovations are built on a response to those natural disasters but generally, it does take some acceptance of this risk and acknowledgement that it will happen to me to start making those innovations. Often you can tell someone something many times, but until they experience and learn the lesson for themselves, they don't take it on board.

R: Do you think learning from frequency of disasters is impacted on resilience?

I: It's not the most important but it does play a part.

R: what do you think about the coping styles?

I: coping is one of those words; I just get through this, does that impact resilience? I have a strong association with the word because it means to me I just make it through I don't really try to do more than that. I'll try to put it in my words for you. If I know about my risk, and I do something about it, I understand it and take action to prevent it and prepare for it. Is that what you mean by coping style? Then I am better off in my perspective than if I ignore my risk and get into trouble.

R: What about the adaptive capacity and learning?

I: the ability to go through a disaster and learn from that experience? Yeah, I think that plays a part as well. What about the trust around a community? That's fairly key as well. I think as you build partnerships and networks, often trust is a big part of that. If you didn't trust me and I didn't trust you, this conversation wouldn't be as open. I think it plays a part.

R: are there any other indicators or parameters impact on resilience that we haven't discussed?

I: there probably are. Maybe there is some good research that might help you. I know there is a thing called the National Disaster and Resilience Strategy, and it talks a lot about the factors. Maybe you can look that up. It's put out by the COAG. It has some good definitions about resilience. It's a paper that's been put out by all the governments around Australia. It's definition of resilience. There is another thing if you're interested in community engagement. There is a National Framework for Community Engagement. It might be on our website. Can I have a look at this for a moment? Did you get this off our website?

R: Yes.

I: There are tools on our website, but there are tools at lots of levels of government. I think the framework for community engagement is put out by the Attorney General's Department. It's probably not on our website; it's published by the federal government.

R: Thanks and appreciated your time

Scott

R: Our research is about community resilience from the social perspective. In this study, community resilience is the community capacity to jump back to previous situation of life quality and sometimes go beyond the situation and becomes better situation than before, through innovation and improvising within a community. As resilience is a very huge topic and multi-disciplinary context, it is beyond one research that's why in this study; we only focus on social perspective of community resilience. So we would like to know your organization role specially your team's role to develop and improve resilience within a community and the procedures in SES to achieve this goal. Can you please describe your team's role once disaster happens (Wagga wagga and Kempsey) from the start point? Also please let me know your thoughts about indicators or parameters that increase resilience within a community?

I: We don't worry about the size of the incident in the first order. We try to get what the likely impact is going to be. Unlike fire where you can proactively reduce the hazard, we can't stop storms and floods. Our goal is to understand the likely impact on the community and how to communicate that threat to them. Our first thinking is how do we actually add value to the warning given from the Bureau.

We've got these winds, what does that mean to you? Does that mean you need to think about big trees that could land on your car. Have you packed up things outside that could go flying around? We always think about warnings.

The size of that is not in the forefront of our thinking at all. We will think about it from the point of view, if we think it's a large impact, do we have the right level of incident management? And the right leader in charge? When we categorize based on 1,2, and 3… it's about the capacity about the person in charge to coordinate that response. By level 3 politics becomes a major player, as well as media management. At 1 it's more about coordinating the response at the local level.

R: Can you please tell me how the SES process started?

I: We receive it here. My duty operations officer would be the first point of contact by the bureau, and that's a 24/7 capacity. We always have one on duty. They will have a discussion prior to the bureau putting a warning out. They will give us a heads up. We have those discussions as early as we can. Communicating to the community and making sure we have the right level of response. Those are the two crucial things. Social networking is something we need to spend more time with. The more time the community has to internalize things, the less work we have to respond. It multiplies quite dramatically. The language is different in the social media space. We have traditionally been an old generation approach – we used to put out bulletins, back in the day of telex machines. We are finally now embracing things like twitter and social networking. Social networking is a much better to communicate to a large portion of the community. It's not the only way. We have to use multiple strategies.

Every day we have a planning meeting, and it will involve our community engagement and media people, and we will determine our strategy about the social network. I just know I want maximum information to the community.

When we are analysing the threat to the community, looking at the flood intelligence database, we don't have good science around wind affect. We can tell our intelligence database is quite complex and well developed, showing that so much rain will equal a certain height of water. But this week there are all wind events. It's difficult for us to translate that into potential damage.

We have a planning meeting. We have all the functional areas involved in operational response will get to one spot.

R: How did SES inform community or other 17 regional offices for both Wagga and Kempsey

I: It's a bit different. They will also get this same warning. This bit is acting concurrently with this. We are doing this at the state level and they are doing it at a regional level at same time. We will then assess what they are seeing a local level.

So when this person gets that warning, they send it to all potentially affected regions.

R: How do you exchange information with bureau?

I: Once we have this, we have a teleconference with the bureau that's involved. They give us another briefing, which is more in detail. The bureau will give a briefing, given the best prediction. That does not give us the parameters around risk management. WE need to know the best and worst case, though.

The more those models diverge, the more volatility in the outcome. We will ask them, what's the potential for further significant rain, and where might that occur. What's your level of confidence in your prediction? We need to get an understanding about the full likelihood of this occurring.

We do that in a teleconference with the 17 regions. Someone like myself will chair that. It's organized by the duty operations officer. All our function areas will come to that. We ask the bureau to lead off with a detailed synopsis.

R: does it mean each region has their own functionality and instruction to respond to disasters?

I: We will start to rearrange ourselves into an incident management team. In public information and media management, I'll go to the media. I'll go to the manager of community engagement to make sure they are there. I will go to the manager of logistics as well.

R: Are they internal resources?

I: all the mangers are internal. They are all in state headquarters and we have an internal media manager. I will say to Becky, and say what is the media impact of this event? We have a media studio downstairs and a dedicated space for media management. We step through the threat, and then I ask them for input about what they see the impact in their area of specialty.

Largely that's around resourcing and the like. We will use traditional mass media. In NSW radio is one of the biggest. Commuting most people listen to radio. We will start with a media

messaging campaign that's supported across all levels. There are two components: we want to manage the media interest and we want to use them as a means to communicate the warnings and behaviours of the community.

My interest is in engaging the community about a warning.

R: Do you exchange information with other regional offices?

I: Yes they should be. I used to work in one of the regional offices and managed about 20 disasters. It is a very busy area. What I would do, and most regions will do this to a degree, but I would bring what I consider my planning team.. I bring my logistics manager, my deputy, who is my planning officer at the regional level; I would bring my volunteer element that is involved in the incident management.

R: Do you coordinate all resources from the operation room?

I: more likely to be in a conference room rather than the operations room b/c there is the teleconference capability. Volunteer are involved at this state at the region level, we don't have any at the state level. At the regional level and the 289 units volunteers are involved. This all happens at the same time. The process should be mirrored in the units as well, but it is smaller.

When we get to the teleconference stage, the questions to the bureau will be specific detail about the hydrology, the duration of rain in specific areas, in catchments, how much adjustment there might be in that prediction. They will start to set up for that sort of thing.

At the end we let the bureau go, and we have a round table talking about what the regions think are the largest concerns. People are looking for confirmation. There will be private sights that get to pick and choose what model they want.

For example, we will have people ring us saying I see on such and such weather tracking site that the world is about to come to an end. But we know that the official bureau is saying it's less of an ordeal, and we have to manage that. The rest is about resources. Incident management, and flood response all with the right numbers.

R: How do you involve the external resources?

I: If I start a unit, I will call the local emergency management community together. Each community has one, which is held by council, and the chair is usually a local police officer. That is focused just on their community. They should brief them and it will have all the local players – police, fire brigade, ambulance, council, and any other government or local departments that are part of the response.

R: is it the unit level inform other communities?

I: Yes. They are not always represented locally, though, for example the department of transport. So in transport they might have a link to a local bus company, and it will be the company director that will come to those meetings. Or it might be the rails representing all transport.

R: how do you coordinate and know about required resources?

I: We don't ask for a specific resource, we tell them the threat and come up with a collective view about what that as a committee decide what they want.

For example, a town has 30 houses susceptible to flood called the flat. There is an evacuation plan, which has been built and written by the local people. They will start to enact that plan when a flood warning goes out. Lismore is another example. The evacuation of that town is done by the rural fire service, and we have pre-planned which brigade goes to which streets. They have to have that plan detailed before.

R: so the coordination centre is in SES and SME make a decision about required resources?

I: Yes it will be a collaborative effort, but it's chaired by a local SES officer. He is in charge and has the accountability.

R: Is that from local or unit?

I: It could be both. Some local areas only have one unit, and then officer will be the unit and local controller. Some local government areas have multiple units. Only when it's our role, we chair the committee. If it's flood storm tsunami, that's us. If it's bush fire it's the other agency that will chair that. It all depends on the agency in NSW. That's where we get our powers to evacuate and direct.

R: Do you have any pre-plan program for disaster? Have you been trained and also coordinated with other communities?

I: Yeah, there is a local emergency management team for every local government in NSW. There are district emergency management meetings where all the functional areas of government meet regularly chaired by a police officer. These are usually quarterly. It depends on what they are working through in these programs. And how serious the nature of the threats. If you are way out west, they are less frequent and more around coordinating rescue. Whereas on the coast there is much more a threat. There are three levels, the local, and district and state level. The emergency management committees: there is the local LEMC, DEMC district, and State SEMC. And that's where the different agencies come together. They are to develop plans. There is suite of state level plans and district and local plans. Three levels of plans in most cases. There is only a State storm plan however. All of these are sub plans of the NSW State Emergency Plan.

That's specific to NSW. Queensland is completely different and not aligned system. The SES there, are part of council, not a state body. They have a different structure to get through, but we can cut across that. Mainly because of the legislation that backs us up. It cuts across the bureaucracy day to day.

For example in NSW there might not be a health representative at each local area, the health emergency planner might stay at the district level. Because they don't have an equivalent at the local level. It's very effective.

You build a relationship with all the other players, and I know them all by first name. It gives you good linkages. I don't need to have a good knowledge of everything, but I can all an expert that I know. we wont get many volunteers at the state level, but we can reinforce. We will fill in the gaps. The units are 100% volunteer; there is no staff at the local level. There are no state volunteers. At the regional level it's a mix.

R: So how to do you involve volunteers?

I: I don't know need to b/c the regional and local levels involve them. Occasionally we have a volunteer here at the state level, but very rarely. There is no permanent establishment of volunteers here.

R: What's the process after that?

I: The three tiers are crucial here. We will have a local presence, and some of those units range from 150 people to less than 10. They can move a fair bit. So when they do an assessment of what they need, we will start to bring them up to the full strength to help enact that plan. We do that collaboratively across the three levels. If the region needs more resources, the state level will help find more. We have become quite practiced at that. We sustain 5 rotations of 100 plus people in Queensland during a cyclone at the same time conducting major flood operations in NSW. But we pushed 500 volunteers up to Queensland for 5 weeks and sustained them. That's a good measure of the capacity. We ran out of people to manage that.

One of our challenges with volunteers is that they only have a limited amount of time they can give before they have to go back to work. That's a challenge. Once the weather arrives, you can't move, can't fly, rail will close down, etc. You don't want to be moving large resources then. One challenge is around the weather.

The weather system coming down from Queensland was supposed to arrive Thursday but didn't arrive till Sunday, and we pulled all these resources and by the time the system arrived, we had to send the resources home. They gave all their time up, and nothing happened for them, and then we struggled to create a second rotation. To get the time to move people.. Optimal time is 72 hours, but often its much less.

The bureau will give a large circle saying it's happening here, and we will say, that's actually an area the size of France, can you narrow it? And they will say no, we cant. So how do we know where to put the resource? We don't have enough to cover the whole area. We work from the bottom up, from the local up. The local will say what they have, and when there's a gap, the region helps fill, and then the state helps fill, and every once in a while it goes inter-state where we have to ask other states to send resources.

R: Do you have any documentation for the processes?

I: all the plans are available. I don't think we have a diagram of that.

We have incident action plans, which are a set of orders and show some of the strategies, but it's not quite the step-by-step process. As a single document, probably not, but there are a number of documents together that would show that. What might be what you're looking for is the state emergency plan and the state flood plan. It's written along the PPRR construct, Prevention Preparedness, Response and Recovery. And it talks in each of those sections about who does what.

R: Is it on the website?

I: Yes. The State flood and storm plan would be good to look through. They outline the different agency responsibilities and outline the PPRR phases. The district and local plans will

be very detailed with many annexes with evacuation plans, caravan parks, and evacuation center locations. They are all public and pdf'd documents including the NSW overarching plan.

R: How do you measure the coordination gap?

I: It's a matrix type approach. We will try to list all the actions that need to happen and who does those. At the end of the day, we should have enough people to allocate those tasks. And we will look at where the gaps occur. It's quite specific to the event.

R: How do you measure the coordination gap?

I: what are our key performance indicators? It's very hard to measure. At the state level, we measure around out capacity to answer calls at the call center. We will know our answer rate, the average length of phone call, how many translate into actual request for assistance? In a traditional KPI sense, we are looking at one area vs. another. But there is so much variation in every event, and the skill set and technology available hasn't allowed us to do a good analysis. It's very much intuitive and by people's experience.

We would love to get some science into that space. The biggest trick is to identify, before it happens, the level of damage. So in a high fire season, most of my resources were dedicated to that. But then the head meteorologist calls and says I'm tracking the worst super cell thunderstorm I've ever seen in my career and it's about to go through your region. My resources literally raced from their other stations to get to a place where they could address this storm. This storm in the end did almost no damage to any community, but we couldn't tell from the warning. It's hard to take the warning and be sure. It's hard to be proactive. In measuring that gap it's almost impossible for a short notice storm. For a flood it's easier because we have very detailed planning about what we're doing when it gets to a certain level. It's even difficult to know what kind of flood rescue response.

Most problems are people driving through water and getting stuck. If we are able to convince people to not drive through those waters, we don't have a job. About 90% of flood rescues involve people driving through water. You talk about resilience, if we can convince the community, we will drop our workload down. Resilience is more about the community understanding the threat and being risk averse. When damage actually occurs, we will have minimized that impact.

In quantifying the gap, the call center becomes pivotal. It's the first point of contact by the community. The quicker we can take it in, the quicker we can figure out the resources. For example, if most of the calls are about trees down and roof damage, so much of response will be about chainsaws and putting tarps on roofs. That drives the way we respond. If it's a hailstorm, we'll get lots of roof damage and not much else. The first way we have to quantify that is taking the calls and putting the info into the operations center. We've only had a central call taking capacity for 5 years. As a regional commander trying to respond, where this got important… before they had taken the calls, I am trying to work out how big is this problem, and the storm is minutes old… my best indicator is watching how many people are calling. Our first indication of whether its large, medium, or small is how many people are calling in.

It's not a nice neat mathematical equation though. We are looking for some science in the longer term.

R: What indicators or parameters do you think can impact on community resilience? Which has the highest impact and which has the lowest impact? What are your thoughts about sense of community, social support, trust, adaption capacity, sharing information?

I: It's hard to answer which is the most important.

R: How much do you agree that community participation impact on social resilience?

I: Yes, absolutely. We have many flood prone communities with absolutely no SES in town, and therefore have no capacity for resilience. I can remember recently going to a town on the Tweed River, a community of 70 houses, 300 people, and they were very angry that they didn't think they got an early enough warning. As a result, they made poor decisions about protecting their property – cars, etc. We bluntly said, actually we had 40 odd rescues to do and we had no resources left to knock on your door. There had been plenty of media announcements about the warnings. But the flood was higher than the predictions. I asked the community, how many people are in the SES, and it was zero. We are not going to solve the problem for you; we are not going to make you resilient, because you take no responsibility. SES is designed to help people be resilient, but if it's not taking ownership and engaging with our organization, then invariably we can't be there to help them when they need us most.

I think that is one of the pivotal things. We need to fundamentally understand that the SES is a community-based organization of volunteers. We need membership in the community to be effective. It's one of our cornerstones. Where we have that we do really good work, where we don't they are often not happy with us. That seems to be a common denominator in my mind.

R: What do you think about social support within a community?

I: It is important in the smaller communities. One of the ladies came up to me, and said, I was frightened to tell other people what to do b/c they would think I was a know it all, and they knew floods better. Depending on the nature of the community and how they do business together.. If they are a tightknit community there is good resilience. Where there is a good sense of community it's resilient, and we can focus on people that are leaders. If we can convince the leaders, then the rest of the community follows their lead. We don't always know how communities work though, b/c each is individual.

R: How about learning – adaption capacity. Do you think there's an impact on community resilience?

I: Yes, we've discussed how there is effectiveness in targeting the children and doing that through mainstream education circles and being prepared. Particularly talking about climate change. We get good results if we can get into that space.

R: Thanks for your time. Can you introduce me to someone else with the same position as you are and is the subject matter expert in resilience domain?

I: yeah, I think our manager of media would be good, Becky. I will introduce you to Gina as well. Do you want to speak to them today that would be good

David Chamber:

I: So, the person at a house rings up 132500 they speak to a communications center. They say that a large tree has blown onto my house and it's a safety issue. Can the assist come and help me.

The communications center upstairs will then send a message to the local SES unit, for example at Manly. That doesn't operate during the daytime, but all the volunteers have a phone. They get a message, can you go to this house with the tree.

Up here will message direct to the unit.

We have the member of the public at Manly. He telephones the communications, which is up here at state headquarters. They take details, and then they send either a sms to Manly SES unit (volunteers). So this message will go to certain people. This unit here, they might designate that 5 people will get the message. Then they will respond.

They may be working or at the beach, but they have to make their way to the Manly SES unit, and get a truck and will drive to this house and try to fix the tree. Over here is the regional headquarters and if it's not a big event, I wont know that until after. I don't get involved. It goes up here, it goes down there. If there is no response from these people, then this area upstairs, they will send a message to my headquarters to say that there has been no response can you chase it up?

In a major event when there is lots of work and big storms, then this area up here will be very busy. I might have my headquarter unit open, my regional unit might be open, because I might have Manly, Hornsby. I've now brought volunteers ready to go and do jobs. There will be lots of jobs. I will monitor all the work that these people are doing and I will be prioritizing in terms of most urgent.

If there is a big storm, in this room over here, which Gina will talk to you about, we have a state operations center. So, if there is a major event, then this state operation unit, they will be communicating with all the regions that are operational. My region is called Sydney north. They will be talking to me, they might be talking to Sydney western and Sydney southern. So all these 4 regions, this region might have 8 units operational with lots of volunteers.

So these are the people who are supporting those out in the field. The actual paid staff, we don't go out and do the work, we support or do the management. We will run the incident management team. In your project, is social media?

R: It's social networking and social resilience.

I: What we see here, is that I am here, we created a Facebook page. Some of these units have Facebook pages as well. Ex. One of the people/staff at this regional headquarters is called a community engagement manager, about which Andrew Richards will talk about. So I have a staff member here, who would develop strategies for community engagement as a preventative preparedness approach. She would start to work about regional strategies. She would then work with a volunteer from manly on a committee and maybe some other stakeholders to have a flood safe breakfast meeting. So this volunteer and my staff member will give our brochures about what you do with floods to how to prevent floods.

Let me see if I can show you a Facebook page. If you look here, this is NSW rural fire service. They have their own page. They are talking about hazard reductions that are going to occur next week. They are warning the community there could be a lot of burns.

This is Gosford. For me, if I have Sydney Northern, I went from Sydney harbor, I had Manly, North Sydney, Mosman, Willoughbie, Maringa Pitt Water, Karingai, Hornsby, Hunters Hill, Ryde, Gosford, and Whitehall. So, I had 11 units. And they look after the local government areas.

So the units are broken up into local government areas. Hornsby is full of Hornsby council members. I had two which were joint. Willoughbie Lane Cove share with Maringa Pitt Water. I had 11 units, 750 volunteers and 1 regional headquarters with 6 staff. This was Gosford. They sent out to all their friends on Facebook – they have sent information about temperatures, winds, it looks like it's going to be bad weather.

R: are you place in the SES headquarter?

I: Now, I'm here just doing a special project. I would have been up there but I've moved.

But when there's something major. That's the regional. This lady rings up, sms goes here, if they can't answer it, it comes down to me. If there is a big storm, the state operations center, which Gina might talk about, will be activated. People will go there to get advice and more resources if required.

The storm now has gone down there, but there is more bad weather coming. And now it has gone up to the Hunter region and the mid-north coast region. Now we have another two regions operational. What's happening now is that we have 6 regions out of 17 all active. Our volunteers here are getting tired. So what we do then, is that we send here, a message to all the other regions which is down at Murray, or far west, or maybe Richmond tweed to say have you got any volunteers that you can send to help with the storm or the flood? They will say, I can send 10 people. In 12 hours time to help out here. So these volunteers get in their trucks and come up to help. Because the normal volunteers are exhausted.

Now my role at the regional headquarters would be to organize these people here, to help me out. And I would decide where to send them. So I might send some to this and some to that one.

R: And how do you coordinate them?

I: The storm has gotten large; I still have 10 big jobs to do. But I haven't' got enough resources, so I send a message to here, saying I need x number of people. I send a message to these people to say can you find somewhere within the state, 20 people that have this and that skill to come and help me in Gosford?

They say to me, just wait, we'll send out a request and let me know. They request to all the regions that aren't operational. They might be able to help me b/c the storm isn't going to their area. Btu these 6 regions are very active. My role is an incident controller because it's quite complex. I'm talking to the fire service, or the fire rescue, to say in my patch, do you have any people to help me?

They might say yes, we can help. But I'm telling here that I still need 20 people or 5 teams. I am here and here what they call an incident controller.

R: What is the command center?

I: I have my own command center, or what we call an operations center. During the day nothing happens on a quiet day. In Sydney northern, the storm is only impacting down here. I have got these three units with volunteers.

I would make sure the storm isn't going to impact in that area, and I would ask these units can you send some of your volunteers to help these units. I would try to resource first within my region, and if I cant then I communicate here with Gina to say, can you find me 20 people to help out here? Because this storm is going to last for another 2 days, and jobs are building up. She would then send a message to these other units and regions that have not been impacted.

With staff members, I am currently here. Now it's getting quiet, but it's getting really busy here, so they may send me up here to relieve up here as an incident controller. They will then find people from other incident management teams to go from anywhere to help out here.

R: Is that the main centre to coordinate the resources.

I: for my region, and here, which is state headquarters, they try to coordinate the resources to help all of these people.

R: How do you request for more resources?

I: if you people need that, they would ring 000 and they would get the ambulance.   But because the storm is getting big, we have at a regional level emergency management committees. With these committees I would have police, SES, local government, rural fire service, ambulance maybe and a regional emergency management committee.

If it's a really big thing, on a state level, they call it SECOM State emergency coordination center– it would be a state commissioner, deputy commissioner level. Last year there were big floods down in Wagga. Id' worked up here as an incident controller and then they sent me down to here.

So all SES units are aligned with Local Government Areas LGA.

R: who is in charge of SECOM?

I: Currently it is an assistant commissioner of police.

R: so it's not SES?

I: No, it's independent. It's if it's getting very big. If we can't manage it, we would seek more assistance from here, and the person who is currently in charge of that is a very senior police officer. But they would generally support us but not manage it. They are like an advisory panel asking how they are going. If we got to the stage where we couldn't manage then they would try to get us more resources. If it's little they manage as a unit; if bigger I start to manage; if it's bigger I manage but the area is supporting me; if really big then we have here. even if it's big I'm still managing this. So all of us are talking here. I provide a situation report, like an update. They would then bring all the information, condense it, and summarize it for the information

here. So they can see the bigger picture. And I'm only interested in this, Sydney northern. This guy at manly is only interested in this area. Or he may be able to send others to help.

R: How do you help community in disaster?

I: State emergency service, we manage repairing or rescuing people. So we might do repairs to the house for safety or we might rescue people if they have driven into a river. We will liaise with ambulance, but they will be responding to emergency calls. They are not working for me. They are responding if a call comes in. If I think we need an ambulance as a safety precaution, I will liaise with them. We would send only SES if they are trapped. Only the ambulance if there is an injury or illness.

R: how do you coordinate with other emergency organizations and send a request to join you and help communities?

I: I can pay for a private contractor, if I need a crane, I can authorize to pay. We ask the fire rescue can you come and help us? If we need the police, and want to evacuate an area, I can issue an evacuation order to ask those people. I make that order. My volunteers start to door knock.

R: Are you command centre for disaster such as flood?

I: yes, b/c we've identified the most vulnerable areas. But in the preventative stage, we need education. My community education coordinator works with the volunteer here who likes to do that type of work. We should be creating the resilient community. Before storm season you should clean gutters, and you should cut down trees before it falls in a storm. Or because you live in an area likely to flood, we'd make recommendations.

I will hopefully know if a community is more resilient, so I don't need all my volunteers to go door knocking.

R: what indictor in social resilience has the highest impact?

I: Education and council and building regulations and different types of maintenance for infrastructure. Like making sure your storm drains are clean. And building legislation as well. Plus education, the tv commercials to let people know what number they can ring. But to make sure they do things before the storm comes as preventative measures.

R: do you think community participation and sense of community has impact on resilience and how much?

I: yeah, different types of communities. Sydney metro is very different than Grafton or a little country community. Sometimes in a big city you don't have that sense of community.

R: Thanks for your time

Gina Jones:

Our research is about community resilience from the social perspective. In this study, community resilience is the community capacity to jump back to previous situation of life quality and sometimes go beyond the situation and becomes better situation than before, through innovation and improvising within a community. As resilience is a very huge topic and

multi-disciplinary context, it is beyond one research that's why in this study; we only focus on social perspective of community resilience. So we would like to know your organization role to develop and improve resilience within a community and the procedures in SES to achieve this goal. At first, can you please tell me how the coordination processes are taking place in SES?

I: It might be worthwhile, if you're looking at community resilience, for you to talk to emergency risk management department. To answer your first questions, from a state perspective. AIMS is the Australian incident management structure that we use. It's used Australia wide and also in New Zealand. Many use this. There is a common understanding amongst all of us as to how the structure works. There is common understanding between and within agencies. AIMS is written so the response is coordinated at the lowest possible level. So if there is a cyclone, that is coordinated there by the local unit. They do the response, if they need resources they call those in. If it gets too big, it will bump up to regional headquarters.

The incident controls you see at the local level, have an understanding of the local problem, but state headquarters is open in order to support them with resources. If they have resources for three days and then need more, we will coordinate that. We will coordinate them in regards to the support for aircraft and logistics. In their own store, if they've run out sand bags, we'll coordinate that on a larger level. Also through information flow. We have a very strong chain of command structure.

All the reporting goes up to the next higher level. Even if we aren't staffing the local level effort, the information will still flow up through the state level to go to the ministers and other organizations. How that ties into the emergency services… if the combat agencies are getting support by us, we will bring one office staff member as a liaison into our office.

Another emergency organization we will bring one of their staff members into our office as an information conduit. We need 10 teams in Kalama, we will go in and coordinate that from the agencies' perspective.

We also may call on other agency staff. Last storm season we had very busy years with the flooding in NSW. We were operation for four months straight. A lot of our staff got fatigued, so we could bring in other agency staff to help. Not as a technically a rural fire service member, but in support of our incident management team and the AIMs structure.

R: It is hierarchical?

I: Yes, it all flows through veriquest. It comes through from the local level. They can facilitate at the local level but the need to let everyone higher up know what they are doing and create visibility.

R: Is it more informal communication?

I: We will write a state level concept of operations, which is like a plan. What the priorities are, the strategies. At a local level you write an incident action plan, which is more specific, task driven. You stick to that as much as you can. And when you diverge from that, you should write an updated version. Because that's the document that all agencies use and they need to work off the same sheet. You're right, everything doesn't always go according plan. It's the information flow part of that that is the most important. As long as you're reporting it up down

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and sideways. You have to tell the people below you, keeping people those at the local level and your peers and you're also reporting up, then you are making sure you're covering all of that information to all interested parties.

The information flow is the most important part.

R: What is the next?

I: We say, this was what we're doing, we can't now do it and because this happened, so now we're going this way. And you should put out a revised plan to let everyone know what you're doing. You would like to think when you set down and worked that plan, you sat down and you went through and thought this is the most likely course of action, but this is worst-case scenario. You want to have a plan for worst case scenario b/c if things go that way then you're going to have pull that out pretty quickly. You normally would have work shopped and worked through those alternatives. And all of our state storm plans are all documents that are a number of agencies have input on those.

Being a volunteer organization as well, you may not have enough people, and you may need to go to plan b. You can't write everything in stone.

R: How do you coordinate with other organizations? Do you have any regular plan among different organizations?

I: The state emergency management committee, they sit above all of the agencies. There is a representative from every agency on that committee.

R: Is that SECOM?

I: So SECOM is the state emergency control operator. SEOC is the State emergency operations Center. SEOC is a department within the police that is staffed and they are not a governing body, but they sit above all of the other organizations and information feeds to them.

If we are in a flood response, an SES combat role, they open up in support of us. SES is looking after the flooding staff, but who is looking after the other side? So SEOC would look after the extra, we need aircraft from you; they step up as support to the combat agency. Our commissioner is in charge until this person says all bets are off because things are too big. If at any point they are not happy, SECOM can step in and take control but it's rare.

R: So if they are not in charge of it, how do you call it?

I: they are in support of the combat agency. The SES is the combat agency for flood, storm and tsunami. NSW fire and rescue is the combat agency for fire in the metro area, and anything outside of that is with the police.

So they step in during times of operation, but there is a State emergency management committee. They meet regularly, quarterly, and they discuss what happened over the last few months. There are a number of working groups lower than that that also meet. The state rescue board… so there are a lot of interagency, multiagency meetings.

R: Do you think right coordination can impact on performance and also resilience? When I say performance I mean responding to a disaster.

I: Yes, or course it does. Especially for something like the SES being a volunteer organization, we have to rely on the fact that our volunteers can get a day off work to get off and respond. We are heavily reliant on other agencies supporting us as well. If that's not coordinated centrally, and those arrangements aren't in place, those things won't happen.

If we didn't have those plans in place prior, and there's a tornado in the middle of the day and everyone's at work, it's going to take a while for the volunteers to get off work and get to the unit to get to the unit. In that time we might call on other agencies to assist us, and we use those plans to do that. That are already put in place. Those relationships and networks. At a local level, all of our regional networks, they might do some training together.

R: How do you educate communities?

I: it varies statewide. In the metro they might do it more regularly b/c there are more people. Somewhere out west where it's quite remote, they might not get together more than once a year. But it might be once a month in Sydney.

R: What type of resources do you need from other organizations? Is it only people, machines, trucks, information?

I: all of those things. Especially information.

R: What kind of information?

I: if we are in the middle of a storm event, and we've got our guys out there responding to jobs, some calls will come through to 000 b/c we're not on that 000 network, so that will go to the fire brigade or police. They will send that along to us.

So that's sharing of information. It might be at they arrived at the scene before. And then there is a handover of responsibility.

R: what is the method to communicate with communities?

I: I think it's through cloud-aided communication. They have systems that talk to one another. Our system doesn't talk to theirs, so it would be a higher-level call from their organization to pass that information on.

If we are fully operational, and we are all staffed here at state headquarters and they have a liaison office; that information would come through them. They would call their own people, can you tell the incident management team at SES that this is what we're doing and this is what needs to be responded to. Sometimes there are multiple calls for a fire rescue. Our people will be en route to the flood, and the calls come through our comms center upstairs at the same time it's come through 000. So the police might call and say can you make sure you've got this in your system we are both responding. And it's fine that we're both responding.

They just want to make sure they aren't assuming we're on our way. Especially those priority ones.

R: How do you manage the volunteers?

I: As I was saying before, it's very militant. Here in state headquarters I get very little access to talk to the volunteers b/c I need to go through our region headquarters to access them. So they

manage themselves within their own units. Each unit has a controller and they do their own training, and operational readiness, they look after their own local community. But at the region headquarters is there in the support of them. They are sunny day kind of stuff, get uniforms, organize training calendars, etc.

We have 229 units, so average is 10-17 units per region. All the administrative staff is at the region level. At a state level we look after more things re: policy and procedure, bulk orders, major logistics. We manage the working groups.

For example, for aviation, David is chair of the aviation working group, and on that sits a number of staff from state headquarters, regional headquarters and volunteers. We look at equipment, and after action reviews, all of that runs through the working group construct. Even though you physically work in different locations, you are getting input from all those levels.

There are a lot of working groups across the different portfolios in the service tat is fed by state headquarters and regional.

R: How is the structure at unit level? Do they have offices?

I: Yes, they all have a building. Here in Illowa, there is one in Wollongong. Do you know where Illowa south coast regional office? Down on Masters Street.

Every unit has a building, a couple of trucks and a whole lot of equipment and a lot of volunteers. There are 229. Scott told you the wrong number.

R: How do you measure the resource gaps? Do you have any measurement for that?

I: Regions are currently going through capability process. It's not like you can say every unit needs the same resources. It very much depends on the local community. Sydney metro might do something completely different.   The biggest type of work you'd get would be storm response. In measuring the capability of each unit is quite subjective.

We are looking at doing a capability measure for all of the states. Each region will look at the units, and see over the past x years, this is the size you need to be and this is what we've done, in regards of people, trucks, equipment. At the moment the identification is ad hoc.

When we did this, we didn't have nearly enough of that, or that piece of equipment doesn't service that. Is that legitimate gap? And then how do we go about addressing it?

R: How do you measure coordination?

I: After we have an operational response, we will have an after action review. Even if its one unit going to a road crash rescue, they go back and have a debrief. We need to know what went well and what could be better next time.

We have a department called lessons learned. It might be worthwhile to talk to them as well. After we've been operational, the units will all have their after action review, the regions will have one and state will have one and we'll have a multi-agency one. It's managed at state level by lessons learned. Depending on how big, for the regional and local, lessons learned by go out and manage that for them. It's like a one-day workshop. You get a representative from each unit, and you talk through what did you do, why, what do we need to improve on? And a report will come out and the responsible departments for that will look at it and see what they need to

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change, to make sure the process is smoother and more efficient. There will be accountability as well, you will have to report back say monthly and this is what we've done about that. We've now fixed that. We were there, now we're here.

I will introduce you to lessons learned.

R: What are the main indicators or parameter that impact on social resilience?

I: Information. Our highest level of responsibility at SES is to get our warning products out. During an event it's letting people know what is happening and what they are supposed to do. Worst-case scenario is you are putting out that information during the event. Communities should know about their local risks, and should know about it on the sunny days.

You should know about the flood plan where to go, what to do, so when it happens they know what to do and are not vulnerable. I know I need to go down that road, and not drive there. So a marketing campaign and getting that information out there is the most important thing. It comes higher for us than the truck going out to pick up the trees. It's more important that we warn and educate people. Our business is about doing ourselves out of a job. The community should know so well what the risks are that they don't get themselves in that situation.

R: What do you about the impact of coping style and adaptive capacity on social resilience?

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I: I would say in an emergency situation, I would probably disagree with that. I would think that people panic and they don't know. So that's why the information ahead is so important. I think people do silly things b/c of a lack of information and just don't know what they're supposed to do. So if they aren't exposed, they will not make good decisions.

R: What do you think about trust? Do you think it impact on social resilience and how much?

I: Yeah, strongly agree. It's about communication and information and we'll find and I don't have any numbers, but if we put out an evacuation order, people will look to their neighbors. It's not until they physically see people moving their car, that people say this is real. Oh, I got that text message, did you get that too? I'm not doing anything about it.

It's like if you're in an office building and the fire alarm goes off. Are we moving or are we just going to sty here? It's the same kind of things. If you trust your peers must people will do what they are doing.

R: What do you think about rapid response? Do you think coordination impact on social resilience and how much?

I: It probably does, b/c if we're in there telling people what to do straight away. When people will sit there and wait, if we are there doing that for them on the day, they will think, oh that will happen next time. So they don't bother and become resilient and learn the things. They just think, like I sit here last time, someone will come pick me up, so they don't see the need to make themselves resilient. We are society that thinks we just need people to come fix things for us.

It will fix itself, that's someone else's problem.

R: What do you think about social support? Do you think it impact on social resilience and how much?

I: Yeah, I think it's a similar thing. If someone is handing you things and doing them for you, you don't see a need to go build that for yourself. You will rely on others because they did that last time. But if it's the neighbors it different, you are supporting them and they are supporting you. You're not waiting for someone to come and fix everything for you. For example, for someone to give you a $1000 to come and do your groceries because you've been isolated or you've been flood damaged. I think that support, the social support from government organizations or donations is a little different than helping your neighbors. That information exchange is between neighbors does build resilience, whereas the other type probably isn't so much.

R: What do you think about sense of community and community participation? Do you think those indicators and parameters impact on social resilience and how much?

I: Yeah definitely, Scott probably goes through the same example, but there was a lot of pushback from a community. the SES didn't go do a knock up, they were too late, they didn't show up. And Scott was at the meeting when they were saying that. He asked, how many of you are members of the SES? You're waiting for someone to come in and do that for you.

SES is volunteers from within your community. I think those kind of smaller communities in those areas that pitch in and are part of the SES. They know the person who came and gave them the evacuation order or cut down the tree. It's a little different in the rural areas than in the metro areas.

R: Do you think social media has impact on community resilience?

I: Yeah, again it's another form of communication. If people are talking about this stuff. You obviously have your regular broadcast media, but there is so much. When we have an operation, there is so much interaction with people, the facebooks and twitters, just the volume of information and communication, I think yea.

R: Have you ever had a plan for the sharing information among communities? And how?

I: When we are in operations we do regular situation reports. They go out to local counsels. From the unit the go to the region, from region to state and we distribute them to other agencies. It all goes through SEOC website. Every agency can see what the SES is reporting.

R: How often?

I: When we are operational if there's flooding, we'll do a situational report in the 10 morning and 4 in the afternoon, but any changes in between there will keep a quick report. Other reports, things like the CMC meeting I mentioned, they have a 3 month report, what we have done over the last 3 months.

R: How often do you inform communities about changing plans?

I: Look, if the change affects someone they need to know immediately. As often as it changes is as often as the updates need to go out.

R: Do you think any other indicators or parameters that impact on social resilience that we haven't discussed?

I: I think the most important thing is information and communication, for them to be armed with as much information to make good decisions.

R: What's are your thoughts about communication among communities and sharing information? Do they impact on resilience and how much?

I: I think probably both, but most importantly the correct information coming from the organization to the community. And not just waiting until we are on that day when it's all about to happen. The education needs to happen early. It needs to be tailored to the risk. Local papers need to run ads and we need things that are relevant to that community.

We could do a strong safe campaign everywhere, and you need to tailor that information for the right audience.

Heather:

I: So generally we focus on things that haven't worked well during the weather event. We will then go back to the people that own the process and work with them to find better ways to carry out the process. So it might be the fact that we don't have enough trained staff to fill all the roles for a weeklong event. So we'll work with the human resources people, look at training, and a few other working groups to look at training.

Once that is done, we then look at how we can best publicize information about the changes to make sure all the members of the SES across NSW are doing things to revise.

So we can't fix it but we work with people that own the process.

R: and who are the observers when this incident happens?

I: anyone that's been involved in the incident. It could be a staff member or volunteer about an observation. So we hold meetings. Units will hold meetings amongst themselves and they will feed that back to the region. So the units will have their after action reviews. And then we'll hold a statewide one for the regions to come together and talk about things.

R: in that case, do you think learning has impact on resilience and how much?

I: We have certainly improved some of our processes about how we warn the community. And how we work with the community between events to build resilience and make them more prepared.

R: can you explain it more.

I: we've identified. Have you heard of the emergency alert system? You get a text message saying there's a major bush fire or flood coming your way. it's actually a national center that sends out this message. That system is owned by the federal government and all emergency service across Australia can use that system. It could be us, it could be the fire people, could be NSW or any other state.

We identified that we didn't do that well, our messages were not very clear or timely. So we've improved our processes so we are able to get the message out in a better timeframe. Or as much as we can.

R: do you think learning and lesson learn has impact on resilience and is negative associated with vulnerability

I: It's not necessarily cause and effect.

My lessons learned is looking inward, at SES and improving our services. Some of that will flow on into helping the community be more resilience, with some of our community safety messages and some of the promotional programs.

R: what is the most important indicators or parameters that impact on resilience?

I: I'm probably not the best person to answer that. Did David introduce you to the community engagement people? Andrew Richards? I think he's the best person for you to talk to.

What we've done, the SES, this year, runs the storm safe each year which is running awareness in the community. Storm and flood are the most expensive disasters every year. We run a storm safe campaign every year, make sure your gutters are cleaned, if you hear a storm coming tie down your furniture, don't park your car under a tree.

R: what about education and how much do you think impact on resilience?

I: that program is, yes. After each of those programs run, the SES works to conduct one of those after action reviews. We look at how effective was our program. They are also looking at some statistical analysis about effectiveness. A little hard because it's about attitudes. Do we think the message is out, did people come to the meetings we ran? Do we have many people looking at our website for how to prepare your house.

What we've done for 2 years is run those after action reviews. The information that we gathered about where we should improve has actually been implemented and it's getting better and better. So that's one way we can improve community resilience.

R: how about sharing information and its impact on resilience.

I: I don't actually deal with the community; I only deal in-house with SES. The lessons learned from my perspective is focused on the activities of the SES

R: Can you explain about lesson learned process in SES?

I: That's what I was explaining earlier with the meetings we have after events. The units have their meetings, what things worked well, that feeds to the regional then to the state level. We gather those observations and look for patterns as areas that need to be improved. If something only happens once, unless it's a risk to someone's life or safety, then we probably don't need to address it. But if far out different places are saying this is a problem, then we probably need to find a solution.

R: How SES manages or coordinates with other organizations and make communications?

I: the feedback is generally very good. Occasionally a personality clash, but we tend to work very well with other emergency organizations. And other NGOs like the Red Cross who are going through the recovery process. There are meetings at a high level in each region. Did David talk to you about the regional emergency management structure? Where all the regional emergencies come together? They meet regularly and then you'll have a local emergency management team that meets regularly. In a number of towns. You have a local emergency management in your town and a group of suburbs come together as a regional emergency management center. It's the main government agencies, the providers.. So they have Sydney water, the Red Cross, Dept. of community services, b/c they look after the recovery.

They meet on a regularly basis and do planning and do exercises once or twice a year where all the agencies have a simulated emergency. They will go through what the steps and stages are for the hospital and ambulance and police. All of them come together to practice this coordination. That coordination happens at a high level.

What was the rest of your question? What coordination happens?

Emergency management is a fairly coordinated activity. There's also a state level coordination, but it's the heads of the government departments. They set up policies and strategies that flows down to the departments. And then it flows down the regional emergency man communities and local emergency man communities.

R: what does the information distributed among communities? is it centralized? How does information flow?

I: do you mean during an emergency?

R: Yes

I: In a major emergency, if it was a storm event, this week when we had the wind event, we had an emergency man center here operating. We also found the fire brigades had a number of requests for trees that were down and power lines that were down. So the SES is the main response agency for that, so we got what is a liaison officer from fire and rescue to sit in our operations center so that we could liaise with them and share information about types of jobs whether we needed extra assistance, and they could also give us the jobs that were related to trees. We don't deal with power lines.

So we have those liaison officers come into the emergency operations centers. There is that direct communication. They sit on the meetings at the emergency operations centers. They feed back information to their agencies. We also feed information up from the units to the regions to the state level and we feed info up to the minister. There is that 2 way flow of information it goes out to the other organization s that are involved and it will go up to the cabinets as well.

R: How the information share among communities specifically among volunteers?

I: They will be coordinate at the level they are working. Information will go out to the region and into the units and the units would spread the information to the volunteers. The volunteers also have access to our intranet system, so they can see documents that are available to them. We also distribute the warnings from the bureau of metrology. We get updates that come through. And they distribute it through sms and emails.

So we use a lot of communication with the volunteers particularly when they are in their local operations center.

R: IS sending email the first method to exchange information?

I: no. Many don't use email, and the ones who are chopping trees and filling sandbags aren't' at a computer. So it would be verbal or potentially radio or telephone. So their team leader may get a radio call, and they will be able to relay the message.

There is a lot of verbal communication. Otherwise there is some email, some sms.

We have a lot of information, like any big organization, given by email. Every SES member has an email account. I will send out emails to various units and regional controllers. We have a lot of newsletters both electronically and in hardcopy. We use, just now YouTube videos for internal communicating. All of our members are access to our intranet site for policies and procedures and operating guidelines. All of our manuals and things are on our intranet.

We also have our tasking. Did David talk to you about our rfa system? When someone from the public calls up and says a tree fell on our house, they ring the 123500 number. It goes to the call center and the operators take the details and its distributed to the unit where the location of the job is.

R: do you archive all the information among communities and use it later ?

I: some are. Email, like any government system, is all stored so it's accessible. Official emails, we have a records management system. We can also do that on paper files as well.

R: do you think we can access to it?

I: No.

R: Will the email track whom it was sent to?

I: You'd have to ask Andrew whether the IT system does that kind of stuff. That's a bit technical for me.

R: Do you think community efficacy impact on resilience and if yes, how much you agree or disagree?

I: I think in some instances it does. If you look at some of the spontaneous volunteering during a massive disaster, I think you would say yes. In close knit communities I think you would say yes. I don't know if you would say that in a metro area. I think it depends on the scale of the disaster and the locality.

R: Do you think sense of community and community participation impact on resilience and if yes, how much you agree or disagree?

I: That's a tough one. If I'm not being resilient, then other people will just sit back and say why should I do anything b/c no one else is. So I don't think I can answer that one. I can see both sides of that one.

R: Do you think social support impact on resilience and if yes, how much you agree or disagree?

I: yeah, I think so. I agree.

R: Strongly?

I: No, just agree.

R: How about coping style? How much you agree or disagree?

I: My background is in psychology. I think coping style has a lot to do with resilience. I would strongly agree.

R: How about adaption capacity? How much you agree or disagree?

I: my gut reaction says yes, but I would want to see some evidence. I don't know the evidence supports that.

R: Do you think trust impact on resilience and if yes, how much you agree or disagree?

I: I'm interested to see your research. I think trust is an important factor in resilience.

R: Do you think social rapid response and coordination on resilience and if yes, how much you agree or disagree?

I: No. I think that actually decreases resilience.

R: How?

I: I think communities have become reliant on agencies like the SES to respond on their behalf, whereas years ago people thought they needed to do something for themselves. Now there are services readily accessible and they are willing to sit back.

If you mean community resilience as in the community working together without waiting fro government agencies to assist them. It has reduced that resilience.

I grew up in a country town where you had to be resilient. b/c there were no services. I see it very differently than here in the city.

R: how about the coordination?

I: I think it does to a degree.

R: Do you think communication and exchange information impact on resilience and if yes, how much you agree or disagree? And is it the strongest parameters to increase resilience?

I: I wouldn't say it's the highest priority but it is very high. Because if the community isn't aware that there is a threat, they can't prepare for it. If they don know how to respond to it, then they can't do anything. Its one of the highest ones.

R: what about learning?

I: I don't know that has a strong. Some of the major disasters in other states where people have rebuilt in the same area their house flooded and was destroyed. They built back in the same place. I don't think that's learning.

Potentially could. But I think we need a change in attitude before that happens.

R: what about education?

I: I think that's the important factor.

R: what about social media

I: for younger age group yes. There a lot of people that don't access social media, and we need to be aware of that. radio plays a very important role, especially outside the metro areas.

R: what about group education?

I: I think again historically its shown that kids to learn about get down low and go in a fire and how to dial an ambulance. I think keeping that traditional education and it does play a role, but I don't know, I think we need to look at the programs and see if they could be improved. I don't know how effective those programs are in terms of community resilience just yet.

R: do you think volunteers can assist you in sharing the information?

I: yes. Definitely. We only have 250 -270 staff members and we have 8,000 volunteers across the state. So the volunteers are the key to our organization. We have b/w 8-10,000 volunteers. They are the key to us getting messages out to the community.

R: Thanks for your time

Gina Jones:

R: Can you please explain the SES role and responsibilities once disaster happen?

I: If they are saying this is big disaster, the BOM will get on a teleconference at a state level. They are talking to our duty information centre upstairs daily. We have daily operations brief every day at 2pm.

They give us a briefing on the weather. They will tell us which regions are involved. At the teleconference, we go through a series of questions, volume, time frame, where it's going.

R: how do you communicate with bureau?

I: the duty operations officer will call down here to special operations, we will get the media involved, public. In effect we create an incident management team, if the region is involved they will also dial in.

The BOM Depending on what we're looking at they will bring in the severe weather desk and the flood hydro guys. If there is just a big storm with no flood, then we will only talk to the severe weather department, if flooding, we'll get the hydros on as well. Then BOM will leave the line, and we'll just be talking to the regions.. and see what they are doing to prepare.

R: How about incident controller? Are they with you in conference room or just on the phone?

I: yes. We will then go through the questions about what are you doing, etc. many times with weather it's very patchy. We have to prepare for worst-case scenario. They will say our

coverage is good, we have people positioned, we don't need any help.. we've let everyone know. We think for us this will be an 800 jobs and for 3 days. These are only educated guesses.

They might get all ready and then nothing happens. Alternatively, they might get ready and then the storm hits somewhere else. It's very hard to say. If they need extra resources, we will help from a state perspective.

R: Once you informed by BOM, how do distribute information within community

I: internal first. The BOM will let us know and the BOM will let us know before they have any public products. They will let us get our preparations together. And then we will do join media. They will start to put out their products and we will put out media releases at the same time.

To a really big event they normally know a few days in advance, so we have a few days up our sleeve to start putting out the warnings and getting people prepared. If it's bang, like a tsunami, we don't have time.

So the products are planned for in advance and they come out with dual messaging. In tsunami messaging there is a section from the BOM and on the bottom is the message from the SES.

The storm comes in and if there's not a lot of wind involved, we may not get work out of that for a couple od days b/c it take s awhile for the rivers to fill up the encatchment to fill, so it gives you a little time to work. River and flooding is a little different than the flash flooding.

The short notice events, operationally, we always need to be prepared at a moments notice.   So we have talked to our regions and we have come up with what do you need, and we will still be talking to the BOM concurrently to know when they are putting out the warnings? And over a long weekend, when many storms seem to happen, we'll say, we're coming up to Thursday and seeing a big system coming in on Saturday, we know there will be many holidaymakers. We will negotiate about when we will start releasing the messaging. So people will either delay plans or take a different route.

That's the kind of ongoing negotiating process. They will say, oh we can't put the product out until this point.. It's very scientific. But they might put out a severe weather media release and we will do concurrent things from here. So that's happening in the background as well.

So the regions do a similar thing with the units. They get off our teleconference and get on a call with the units, and they say this I s what's happening and they get their units prepared.

R: Who is unit controller? Is he someone from SES?

I: No it's a volunteer. State Headquarters are all staff. Region headquarters are 6-7 staff but they have volunteers attached as well. But units are complete volunteers. There is a unit controller and all their volunteers. Some units are very large. Southerland has over 100 members, so does Wollongong. Some of the regional units might have only 4 members. They have a unit controller and a deputy. If there are several units in the same governing area, there will be a local controller that sits above the two of them, also a volunteer. So that when there're responding in that area it's a coordinated effort

R: Are you involved when a region is having a teleconference?

I: No, they go off and do what they need to do. Anything they need from the units comes back through that chain of command.

R: When do you start to inform community or public?

I: It's all happening within a matter of hours. It's all happening straight away. It depends on when you get the timing and when the warnings are coming out. Sometimes with the BOM we're getting the product as the same time as the public. If it is a quick onset event.

We have some people at the media and some with the teleconference out back. If there is an event and something is happening in a few days time, we'll negotiate with the BOM about when to release things. And we try to go as early as possible, but with the BOM there is a lot of uncertainty. They might be staying there is a huge system off the coast, and then it never even comes in close enough.

You need to be careful about going public about stuff. Eventually people will stop listening. There needs to be an amount of certainty from the BOM before we go public.

R: How do you inform community? Do you have a system or an alert system or sms?

I: we have a number of ways to do our public alert. We have our bulletins. When a flood warning comes out we'll put out a subsequent bulletin that gives additional SES advice the flood warning might say flood on the Clarence it's going to reach major. And we will say: this road will close, impossible evacuation in these areas. That bulletin goes out to all radio stations, up on the Facebook pages. We'll start doing media from here probably depending on the size. If it is a localized event it will probably be only local media.

Local media will turn up at the region headquarters and want interviews. So media is done at all levels depending on the size. Even when we have a huge massive event and the commissioner is on the Tv. The region will still be doing local media b/c there is a lot of interest.

Depending on the level of interest and what else happening, if this' the day the royal baby is born no one cares. We do push that as well though. The media team will start making contacts.

So media interviews – we have a thing called Chumby. It's like an sms but it only goes to media outlets and other emergency services. When we get a warning, media will activate that and it will go out to all the outlets, and they will start to schedule interviews and it will let other emergency services know what's happening with SES. We'll also from the state level give SEOC a ring. We'll say we might be opening our ops center, and we might need liaisons from other agencies.

We would be open here before we started requesting liaison officers.

In a flood event most of that.. They will probably have a lot of liaison officers in the region offices b/c they might using their crews, RFS might be cutting down trees doing flood work. But at a state level, we don't have someone. We normally have someone from SEOC but the others would only come in for a really big event.

R: is region is mostly command centre for requesting resources?

I: mostly region or at the unit level they will get them from the local area.

So other warning products – we put out bulletins, media releases, we put out evacuation orders. They go via radio, on the live broadcasts, on the website. If it is an evacuation, we'll put out an emergency alert. An emergency alert is a national Telstra product. All emergency services have access to that. You say we have an evacuation in a certain town, we'll get onto the website, well draw a square around the evacuation area, we'll type a message in and the message will go to every phone in that area.

It will say evacuation warning for x please be out by x time.

It used to be that the messages would only go to those phones where the billing address is in that area. But they've updated the system, so now if you're driving through there, you'll get the message as well. It's location based. The towers can tell where you are, and even if just traveling through you'll get the message.

All of the agencies are using that emergency alert system.

R: Who is in charge of mobilizing resources?

I: It depends. The unit controller is managing at a very local level. When a few units become involved the regional controller takes over.

There are certain cases when that might be different. Sydney western, Hawkesbury, you'll find that regional control officer moves out to the blue mountains or the control goes to region headquarters b/c of the sheer size of the event. IT's a big coordinated effort. They will shift control from one level to the next depending on how big it gets. You might have every unit active in some cases, and the regional control officer steps in or maybe there is a massive event at one unit and they move it forward and the regional controller goes to the unit.

The AIMS, the management structure has to be flexible b/c every operation is different. Some of the flooding in the last few years in the western areas was over such a big area. 75%of the state went under water. That's huge. It's not a single incident and many affects. And that's why the regions and units are divided up to have that local knowledge. That's why they leave the control at the lowest level.

In every emergency, you work with people a lot better when you've worked with them before, so they try to get together to do their exercises with the other agencies. If someone hg has happened, and you're in there from out of area, if you're the local you have the mayor straight on the phone.

That is very important, knowing your local people. It can be done without it, but so much more streamlined if the local presence is there.

We've done region, unit teleconferences and then you've got all of your resources ready. You sit and wait for something to happen. You are doing your warnings and messages but until something happens, you preposition people.

If we know there will be lots of road closures, we'll move out of area people in and have them help. Even if something doesn't happen we'll have them do some training and get to know some people they haven't worked with before.

If we aren't ready and we haven't put people in, it might be you cant get them once the event occurs b/c roads are closed and aircraft cant get in. We preposition where we can. You have to make a judgment call in conjunction with the BOM and the locals. We might just move people… so say we have something happening on mid north coast. We aren't sure where it's coming in. We might move everyone in Clarence Nambucca.

Most regions should be able to keep going for 24-48 hours without calling in assistance.

R: How often do you have communication with BOM?

I: We'll have daily conversations with them even on a sunny day. Once the weather starts, there is at least a daily conference normally at 1130 with the regions on the line. The regions will contact the BOM as well if they have a specific question. They need to keep us in the loop, but they don't have to come through us.

R: do you inform all regions/communities or just the region/ community that disaster happen in that area?

I: all the regions will know about it. A warning order will go out to the state. It's like a heads up warning. This is what the BOM says, these people will be affected. The people not in the affected areas, this is what you need to do. They need to get ready to potentially provide out of area assistance.

Everyone knows, from every region headquarters will know and they will pass it onto their units.

R: What is the main method of warning system?

I: email normally, but depends on the time of day. If it is during work hours, it's via email. It also depends on the timeframe. If it's happening in half an hour, everyone is on the phone.

If it is a day or two out, they are talking next week, we'll email out the warning order. We have an operations account that is monitored 24/7 that's marked as urgent. If it's truly urgent we'll use the phone.

R: What do you call the committee at region level?

I: REMC regional emergency management committee. And REMO Regional emergency management officer. At the local level: LEMC and LEMO. On these, are representative from every agency, area, local council, the mayor. When a disaster happens everyone is there. These people are probably meeting daily when there is a flood.

Sunny day I think they meet monthly.

R: is it the same structure for other emergency organization as well?

I: yes, but they call them different things. RFS, they say state, district, local.

R: Does it mean the peers of each level from different emergency organizations exchange information and have communication among each other?

I: yes. They have meetings together, and then they will go back to their agency and push the information up in their own agency. All the information from this meeting is going up, down and out. It goes internal, it goes state to unit, and other agencies.

R: Where do you receive a request for more resources? from region or unit?

I: unit sends to region and region sends to us. We'll look internally for resources first. We'll go to other agencies via SEOC or the LO here. The LO helps organize for other agencies. LO – liaison officer. If they've got one sitting in the region.

If there's a tornado, they're resources are exhausted... they would go to their region and say, we need more resources, so the region would have fire and rescue and they would ask them to see how many can you send and how quickly?

R: What is the information follow? Do you inform region and the region inform units?

I: always follow chain of command. The decisions should be made by the incident controller. At a state level, there are some decisions that we might question. We are like a support back up kind of system. If the person in here, the state duty operations controller, questions that decision, they can say we're not doing that we're going in this other direction, that might be a very rare occurrence.

These guys have an incident controller, but if too big the region will take over.

R: What happened after rescuing people?

I: the people in the field, they also have an IMT sitting at the unit level doing regular situation reports. Regional will collate the reports and send it to state. They come through at 10 and 2 everyday. They are constantly updating.. this is how many jobs, we've got rescues here.. and it's also going through the operations center as well. From the state level we're watching how quickly they re completing those, and we're looking at the life threatening ones.

They are pushing their situation reposts to us, we are then reporting out to the minister's office. More and more and the commissioners have for the past 12 months have said the flow of information is very important. Our primary role is to warn people and keep them informed. Obviously it's important to rescue people, but if we don't have the information we can't. If we're doing our job properly, we should do ourselves out of a job. Unfortunately we're not quite there yet.

If we know that an area has to be evacuated, we want 24 hours. Enough time to get people out safely. We don't want to find ourselves in that situation.

R: Do you mean SES's most responsibility is informing people rather than responding to disaster?

I: that's where we should be. That is the most important thing. To get the warnings out in a timely manner. The rescue and all that, you don't need it, if we've warned them well.

R: Do you concentrate mostly on prevention and preparedness

I: yes.

R: Does the unit level get more resources if they or should they send their request to region level?

I: they can do it locally as well as long as they let the other levels know.

R: so they inform LEMO that need 2 more resources from fire service and only report it to the region level.

I: yeah, that can happen. But if they are too busy, they can go to region and ask them to organize it. It's flexible.

That's why these levels are here as support not a control. But if it gets too big, we're transitioning control to the next level up. You all need to be out tasking operations.

R: What is the last step in the SES after disaster?

I: And this is where you're going to have to focus on your Daves and Gregs. Most of this happens at the regional level. While we're operational, most of the information we're collecting is being sent over to recovery. These committees decide whether you need a recovery committee.

Whatever they need to get that community back and running… all of those agencies need to get involved in that. Our role is to provide as much info to the recovery organization. Information around how many people are displaced. And we would know that b/c we would do an evacuation, we would call in welfare services and everyone would register through them. We would do reconnaissance, and honestly we're not great at this, but we should be collecting information like how many houses were damaged.

So that other agencies like human services know that house was damaged and those people are going to make a claim for $1000. Our systems in that area are not very sophisticated. And we're looking at that from a multi agency point of view. All the agencies need to be collecting this.

MPES Ministry for police and emergency services are the agencies responsible for recovery. They will send along people asking who is collecting this.. I need to know what's broken and needs fixing.

I've been sitting on a committee that have only had one meeting so far, and they are talking a huge level like Christ church. They are talking about having a committee at that level., getting funding for that. Our part in that is to provide information from response to let them do their job well. And there are questions around funding. If it's a disaster, can they access the NDRRA – Natural Disaster Relief funding. If it's not a disaster, like swine flu, you still might need a recovery center, but how do you pay for that?

All those things need to be put in place prior to that. We are part of the development of that. The responsibility of that lies with MPES at this point.

R: What is the flood intelligence system?

I: Talk to Simon. I would not do it justice. Simon worked over the last 12 months at MPES. He now works in our emergency risk management department. His father was the director.

R: Thanks for your time.

Focus group:

R: Our research is about community resilience from the social perspective. In this study, community resilience is the community capacity to jump back to previous situation of life quality and sometimes go beyond the situation and becomes better situation than before, through innovation and improvising within a community. As resilience is a very huge topic and multi-disciplinary context, it is beyond one research that's why in this study; we only focus on social perspective of community resilience. So we would like to know your organization role to develop and improve resilience within a community and the procedures in SES to achieve this goal.

I: So the section I come from is called emergency risk management. There are two important parts, planning on a sunny day and then use of that information during the incident, on the day. The bulk of our work is on the planning before a disaster.

That involves a lot of people from this organization and across the state. Flood is the biggest amount of work that we do, and across the state, every local council area is subject to our plan, and within every council there is a committee for flood emergency planning. On that committee ideally should be represented all of the stakeholders. It includes public members, agencies, ngos and other bodies that might be involved in the emergency.

R: Is that at a unit level or state level?

I: that is at the unit level. Each council provides two people from council who manages and contributes to local emergency committees. One is the chair, and one is the secretary of the committee. They are council staff. Those local emergency management committees are for all emergencies, and under each are subgroups that deal with floods, bush fires. etc. So under the local emergency management committee, the SES at the local unit and an officer from the region set up a committee. The purpose of that committee is to assess all the data possible for the flood risk. They assess information from the bureau, and assess the impact on the committee. So what is the population, the demographics, who is at risk, where are the critical facilities like special care homes.

R: do you have access to demographics Information?

I: Yes, we have census data. It is nationally required to collect this data. They have their own process called the integrated data and reporting system.

R: how does demographic information impact resilience?

I: The demographic information shapes the way we plan. Together demographic information together with the hazard and key risk groups will dictate our priorities. If there are aged people in high-risk areas, we will establish a plan around them.

So that committee should participate in working out that strategy.

There is no standard process, or policy on reviewing demographics to identify resilience. For context I used to work at the state level for the police in a strategic risk management. For any of the hazards, I'm not aware of any rules for measuring resilience. What happens is its using best knowledge of council, the Red Cross, salvos.

R: Can you please tell me how do you measure resilience or vulnerability and what are the indicators or parameters to measure it?

I: we take the demographic information and we look at the concentration of populations, certain age brackets. We also use the CEFOR index from ABS (Australian Bureau of Statistics) and see who is most vulnerability.

R: so you have access to this demographic information. What sorts of demographic info, age gender socio economy?

I: we have access to everything the bureau of statistics has. The census, there is a huge range of metrics that ABS has developed.

R: How do you measure vulnerability? Do you measure marginalized communities?

I: it would be our judgment. There is not central special process. Some of the bigger councils may have been using that census data to map their communities. The vast majority wouldn't do resilience. If you're looking for methods measuring resilience. then in the community emergency. Management, the SES doesn't do it.

But under the Min. of Police and Emergency. Services they are connected to state and federal working groups and technical committees. In those technical committees there is work to measure resilience. There are one or two key projects that are being test piloted to map resilience. using data and special tools.

We don't have direct access to those.

R: do you think sense of community has impact on resilience and if yes, how much?

I: so that plan is everyone's agreed methods on managing the flood risk. IT's a statement, this what we believe the flood risk is. People manage the flood and the community with that plan, but the community doesn't have involvement with that plan. Agencies do and work to the plan. The public aren't engaged in the development of the plan. When they are evacuated, and where, they haven't been involved.

R: How about education?

I: It's not just education and it's not just engagement, it's at least all three. You need educate, you need to share and you need to engage. That they are all very different things. At the moment we do a little education, and we do a tiny amount of sharing, and we don't do much engagement.

we know it's little education because we only have a small resources devoted to it.

R: How do you educate communities?

I: the minimum level is brochures and pamphlets and that's what we do.

We have developed some unique brochures for hearing impaired groups, but everyone realizes they are just a small part of the community.

R: Do you post all catalogue into their home or using social media tools?

I: maybe in small communities, yes. Some communities have very strategic engagement workshops. They use social media, etc. but things like that are not common. The amount of the budget that we have to do education is very tiny.

You would have spoken to Andrew Richards about that. He engages with the community about risk. The purpose of our branch is developing the plan. We are trying to engage with the community about the development of that plan.

R: how much do you agree that sharing information has impact on community resilience?

I: There are 2 or 3 types of information. One is flood risk. There is the national flood risk information portal. That will be a tool where flood data and maps are available, through the website, and NSW will have it's own portal.

R: do you use any tools to distribute info within community?

I: Yes, inside the flood safe there is an application and you can register, and get warnings. And also more and more we're using those tools. The engagement and the sharing about the plan. At the moment all of the plans are on the flood safe website. The next step, when the plan is under development we will have a consultation process. But that's a minimal approach. We are investigating how to have more public engagement.

R: Do you think community efficacy has impact on social resilience?

I: Yes.

R: How much do you agree?

I: I agree, yea. I have a comment. And I've made this point in many forums. In our job, we have a very good understanding of everything from small floods to big floods, and I'm very supportive of resilience. But I think resilience only lets you deal with a certain level of flooding. You can deal with small floods if you're more resilience. It will help you recover, make better decisions. But there is a limit when the floods become too big, and it doesn't matter how resilience you are.

What is very important, is that people are aware of what level of risk they are capable of dealing with. We need to get better at giving good advice. If the flood is so big we need to evacuate, we need people to listen, and we need to get better at communicating that. People think that resilience can be a solution, but only bits of it.

You can be as resilience as you want, but you need to evacuate. People confuse those things. A very common thing we see is people not evacuating b/c they think they can deal with the risk. Sometimes that's okay and sometimes it ends up with people dying.

R: Do you think sense of community has impact on social resilience? And how much do you agree from 1 to 5?

I: Yes. Agree. 4 out of 5

R: what about community participation?

I: Yes. Strongly agree. 5 out of 5

R: Do you think social support has impact on social resilience? And how much do you agree from 1 to 5?

I: Yes. Agree. 4 out of 5

I think it depends. It comes back to the example, if I was to reshape the SES into models where we are doing a better job. It would be that people are informed about risk, and deal with low-level risks themselves, and people are less of an authority at that level, but for big events, they need to understand that we know the risk and will deal with it.

R: Do you mean it depends on level of disaster?

I: Yes. When we tell people, b/c we don't have good data and systems and cant disseminate information, it means we have simple messages. When the message doesn't fit their scenario, they don't listen to it. We need to get better at targeting the message.

R: how do you measure these gaps?

I: there has been 2 or 3 studies over the last 5 years where it's been a steady program of dissemination of messages and a collection of community reviews.

The example is and I can give you a reference. There are key communities in the state, which have a couple of flood problems. The SES has tried to evacuate in the past. The study said that 60% of people wouldn't evacuate in the future.

They say it's skepticism or not trusting the SES. Because of the limitations in our ability to communicate. Floods are very complex and there is uncertainty. When the flood actually came, it wasn't as big as expected, but we couldn't have seen that and now the community is distrusting. If the flood is bigger in the future, we have more certainty they wont evacuate.

R: Do you think trust has impact on resilience and how much you agree with it?

I: Strongly agree.

But some people often forget if you live in a town on a river, how do you know when it's flooding. Is it up to you to monitor? Sometimes yes. But is it up to your neighbor to tell you, or is it the job of the SES? I would say it's the job of the SES.

R: Do you think adaption capacity has impact on resilience and how much you agree with it?

I: I think it's the same as the overall concept of resilience. Adapting and innovating and being self-reliant is very important but it can only go so far. I just agree.

For lower level flooding, I think you need to be able to adapt, but for big flooding it wont help you. The SES needs to know where people can adapt and where they can't.

R: Do you think learning has impact on resilience and how much you agree with it?

I: Strongly agree. When a community has been through an event, when it's been good and bad, it's one of the most significant things that impacts the next event.

R: do you think rapid response among the organizations impacts community resilience?

I2: there are some things that we can and can't do to mitigate and prevent. If we were to do that uncoordinated, then we would lose credibility.

I: I take that back a step. I want to emphasize the planning bit. We do all the planning before and we use that to respond. How rapid we are to engage in the planning is important and the community looses faith.

R: Do you think sharing information and communication within community has impact on resilience and how much you agree with it?

I2: at a local area, we have the local emergency management groups, so there are 4 agencies. If there is an effected community, like Wagga, I run a community meeting at the school if we need to evacuate. There are 350 members; the local mayor and politician are there. We arrive to brief on what is likely to happen and best course of action. They have the opportunity to ask questions for clarification. The community members then talk amongst themselves and that's where we've started social media. We monitor that so we can correct any rumors. So we need to be digital in this day and age.

In the Tasmanian fires, the social media complemented the emergency services. And that was a private person setting up a website, where they were able to provide a mechanism for the community to help one another.

R: can you please briefly what was SES process once Wagga Wagga disaster happened?

I2: with the Wagga incident, as an incident controller, I had a media assistant who helped with print and radio. That's one messaging. Then we have the warning systems that have alerts for impacted residents. We then have the public meetings. We then had local controllers in different areas talking to residents. We have the communication b/w myself and the regional emergency management group. So they then communicate out as well. Plus the social media, and they have theirs as well. There is a diversity of communication.

R: how the information distribute?

I2:: if it's a small event I might do the media myself. If it gets bigger, then we would bring in media resources. We have both staff and volunteers that help. We use other organizations like the rural fire services and use their media person. They will work with me to assist me in messaging out. We will come up with a media strategy.

R: For example for Wagga, can you tell me what exactly has been done in SES

I2: sometimes things escalate very quickly. I have to provide reports to the centre on a regularly basis. They will ask what I need. I provide communication to the state operations centre twice a

day. They would advice the state and the minister and the commissioner. The commissioner might come down, which he did. He might actually visit Wagga. The Prime Minister might visit, and we have to work out the communications strategy for that.

I would then brief the regional emergency management group, which is made up of the local mayor, fire, etc. And I would verbally brief them. That briefing would give guidance on how to get different logistical support.

R: do you think volunteers has any role in distributing the information?

I2: many volunteers do this communication. Three are levels. The information would go from me, the incident controller, to the units. I would get a lot of volunteers to come in outside the Wagga area. They would be briefed by myself, so they get their orders. We have what we call incident action plans, so we will document how we're going to manage it.

And we have the policies and procedures they need to be aware of.

R: Does SES has same procedure for each disaster or different procedures?

I: there are to sides. The flood risk side, understanding it big and small, and you take that plan on the day and you work out what you're dealing with and you start developing those documents on the day to communicate.

R: can you tell me about the flood intelligence system?

I: the flood intelligence system is linked to the flood plains and it's fundamentally about understanding what impacts happen on the day. You were talking about how an event starts. Very often it will come from the bureau of meteorology. For a flood, they might tell you it will happen in a few days. As it starts to rain, there are gauges and they know at this height there will be certain consequences.

I2: There is the bureau of meteorology. Gina will convene a conference with the bureau and all those impacted will come together and have a flood conference. The Bureau of meteorology will let us ask questions in the teleconference. We will also discuss with state headquarters any issues regarding potential impact or other resources we might need. During an event we will have these conference every day. The event goes for 5 days. We will have 2 days leading up to it, generally at 10 am. After that I as, a regional controller, I may then have a teleconference with my local controllers who are all volunteers in my region. So I'm cascading that information down. They can raise issues with me that either they can or can't provide the resources.

I: there is also directly to the public. Every time the bureaus updates the flood line forecast, the SES is responsible for sending a communication to the public. We craft a message and send it.

I2: that will be done at the regional level. They will send it to a predetermined media network and stakeholders. The Bureau of meteorology has a website and they put the warnings on there and we do the same for the SES website. And a lot of the regions have their own sites and Facebook.

R: How do you participate or involved in the community or local council?

I2: there is a local emergency management meeting. There is a leader of this, and he or she will meet every several months with their local emergency management committee. If it's a big event its regional and if it's SEOC it goes to the state.

I2: there is a regional emergency management group too. SES will be a partner in that. But if there is a storm, we are the lead authority on that. There will be planning about what happens if this goes for three or four days.

In a regional headquarters, some have a regional unit. They just work as a volunteer around the regional headquarters. for a major incident, b/c it is quite large and we need quite a number of people in the planning area, I need to have planning, operations, and logistics. I only have so many staff so we will bring people in to help. Some of them have more experience at that level b/c they've been exposed to things.

R: How do you learn from the disaster?

I2: the members will return to their unit and take their equipment back. We have an electronic system to record when teams come in and out. Before people leave we have an after action review to discuss how that event is managed. And we also have a small section in state headquarters, which manages and guides in that lessons learned. They will help facilitate those debriefs.

R: Do you think learning has impact on resilience and how much?

I: yes, if the plan worked well, then we say yeah, that's good and move on. If things happened that weren't documented then we will start collecting other information about what will happen. And we update the flood safe guides and public information.

I2: the local unit might do a review, and the region might do one, and the state might do one, all with different focuses.

It goes into a database. So that we can look at the different issues in our special area, and we can match up where there might be commonality.

R: Do you remember any other indicators or parameters that impact on resilience?

I: something that we come to terms with, it's not exactly resilience. There are a lot of people that are given information and are still exposed to risk. They might be resilient in the high flood areas… this is an example of it not mattering if you're resilient or not.

There are people that want to live to places that are exposed to risk.

I2: yeah, it's a negative thing. They are taking a chance with their lives.

R: Thank you so much for your time

Bill Harvey

R Actually I called you in regard to the email I sent you last week, about my research. First I want to say thank you for taking your time. I appreciate your support. As you know I'm a PhD student at Sydney University and doing research in community resilience to flood.

The aim of our research is to increase the social resilience in a community. And a case we've chosen is Wagga Wagga flood in 2012 and that's why your thoughts are very important. I've already had interviews with 9 subject matter experts in SES and they gave me your contact details.

Is it okay for you that I record your voice for our documentation?

I yes

R just to confirm, your position is senior traffic officer in Wagga Wagga council

I Yes, I'm also the   (indecipherable) to management officer

R have you been involved in the response to 2012, in the council response?

I Yes I was involved in the response

R So our research emphasizes the social resilience part of community, which is the measure of a communities' ability to withstand external social shock in a way that minimizes social disruption and increases social capacity to resist disaster losses. We have already found a few parameters that might impact social resilience. I can tell you all these, and you can tell me how much you agree or disagree. You can give a score to each parameter. If you strongly disagree, you give a score 1 and if you strongly agree you can give 5.

So the first parameter is education. When we say education. we refer to the level of knowledge about the flood. Do you think if the community has enough education about the flood it might impact social resilience?

I Sorry. If the community has enough education about the flood?

R Yes, in Wagga Wagga

I I'd give it a 3. There are fors and against. I don't believe that we need to flood them with information. They wont take any notice of it except when the river is rising. If the education comes to them quickly and accurately when it's happening, that's when they learn. And listen. If we try to talk to them today when the river is at normal levels, it doesn't sink in. It doesn't get out there.

R What about the leadership – the behavior among the community? How much do you agree with that?

I I'd say a 5.

R Can you tell me why you strongly agree?

I If the leadership isn't' strong then the community is very disjoined. They need strong leadership to pull it together to get its focus towards bouncing back after an event like that. Particularly those parts of the city that were actually flooded. And you could have a community hat just sits and looks at the mud through their houses and is completely overwhelmed or you can have a community that jumps in and tries to help itself clean up and start working. If the leadership isn't there to drive that, then in all likelihood it will be a disjointed recovery. It won't happen easily or quickly.

R What about the improvisation and creativity and innovation in a community to devise a solution? For example they just find a solution for the next flood, they can improve something like infrastructure or technical things.

I I'd give it a 4. It can help mainly because the community feels like it has some ownership of what's happening. Having said that, it's probably more important that it comes from the other agencies. Including the council. As much as the individual community members. Having said that we're all part of that community. It will work better if it comes from the leadership.

R So how about demographic information? Age, gender, income, education, religion. Do you think it might impact on social resilience?

I Yes, it has to. The ability of the community to be resilient certainly is impacted by its age and financial capability. It can be made far more difficult if the community is younger or substantially older than what would be the average. And of course financially, insurance can have some impact but a lot of people are not necessarily insured or can't get it. I would give it a 4.

R So how about the community participation? If there are meetings in a community or their involvement, can that impact social resilience b/c they know each other and they participate in communities?

I Are you talking about normally or at time of the flood?

R Anytime.

I 3. Maybe even lower than that because as long as it happens when the emergency is actually occurring, that's when it's important. If it's not happening before then, the community still seems to manage through that.

R So how about the community efficacy – that they believe in their own capabilities of performing or completing their job. Does this impact social resilience?

I Does their belief in their own capability impact resilience? That's an interesting question. I suppose they do have to believe in themselves or they wont be resilient at all. I suppose that would have to have a certain belief in their own capabilities or in the capabilities of the community as a whole, including the army and air force and they certainly help.

R What about the sense of community? The feeling of belonging to a place.

I That's funny because at north water, the center of community is quite strong. My experience over last 20 years is that the sense of community in that area is stronger than anywhere else in Wagga. And that is historically the area that's been affected by flood most regularly

R so how about the social support? If they know a neighbor can help them can that impact social resilience?

I No, I don't think it does impact a great deal. I don't think that the knowledge that the neighborhood supports them impacts it.

R Not specifically the knowledge but for example, if the neighbor support each other in terms of financially or even help them mentally, it might impact r?

I I don't think it does. I'm not sure because the neighborhood here always does. I don't know whether saying that is right. Maybe it does have an impact but the fact that it always does.

R But in general any other communities that support each other would it impact social resilience?

I I suppose I've lived in several communities and they haven't always been as supportive as this one. I don't think it does. I think community are still get along and are resilient after an emergency.

R How about the coping style, like adoptive capacity?

I Yes, that definitely does. I'd give that a 4 at least

R Learning from a previous flood that happened?

I No, I don't

R Trust to each other? Trust among the community.

I No, not in their community. It's such a broad statement.

R but trusting means, if a neighbor has run away from the flood and the other people follow what they have done because they trust them?

I No, I don't think t does

R How about coordination among community?

I Yes, I think it does. Even right from the start the community has to have confidence in the combat agencies and the mechanism for dealing with any emergency. If they don't have that in the coordination, that can put them in a negative frame of mind and affects their resilience.

R What about exchanging information with one another about the flood or a natural disaster?

I the actual exchange of information.. well, … there is advice given that will certainly impact social resilience because exchange of information is a social education process and it's worthwhile education. It will be as simple as this is what you need to do to clean up, or this is how you file your insurance claim. This is where you've got to go to get some assistance. That certainly has an impact. Without that happening, we try to get info out there but still often it is underground from person to person.

R So how about the sharing of info through social media, tv radio, one-way communication?

I again, it's about the communities' positive feelings. Yes it impacts on their resilience because there's a great clamor for them to get information at the time, and providing that for people, they feel positive. Which in the end will make them more resilient, not because of any thing physical, but will have confidence about where they're going

R Do you think there are any other parameters that impact resilience that I missed from my list?

I The ability of the community to respond. We are very lucky here because our community is supported by potentially a large contingent of armed services, which are close. If they weren't

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as close and available as they have proven in the past, the resilience in this community would be a lot more stifled.

R any other parameter

I not that I can think of

R In the council do you have any program to increase the resilience and decrease the vulnerability within the community?

I We are currently tackling the disaster plans as they were for the region across the board. For any disaster, not just for the flood. Across NSW they are being re-written. They are being done in a way to not mirror different levels in a disaster plan but rather to complement the plans. So from that point of view I'm expecting Wagga to have a far more efficient disaster plan in the next few months and one that identifies things that need to be picked out and info that needs to be presentable rather than being in an emergency and try to source that information from wherever

R So in that kind of plan do you know how to measure the resilience in the Wagga Wagga community yet, or not yet?

I Sorry what was the question?

R So how to you measure the resilience of the Wagga community?

I Personally I measure it by observing if the community actually does come back and reestablish itself after an emergency. If N Wagga being a perfect example, they've cleaned up the houses, they've rebuilt, increased the height of houses above flood level. And community out there still exists and is strong. If they had said this is an unwise place to live, and we are to leave, then I'd see the community in that location was unresilent, they've succumb to the threat of flooding and they've moved on. That's the only way I can measure it, and from m position that's enough.

R What about the role when disaster happens the council role

I As the local event management officer, I facilitate the operation of the local emergency management center. It's a very nuts and bolts thing that make the center work. Not the operation of the center in its combat role but the facilitation of the center for the combat agencies to use. I've got the keys to the door and know how to turn on the air conditioning and I make sure there is plenty of tea and coffee and milk and the food is delivered at the right time.

R In general do you know how council responds to disaster? For example when disaster hits, the SES informs council that a disaster happened and how you coordinate with SES.

I we don't coordinate them, but if they are the combat agency, like with flood, they coordinate us. They do that through the local emergency center (LEMC), so the coordination is done through the LEMC. That's the forum in which that takes place.

R and you say management emergency center? MEC?

I Local Emergency Management Center LEMC Or Emergency Operations Center EOC

R but SES is responsible to coordinate with you? Or no

I SES coordinates with everyone, with al the agencies that have a seat in the EOC. The members of the LEMC.. so the SES phone up during a flood and say we've got a flood this is what's happened and what's going on, and this is what we need you to do. Fire brigade we need you to do this, ERA we need you to do this.. police this. All the rest of it. My role is to provide tem somewhere they can do that. Desks telephones, computers, projectors on walls. All of those things. I make sure the infrastructure they need to operate that center is there and works, the doors are open, and that it's all working as it should.

R We are publishing our paper in the Australian Emergency Management Services Journal, probably in July, so I think a soft copy of that will be sent. I appreciate your help and assistance and may go back to you for more questions. Thank you for your time.

Donna Argus

R So Donna as you know my research is about the social resilience, and when I say social resilience, it's just refers to the ability of community to really stand external shock and n a way what minimizes social destruction and enhances social capacity to manage disaster losses. What I want to do now is to give you some indicators that impact on social resilience and I would like how much you agree or disagree with them.

You can give the score from 1-5 to each parameter. If you strongly agree that this indicator can impact on social resilience you can give 5, and if you strongly disagree you can give 1 to that. If you agree you can give 4 and if neither agree or disagree can give 3, or disagree 2.

The first do you think that education among community can impact on resilience?

I I'd give that a 4.

R So you agree. What about they leadership in the community?

I 5 strongly agree

R What about the improvisation or creativity or innovation in a community to devise a solution for the next disaster that might happen?

I so community solving problems on their own?

R Yes

I their own creativity, 5

R What about demographic information like age, gender, income or education or religion? Or the population with special need? Does this impact on social resilience?

I who would have that knowledge? Does that demographic information, if known by community members it basically increases resilience?

R not in general for anybody

I I might give that a 3.

R what about the community participation? The involvement in a community? Is it important for social resilience?

I Yeah a 4

R What about the community efficacy. I mean their belief in their own capabilities of to perform and complete the job

I 5

R What about sense of community, feeling of belonging? When people think that they belong to that place..

I also 4

R What about the social support, the support only from the community? Support only from the neighbors?

I Yes, 5

R what about the coping style? Developing the strategy or resources to adopt with a disaster situation or the adaptive capacity?

I Yes, 4

R What about learning. Do you think learning is a factor that impacts social resilience? Like they learn how to cope with disaster next time?

I Yes, 5

R What about trust to each other and the other members of the community?

I 4

R What about the coordination among the community? Not from emergency organization, but between each person.

I 5 definitely

R can you tell me why?

I Why I think .. because when a community are looking after each other, and I guess it goes back to others I've given 5 to.. it's very much about… the trust is important but when times of crisis people will trust each other quickly before outside agencies. I've watched this happen in my community. Local people solving local issues with the confidence to do that, in fact usually present a better solution than supposed experts in emergency services coming in and thinking they know what's best. That's a 5

R what about the exchange in info, like if they know news about the flood and exchange info

I yes 5

R what about sharing info, like social media or website, this info is distributed by one person, one-way distribution.. like tv, radio

I I think it impacts but not as strong as human to human. So probably 4

R Is there any other indicator that I've missed for increasing resilience in a community?

I No not really.. I think you've covered a lot. I think it's a community self-belief as well. I don't know how you draw a parameter or determine what that was, but you can have community that … for my community, that's a small community, I have people that don't talk to people on a day-to-day basis and there has been conflict over the years. However at a time when we need to support and work with each other, that's that confidence that I'm saying they just know they can depend on each other, but that doesn't mean it's a good relationship, when I watch people that haven't spoken to each other in a number of years because they have a confidence in themselves as a community. That they are far more resilient.

An example is we are a small community that sits outside a large center. We live in Gumli Gumli, but we are only 6-7 km from Wagga. But within that small community it's about 45 houses. We have 4 distinct community groups – a progress associations, recreation association, local irrigation, and common land trust. Those sorts of things can cause conflict at times within a community. But we have a self-confidence that we can look after our own. I think that's a parameter that contributes to resilience. Sometimes from the outside looking in, that if relationships are fractured, and I'm assuming the resilience is about when crisis hits, it's how well we bounce back.   And I think it's about self-confidence. If a community is used to look after their own and little outside intervention, there's a lot of confidence within them.

R So can I ask your position in family and community services?

I I'm a senior project senior management for programs innovation and design.   So I'm doing a lot of community resilience stuff myself

R Do you have any plan or program for increasing the resilience within the community?

I Not one in particular, some of the stuff I use in my role is the assets based community development models, it's the Peter Kenyan stuff. There's also a lot of work being done by the LGSA (?) It's Joseph Harwood's stuff. There's a lot of really good stuff coming out of there. They are the 2 areas I draw on to do various programs to do strategies and models when I'm working in my capacity. There are similar things I do as one of the leaders at my home in Gumli. Where you know we have issues, but it's a mentality of starting with what's strong not what's wrong.

R The family and community services is that part of Wagga council?

I No, we are a state government organization.

R Can you tell me, is all of these scores compatible to the Wagga disaster in 2012?

I yeah, it's where I've reflected most on in giving those scores. I've done a lot of training in the emergency management area. But the scores I gave you were from a personal perspective, but obviously that is influenced also by my job and training and other experiences.

R When disaster happens how are you involved in a response?

I I am involved prior to the 2012 floods. I mainly got involved because I'm very passionate about community. From a personal circumstances, I live in a small village type community but

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it's only 6 km out of a major center. My children are the 5th generation that live there. My last name being Argus and I live in Argus Center so you can tell from that there's been a lot of family involvement and generational stuff. My great grandmother used to live opposite the road from me. It's in her to get schools and churches and irrigation schemes because that's what you did for your community then. And that belief system has gone from generation to generation.

That would be the most relevant reason as to why I do that. I haven't been struck by any particular disaster that's had an absolute negative effect, so that's encouraged me to do it. Its really that very close bond win my family but also the community.

R What about your organization? Are they involved in the disaster response?

I Yes. If there is a particular local disaster, we will be a part of the multi agency disaster center with the SES that is opened. I forget the name of that. Essentially we will go in and we look out for the most vulnerable   people who are in housing, aged, disabilities. If there's a disaster welfare center that's FACS role. We have a disaster welfare officer and I'm the deputy for the Wagga area.

R Do you have any documentation and organization in how your organization are involved in a disaster response? A chart? Or process?

I might be able to help you get some of that. I think there would be. I can find someone that would contact you.

R We are in a process to making a survey or questionnaire for our research? Could I contact in public, 3 or 4 months and ask them a few questions? The questions might be different than what I asked you but it is very simple and straightforward. Do you think I could contact the public?

I Yeah, I could help you outside my agency as a community person. That's probably easier to work there. As a government rep you have to be so careful about that stuff. There are a number of associations I'm involved with outside work that would be happy to help. There would be many people in my own community that would be happy to do that, and I have some strong connections in North Wagga. I'm on the flood plain risk management committee too.

R I really appreciate our support. We need to send the questionnaire to 40-50 people.

I yeah I can get that for you easily.

R I really appreciate your support. We will publish our first paper in July in the Australian Journal of Emergency Management, wand we will send you a copy. Your opinion is very important for us because of your experience and you're a subject matter expert, probably in the next 6 months, I'll contact you to help me get some information from the public.

I I'm more than happy to help you in whatever way I can.

Lisa Saffery

R Good morning. Sorry that I call you a bit late. Do you mind if I record your voice?

I Not at all

R So you know my research is about the social resilience. What I mean from social resilience, the ability of community to withstand social external shock in a way that minimizes social disruption and building and enhancing social capacity to resist disaster losses.

The case study that I've chosen is the one of Wagga Wagga. I can give you a few indicators that might impact social resilience and you can tell me how much you agree or disagree. You can strongly agree, agree, disagree or strongly disagree.

The first one is the education, the level of community knowledge about the flood, do you think this impacts social resilience?

I I strongly agree

R What about the leadership in the community?

I strongly agree

R What about the improvisation or creativity before the disaster, in pre-disaster phases

I strongly agree. We would have significant reduction if we were more creative and preplanned.

R what about demographic information? Religion, age, health?

I I think it has some impact but wouldn't say strongly. Just agree

R What about the community participation? Their involvement and engagement in programs for flood or natural disaster?

I I strongly agree. If they have good engagement around pre planning, the impact would be reduced

R What about community efficacy, they believe in their own capabilities of performing the job

I I strongly agree. A lot of these I strongly agree, but trying not to strongly agree with everything. If they have community efficacy, they have capacity to plan and support each other.

R What about the sense of community and belonging?

I I strongly agree

R What about the social support – the support from the neighborhood

I strongly agree

R what about the coping style – developing the problem solving skill

I Strongly agree.

R What about the learning, from the past disaster

I strongly agree

R What about trust in the neighborhood

I I agree. I think trust is earned and developed. I would sit between agree and strongly agree. It's an important factor but proving it is harder

R what about he coordination among the community

I I agree.

R What about the exchanging of information, talking or emailing to each other?

I Yes, agree.

R What about sharing info like social media, tv radio

I Yes agree

R Is there any other indicator that you think I haven't mentioned in the questionnaire?

I I'm not coming up with anything cohesive. A lot of it is in the preplanning if they have the infrastructure. For example, if people's places are flooded, if they have somewhere they can go to preferably within their community that is safe and above ground. But that's a hard infrastructure thing. I think their knowledge of the service system. It is essential to bring in SES and the rural fire service but understanding their role in local governance and where there are gaps.. and I don't know you may have covered that in information and education.

There's nothing that's really jumping out to me

R so you have plan or program to increase resilience to Wagga?

I Well, START is one, but it never was finalized. I worked with another section with Madeline in the council where we looked at a model.

We had a program, we had reviewed some work that had been done in Queensland where they had looked at resilience and helping community become more resilient to floods

R is there any documentation I could have?

I there probably is, but I can't access it. You can send me an email to remind me. It wasn't my department that worked with north Wagga, but another department within council started to do preliminary investigations. But all the people left that department, so it never happened.

The whole thing was to go out to the villages and talk to people about what happened after the flood, what they can do to strengthen themselves and get them to self.. the whole self-efficacy and determination within the community. If we are faced with this again what can we do and how can we move forward? It probably took place too long after the last flood to really have solid momentum moving forward but I wasn't party to the discussions. Did Madeline speak to you about that at all?

I Yeah she said there might be a meeting next week and sent me a link about that. But any extra documentation could be very helpful for me.   I'll see about finding info about the program we looked into doing. If you email me to remind me.

R last question – you are a planning manager, can I have access to any chart that shows how council is involved with a community when a disaster happens or your connection with other organizations? Or any chart that shows what level you're working and how many levels you have in a council. Do you have the regional level/state level and how you communicate with other organizations?

I I don't have that personally but some of the other will and if you send me an email I will request it.

R when disaster happens what is the council role, how does council contribute to a community?

I I can't explain it too well.   I know last time we had a disaster recovery team that worked with state.   We have an infrastructure team that pulled resources to assist in the cleanup and communication around the places people go to. But it's not something I run, but again if you want to include it in your email again.

Madeleine Scully

R So you know about my research in social resilience, by which I mean the ability of community to really withstand external shock and in a way what minimizes social destruction and enhances social capacity to manage disaster losses

So one of the case studies I've chosen is Wagga and I can tell you some of the indicators that might impact on social resilience, and if you could tell me how much you agree or disagree with these parameters that might impact social resilience. You can choose from strongly disagree or disagree, neither, or agree or strongly agree. Or if you don't know, just say I don't know.

One of the first parameters is education. Education is referring to the level of the knowledge about the flood. Do you think education might impact community resilience?

I do you mean in terms of peoples education about where to seek support and understanding where to go to seek …

R Yes, kinda. It's actually the knowledge about the flood and how they respond to the disaster once it's happened. Do you know if it might impact social resilience or no?

I but what do you mean by education? Do you mean peoples networks in the community?

R No

I In understanding?

R Yes

I So it contributes substantially to people's social resilience, people's literacy levels to understanding where to go to seek to support, what to expect, and flood events. I strongly agree.

R what about informal leadership in the community?   And leaders behavior within a community?

I Absolutely . Strongly agree

R What about the improvisation or the creativity, the community ability to plan and devise a solution. This improvisation is in the pre-disaster phase. Would it impact resilience?

I Are we talking about looking now in 2015 what occurred in the 2012 flood? What perspective do you want? Hindsight?

R No actually, yes, kind of… it might be any solution, infrastructure solution, social solution about the disaster. Specifically for Wagga Wagga flood in 2012.

I Does improvisation and creativity in the preplanning phase of a flood event have an impact on social resilience? Yes, absolutely

R What about demographic information such as age, gender, income, health

I Has a huge impact on the connectivity of community and their ability to not only preplan and respond to a flood event like 2012, but importantly demographics actually speaks to connectivity in a community. A particular area, what we've learned is single households and people who are living more isolated lives in the community . If they don't have that neighborhood community connection, they don't have that informal network to support them, not only in the preplanning but also the recovery phase of the event. That is certainly part of contributing to the strength of social resilience you find in a community like Wagga.

R Do you think that community participation or involvement and engagement in a community is a main factor on social resilience?

I that is a huge question. Yes, it is. In order for a community to be socially resilient. And all the learnings out of the 2012 flood event out of Wagga and building on the 2010 event here. Remember we had 2 floods in 2 years. Yes, it is about community connections because it speaks to the 5 pillars that we spoke about before, education level whether formal or informal, how to preplan and respond to an event, through a community supporting each other, creatively reporting and responding to one another An important thing in 2015 in reflecting on what happened in 2012, the likelihood is high that we will experience a flood event in the future. We shouldn't put it to one side, but should plan actively with the community and determining how we are going to respond in the future.

Currently the community is activated and consulting with council about levy upgrades. Next week we are doing overland flooding consultation in the community that were affected by the 2012 flood event. Having that level of community consultation and connection, we need to reflect on what we experienced. What the government authority experienced and what the community experienced. It's incredibly important that we see this as a continuum, not that it happened in 2012, and pack it way. We need to learn it and use it as a case study about determining our future. Accepting that in our future we will have a high likelihood of another emergency event.

R So might be a huge impact on social resilience?

I Yes

R I know it's a huge topic. What about the community efficacy? Do you think that it impacts social resilience? Community efficacy, the belief in their own capabilities of performing their job when disaster happens.

I Community capacity is something in terms of the other things we've talked about . social resilience is a hub and d spoke model. If you examine social resilience it doesn't lean, from my perspective just on one element. So community capacity speaks to the conversation we've had so far in this interview, the ability to plan and respond. Community capacity also speaks to an … we move away from individualism to community . And so we think at a higher strategic level in terms of not just about personal and individual impact, but it's rather about community capital whether that be social capital or cultural capital. But actually how we maximize that in order to respond across the board to a community need in times of flood or other emergency. Community capacity and the ability to contribute is huge and to encourage that is huge. Even if a particular area of a community is not impacted by the flood event, it's actually the capacity of that flood event. It's incredibly important It's about thinking in the short-mid term you could accommodate a family in need because they are directly impacted by the flood. Or how you and your volunteerism with a local community group could consider how you could assist people both in the immediate aftermath of a flood event but also assist in the preplanning of an event.

That could be working with the community to learn from previous emergency or flood event experiences and look at how be clearer in terms of community education emergency response areas, understanding how to contribute to an emergency center's ability to host a large group en mass. That can be from looking now, when we weren't in an emergency is when we should be planning. The type of community , which I've discussed with you before, which is in the Wagga LGA is actually in the time of non-emergency to actually review plans and upgrade assets that the community relies on during times of crisis and emergency. Uranquinty is a great example of community resilience and social resilience is a continuum and when you are not in emergency you should be in a planning phase.

R So what about the sense of community ? The feeling about belonging to other people or places? Like people belong to this community and feel they belong..

I That's a huge question to pose. I would reflect the communities that we work with now, who experienced severe flooding, there is definitely a connection, forged, through crisis. That sense of community is extremely strong there. It's about that collective experience of disaster that brings people together. In the current consultation on the cities levies and overland flooding, there are articulate voices in the community in the 2015 planning and a sense of community strength and conversation is there, but it's based in their experience from 2012. Sense of place is incredibly important. Not just in the planning phase but what the community, for example in north Wagga, what the community still experiences even 3 years after the flood. There is still a lot to recover in terms of hard infrastructure, but it's not to underestimate the psychological trauma they experience and continues to experience about themselves and their families going into the future.

R The next indicator is social support. Social support has strong impact on social resilience, if I'm to understand from your work. Is that right?

I Yes

R what about coping style developing the problem solving skills, mitigation strategy, resources or places to survive. Is there an impact?

I can you ask again? A coping style of a community ?

R Yes.

I Yes, it contributes to social resilience because it's about reflecting on what we've spoken on already. If we increase community education on planning and response, you would hope that would contribute to a more organized strategic response in the future. And people would understand where to seek assistance and understand the level of expectation on the individual. And community to also contribute that response. So it makes people a lot more engaged with how their individual response contributes to the larger community response. It moves to a collective way forward rather than an individual response.

R do you strongly agree or just agree?

I Strongly agree. Everything you've said so far I strongly agree with. It's all important, one isn't of less importance

R what about learning? It has a strong impact on social resilience, am I right?

I what do you mean by learning?

R If we know the flood in 2012, the people living there learned how to cope with disaster and flood. So do you think that learning parameter that impact on social resilience for the future of disaster?

I Yeah it has a massive impact on social resilience. Because we haven't had a flood event like 2012 for a period of time, it also works on the community consciousness that sadly, we live on a flood plain. In lots of ways through that very severe flood event that community reminded us about our vulnerability and need to plan and respond to a flood event. It introduced these issues to the next generation of individuals and families whether it be business or government about the need to prioritize these issues for the community.

R What about trust, to the neighborhood?

I Yeah, trust is implicit in emergency services and certainly for the 2012 event here, the army were called in to assist. We have kapuka (?) army base here. The level of trust that the community invested in government authorities, business, their neighbors to assist them, was at a very high level. Because people individually needed to recognize that collectively they would be able to deal with the massive issues they were facing. In terms of that disaster.

R what about the coordination within the community and people? When disaster happens during the response to disaster does this impact?

I Yea, it does. Coordination here, I've sent you through the coordination report from John Craig, who ran the emergency coordination response unit here. It's not just about the coordination the community contributes here at Wagga, it was also the national response to the flood event. So it's also about being able to manage and respond to external requests who were coming in masse. Organizations and charities wanting to get into the flood zone to help the effected, being able to project manage was huge.

R When I say coordinate, I mean just among the community , not coordinate between the public and emergency organizations. Just the coordinate among people. Do you strongly agree?

I I strongly agree. The ability to coordinate speaks to the planning, community education, and planning and how to respond in the preplanning stage to a flood event. You need to be able to coordinate yourself, your family and your neighbor.

R What about the exchange of info, interaction between people like with email etc.

I Huge, the reliance on social media cannot be underestimated. The media played a huge part in keeping people aware of what was happening. There scheduled neighbor meetings where face to face meetings occurred to allow people in emergency response locations could receive updates face to face from authorities or police.

R You mean, both exchanging information and sharing information such as website or social media like tv or radio has a huge impact on social resilience?

I it had a massive impact on coordination and what is happening factually as opposed to conflicting stories that can be generated but not based on fact

R are there other parameters that impact resilience that I haven't mentioned?

I I think you've covered a lot. I think in terms of social resilience it's incredibly important to understand, as I've spoken before, it's a continuum… learning form what we experience in 2012, 2010 and applying it now in our planning phase when we are not responding specifically to a flood that's occurring. Social resilience is something that is always being honed and actually changes and morphs with new people coming into the community, needing to understand that this is part of a community conversation and an ongoing discussion that occurs in our community .

It's not something that is ever complete. It actually needs to be in our thinking and planning. In order that as a community our social resilience actually increases and expecting that we will experience flood in the future, we will experience emergency events. We need to really be thinking about how we are responding individually and our responsibilities as a member of the community of Wagga.

R you think community resilience has increased recently. How did you measure, or do you have any program and how do you measure that?

I I think it would be termed in terms of community development. I would think, in a non-emergency phase, what is the community doing in order to actually look at their planning for future events. The way I would actually measure that is what here in Uranquity community is doing. What conversations and amount of conversations and planning stage, how many conversations… discussions in the city regarding upgrade of the levy options. Community consultations to the overland flooding plans and also through community grants programs, what community   assets are being upgraded, keeping in mind they are the emergency management sites of the community . Not thinking about what the government agencies are doing but what the community is articulating for themselves and their preparedness for events. That's how I would look at it for measurements. There are some communities in Wagga that are moving a lot faster and accepting they need to prioritize it in their community discussions, and others who, because of where they're at in their individual projects perhaps aren't as advanced.

In terms of building on their current social resilience and increasing that in preparation, not drawing down on that capital when they need it for the next emergency.

R is there any documentation in the Wagga council's website to see what is the council role once disaster happens? How does the process start once the process happens. How does it get from A to B, is there any process flowchart? How is the council involved in the community ?

I I think the flood futures website that I forwarded through has considerable documentation .. it's contemporary and covers what you're asking in terms of who does what. It also establishes what the council is doing at the moment in working for the community on a way forward.

R Can I have the company org chart? I don't need any name, just want to see the structures in the Wagga council?

I What do you mean? Like a flow chart of council? What level of information?

R I would like the relation between the council and other emergency organizations and also the community. I'm not looking for the level of structure within the council, but I would like to see the relation between the council and other emergency organizations.

I I think that's documented in flood futures. I think if you look at the documents there, that will actually help you.

R Do you mind if I have any questions, I send you an email?

I Yeah, sure no problem

R thank you for your time

I I also spoke to Donna Argus, and she's very happy to speak to you.

R I will talk with her on Friday I think. Thank you.

Kathy Oliver

R Thank you Katie. I'm a PhD student of Sydney University and doing research in community resilience to flood. Can I record your voice for our archives?

I Yes.

R Thank you. The aim of our research is in enhancing the social resilience within a community to natural disaster such as flood. When I say enhancing the social resilience it means the ability of community to withstand external social shock in a way that minimizes social disruption and enhances the social capacity to resist losses

Have you been involved in responses to the 2009 flood? There was a big flood then.

I Yes, there was. I was involved in so far as we established a recovery center by state government. We provided resources to open it and manage it. We coordinated, making sure we got information to the community about what was happening and what resources were made available to them.

R At that time were you the director of engagement?

I I was acting director of community and corporate services

R I have already gathered indicators that could impact social resilience. I need your comment about each, how much you agree or disagree about each of them. You can choose from strongly disagree or disagree, neither, or agree or strongly agree. Or if you don't know, just say I don't know.

Community participation is first indicator. The public involvement in a community, does this impact social resilience?

I It does impact in a positive way. Strongly agree.

R How about the education and level of knowledge about the flood.

I Strongly agree

R How about exchanging information, interchanging information among community when disaster happens?

I Yes, I would agree. I think technology… having just gone through other recent events. Technology such as facebook has changed that significantly

R How about learning from previous disasters?

I Strongly agree

R How about sharing information? Shared is different from exchanging. It is social media, tv, radio…

I Yes, strongly agree

R How about the social support – support from neighborhood, not any emergency organization. Is there impact?

I Yes strongly agree

R Sense of community? The public feeling of belonging to that community or place?

I Strongly agree

R How about trust in the neighborhood?

I Strongly agree

R how about the coordination among community? Not with emergency organization?

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I Well you have 2 types of community. The longer-term rural community are very coordinated and prepared and know what they're doing, the people that have moved in for smaller acreage and hobby farms are not that well prepared.

You have difference in the community. I would say some parts are very switched on and capable and other not so.

R How about demographic like age, gender, income, health, education, religion?

I I think an aging population. It's what we need to be mindful of in responding like if we have large pockets of aging farmers and what they have access to. I wouldn't say all of those indicators are important, but age yes

R How about the community efficacy, the community belief in their own capabilities in performing or completing the job when disaster happens?

I that's an interesting question. Previously the community was very capable of responding to disasters and helping each other. I think there's a sense of learned helplessness. The expectation is that the government. Resources are going to A financial support them or B support them in other ways. That capacity that used to be… let's get over this, we live in a flood plain, is somewhat being eroded by the way we respond as government agencies.

R how about the improvisation, the community innovation or devising a solution?

I Certainly not generated by the community. Anything like that is initiated by government. agencies or council. We need to be ready. So you haven't got community groups saying how do we increase our capacity or capabilities in these events? We seem to just move on to the next event.

R How about coping style and adoptive capacity?

I Absolutely. It comes back to the changes of the people living in the coastal fringes. We have a lot of lifestyle people, who are less resilient who haven't been here as long and don't have the infrastrucure that the older farmers do.

R How about the leadership in a community?

I It does. I think a lack of leadership also impacts our resilience. There will be pockets of communities that have a leadership group, but largely the community as a whole looks to council for that leadership in how we are coordinated in responding.

R are there other indicators that I haven't listed?

I The only other thing would be the other groups, like the lions club and rotary groups being part of the recovery process. So that there are broader people in the community outside the emergency services that are helping each other and being aware of what needs to be done

R Can you explain more and how it impacts social resilience?

I I think if you have more of community groups involved in planning – this is how we're going to recover from an event, and part of the recovery process builds capacity in those clubs and in the broader community. We have these plans in place; this is how we go about it.

R do you guys measure the resilience or vulnerability in the community?

I No, we haven't

R Do you have any program or plan for increasing the resilience in the community?

I We use our communications methods; we've come a long way in providing information to the community so they can make decisions. That's been something we've been improving since 2009. We've also looked at having recovery plans in place, and that has worked with MPES minister of police. Also looking at developing, with the SES, leadership programs for our communities where we can identify leaders to do intensive days of training on how to be that leader to build resilience and capacity.

R you mentioned you have a recovery plan. Are you coordinating with other emergency services when that disaster happens?

I The recovery plan, the new template has just been released by MPES. It does take into account what the other resources will be doing. When we say recover, we say we need to start much earlier before the event is over, do it during the event and setting up for recovery then. It's a plan that would involve the agencies that would involve the recovery agencies- police, community services, primary industries.

R You mention you have a plan for recovery, but do you have plan for pre disaster?

I It's leading up to what might happen?

R Or before it happens

I No, you mean like preparing for a disaster? No we don't. Only promoting what the SES and Red Cross put out with their preparing for disaster kits.

R Yes, I had some interviews with people in SES, but can you explain more how you coordinate with SES and how the process starts. How are the council people involved in the response phases? At a high level?

I We have a … I am the local emergency management officer. The SES is the lead agency for a flood event. At this time, we are monitoring our bridges and roads and rainfall and doing modeling. If it's a significant event, we will put a liaison officer with the SES that can coordinate back to council for the resources needed – like road closure signs, heavy signs, sand bagging… there are about 3 of us at a senior level with the SES.

We then coordinate our resources as to what's required.

R Is there any other organization or community involved with the process and SES?

I No, the only other organizations involves are the RSS and police. If significant it would be the emergency operation center.

R and you coordinate with that or SES coordinates with them?

I Depends on the scale of the event… if the SES is running it and needs resources, I will. If a muilti-agency response, like 2007, the emergency operation center will be activated and the local controller, which is the police commander, takes control of the event.

R Do you have any other comments on what you said or other opinions on how we can improve resilience?

I I think you've nailed it when we talk about education. We have looked putting some kits for people that are buying into flood plains, we tell people about the area, and things to be mindful of in the area, and resources available

I think education and potentially creating mentor situations with the other older farmers. And people tend to be complacent. We've been 4 years without a flood and we forget about it.

R Okay great. Any thing else?

I No, have I answered your questions?

R do you mind if I add your name into my PhD thesis?

I Not at all.

Robert Scott

R I really appreciate your time.

I I think you have some very interesting research and would be interested in your results

R We are publishing by the end of this year, in the Australian Journal of Emergency Management and I'll send you a soft copy. You're opinion is very valuable for us.

We are doing research on community resilience to flood. The aim is in creating the social resilience in the community. One of the case studies is the Kempsey flood. Your position is infrastructure service, right?

I Yes

R are you responsible for council response for the 2009 flood?

I I wasn't involved in 2009 as such, but since then we've had about 5 similar events in 2011 and 2013. Kempsey is fairly flood prone; I think the 4th most flood prone area of NSW

R this is why we chose it for our research. We are looking at social resilience, the capability of a community to withstand an external social shock in a way that minimizes social disruption. And increases social capacity to resist disaster losses

We have already had interviews with 9 emergency members of SES, but you working in the council is very valuable for us. We have a few parameters that might impact social resilience. If you can just give me how much you agree or disagree with these that would be perfect. The score is 1-5, 5 strongly agree and 1 is strongly disagree.

The first is education. Do you think that education might impact on social resilience? It means the level of knowledge about the flood.

I I strongly agree. If anything the education and information is probably the biggest impact that happens during floods. Everyone becomes an expert but very few accurately reflect the truth of the situation.

R what about leadership behavior? The leadership among the community.

I I think it would. It's between ad 4 and 5. Within a large community there are large subsets of that community and each one almost needs a leader who organizes people, rings emergency up and tells them let's go down the road and help them with their fences. Within any group there are people who naturally assimilate or take that role on, and that's where you get good leadership.

R what about improvisation or community creativity to devise a solution to increase resilience among the community.

I I think it would impact it, but not as much as it could at the moment. The community in general over the last 10-15 years has been seeking the government to take more of a role in that sort of area. They are looking for other people to do it for them. Not necessarily wanting to do it themselves.

It's highly important for resilience in a community, but people don't want to do it themselves.

R for a score?

I I'd give it a 4.

R what about demographic information – age gender, health, religion

I I wouldn't put that as overly important. I would put that as a 3. You're obviously going to get more resilience from an able bodied area than if they are elderly. But you generally find they move off the flood plain or they have contacts with family. I think the demographics are neither here nor there.

R What about the community participation? The involvement in the community? Like them participating in public meetings.

I I think from building resilience point of view, the community needs to be involved. I'd say a 4. If they aren't involved you're not really doing anything.

R what about community efficacy? Their belief in their own capability of performing and completing their job?

I whether they believe or don't believe it, its thrust upon them, so they have to. There is a coping mechanism that goes along with that. In terms of resilience I don't know if I see their own self efficacy as being important. I'd give it a 3, they are there, the flood is upon it and they have to deal with it. And if they don't like it… no one makes anyone live within a flood plain, so if you're not up to dealing with it, you probably need to move.

R What about sense of community? The feeling of belonging to a community or place?

I I think that's very high. It needs to be. They need to be there to help each other out.

R What about social support, support from neighborhood?

I I think it's probably a 4. It's good to know that it's there but it doesn't necessarily have … I might even give it a 3…everyone says oh the floods, but people don't really help them. They know they get support with people that feel for them, but they aren't out there the next day to move cattle and fix fences, that's for sure.

R what about the coping style or adoptive capacity, developing strategy or resourcing connection.

I I would say that has a high impact. Mainly because if they are aware of it, they will come up with more innovative ways to deal with floods. When they are going to move cattle, what sort of infrastructure they need to work towards.. to make disaster management easier.

R Does this include adoptive capacity or something different? Copying style is mostly about adoptive capacity, not developing strategy.

I Yeah, if they have the capacity to think outside the square.. a lot of people will go along the last few years of experience. And there's been a great improvement on the way we respond to floods. When I'm talking long, I mean a 1 in 80 or 100 years event. If they have the capacity to think beyond that, they may adopt a different plan.

At the moment they are only going on their knowledge. If they could research the situation and had capacity to think about it constructively they might come up with a very different flood plan. Instead of remaining on the plain, they shouldn't remain and move their cattle sooner than later. I'd give that a 4.

The problem we've got, is a lot of people survive by staying on the plain during the flood, very few of our agricultural community shift all of their cattle to a ground above the flood height. They usually move to higher ground but not above the flood height

R So what about learning. Do you think that learning from the previous flood might impact on resilience as well?

I it's probably the only way that you get resilience. By learning from the flood events. We are in a situation in the last 5 years we've had a lot of floods. I would have to rate the community as much more resilience than they were in 2009. The 2009 event was the first flood event in 8 years, and a lot of systems and people were caught a bit lax. Where as in 2011 and 2013, the support organizations the councils the community the people themselves were more prepared. Even now they are more prepared.

R So how about trust in each neighborhood. Can it impact social resilience?

I I'd rate it a 4. If people don't trust the information they are hearing they will fail to respond or react within a reasonable timeframe

R what about the coordination among the community and people in the community?

I I'd put that as a 5. Your formal mechanisms and disaster management agencies can't contact everyone, so you have to rely on informal methods like telephone trees. I know a lot of our community groups have people in the area to rely upon to get information about the flood and help them make decisions.

R the next parameter is the exchange of information. You strongly agree with that?

I Yes.

R What about the sharing of information like social media, TV, radio. Only in a one-way manner.

I That's probably one of the things that we do really well. We share info. We have a sms tree, incredibly good circulation on Facebook. People don't want to get on the internet just want the info on their phone while they are running around preparing. Over all the feedback from the past debriefings on flooding, it's about the timely information and it being repetitive and people needing to be able to trust it. They need it at regular intervals and know when to look for the next update. So for example it's 6 am and we say the next update will be at 10am, they will look for that info at 10. It's a 5.

R How do you know they are waiting for more info at 10am?

I Because if the info doesn't turn up by then, they start ringing us, and if it does, we don't get phone calls from people. Our Facebook updates, we had 44 over a couple of days, and they reached a total distribution of over 55,000 people in that time. At the peak of the flood, our info was reaching 55,000 people.

And through our debriefings, one of the biggest things was that people don't have time to sit in front of a computer watching the bureau of meteorology deciphering… they need to get that information on their phones either by email or short message and need to get it regularly. Because they are out on a horse or a truck and they can't look at a computer

R are there other parameters involved in making a community more resilient?

I from our perspective there's a heavy reliance on the community that someone else will cover them or clean them up. There's reluctance for them to manage actively against floods. We've had quite a few times the disasters have been declared and from an agriculture perspective some of the producers have been eligible for grants. And now they are always looking for grants. The first question they ask their local government reps is for rural or agricultural grants to primary producers to buy feed or fencing. 50 years ago there was none of that and all the farms had to run, had to make sure they had adequate capacity to deal with the flood. They couldn't afford to not. I think now that margins in agriculture are so tight, the self-insurance, running a system where you have enough capacity to feed your animals.. if you get a flood later in the year..

I liken it to being insured by the government. the government is taking that risk and they don't have to actively manage that risk by themselves.

To me the best way to describe it is managing their farms so they can deal with a natural disaster without relying on external inputs.

R do you think that .. do you have a plan or program to increase this resilience?

I We did have measurement in our strategic plan to increase the number of properties that have a flood plan or bush fire emergency plan. So they are prepared. We do have actions now in our community strategic plan about flood awareness through our awareness system and regularly updating of info.

R Is this something everyone can access?

I it's on our website – mclare valley 2036. It's our strategic plan, our delivery plan and operating plan. They all have actions which relate to our main goal, about community safety.

Strategies and actions that are aligned with increasing the community resilience and their disaster preparedness. There are a couple of actions in our community strategic plan and they are underlined through our delivery program. Which from a council's perspective it's key for us to be able to respond. In 2009 they were not key to our day to day operation.

You can find it on our website, or if not give us a call, but best to find it online because it's a pretty big file. It's our community strategic plan.

R And Robert thank you very much. To complete my research I need to interview with all subject matter experts, with all members from Kempsey council. I have emailed Katie but I haven't heard back from her.

I Kathy, she is our local emergency officer. She would be ideal to interview because she's part of the intergovernmental response team. My role as director of infrastructure I'm virtually a combat agency. We have resources based upon what the emergency committee needs and also from infrastructure and community point of view to see what the community needs to keep safe.

Another potential to interview is Ron Kimpsley.

R would you be able to send me an email and cc these guys that can help me?

I really appreciate your support. I didn't get any feedback from Kathy, but maybe if you send an email.

I One of the things that struck me was the 2013 flood event. Our community goes into a bit of post traumatic stress disorder, they end up very tired long hours awake watching and waiting and there's a lot of frustration and they get angry very quickly. They are very irrational and emotional. I often wonder whether a study of that would show that they suffer from post traumatic stress from repeated floods.

All of them know that they are living on a flood plain and could end up under a few meters of water tomorrow. And I wonder their reluctance to leave properties during floods bears some kind of ongoing issue… that they know that while they might have gotten away with this one.. that they stress that there could be a big one coming. By the time, a big one comes, they have to just try and stop the cattle from being washed away.

R is there any documentation or anything I can access for all of this information for 2013?

I From 2013, we worked with police and emergency services with a community recovery plan. We did develop a recovery plan, and not sure where the final document got to. This is where we started to broach the issue .. that there were people out there who suffer from these events and can take up to 6 months or more to have them get back to normal and be a part of society. Especially if they lose cattle. There is the rest of the world gets on with normality but … our last flood in March 2013, it was just as the temperature starts to cool and grass starts to slow and all of a sudden it was dead. And the farmers had to spend a fortune to feed their cattle through winter, and then we went into a dry period. We went from one extreme to another. We went through an extended drought and I wonder if there's an emotional underlying condition that would greatly affect their resilience just from the cumulative toll of agriculture life. To some

extent they probably ignore it and get on with life, but it just stays there. They've never really dealt with it or sought treatment to deal with the psychological impacts and each event triggers it and their off again. I don't know.

R any kind of document would be helpful. I would like to have this community recovery plan if I can.

I I don't know where it is. It could be on the website. It was the recovery committee, formalizing and finalizing the plan which delved into all issues to deal with infrastructure, agriculture, social systems and services. It was much beyond roads and bridges which is what we are normally a part of. I will try to find a copy for you.

R It is very helpful for our research because it is very similar to what we are doing now.

And if you can send an email to Katie and the other guy, Ron, to introduce me, that would be very helpful.

Alistair Peddie

R Alistair is that okay if I record your voice to just have in the archive for our research?

I Yes

R Actually you know the aim of our research is enhancing the social resilience within a community to natural disasters such as flood and storm. One of the case studies that we have chosen for that research is a storm that happened in June 2007. Our research is referring to the social resilience. When I say social resilience I refer to ability of community to withstand the external shock that minimizes social destructions and enhances social capacity to disaster loses

My first question, have you involved in responses to the 2007 flood?

I Yeah I am an engineer. But I was around in 2007 when the pasha valca(?) Flood happened. And we had about roughly 2000 houses flooded above floor level. It was a pretty massive disaster. We have about 60000 properties and about 2000 were flooded. Something in that order.

R Can I ask you about the parameters or indicators that impact social resilience? I can tell you each of these, but I want you to give me the rate of these indicators and tell me how much you agree or disagree. You can just give the score from 1 to 5, so 1 means you strongly disagree and 5 means you strongly agree.

So about the community participation, do you think it might impact social resilience how much do you agree with that?

I community participation?

R yeah involvement within the community.

I I think the community is important. I think that events like this can bring…. Yeah it's important that their neighbors and friends support them.

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R so about the community participation do you score 4 or 5

I Yeah 5 probably.

R so how about education, the level of community knowledge about the flood

I I think that prior knowledge is very important as well. It doesn't completely come out of blue. So 5

R So what about he exchange of information among the communities when people are interchanging information. Do you think this might be impactful?

I when you say information?

R Any information about the flood or the time or the recovery or any information related to flood.

I The information at all times in all parts. You've already got your pre flood then your flood then post flood. There needs to be the risk information, it needs to be available so people can understand what might happen in that area. Very often people are so busy they don't have time for these sort of things. There are too many other things in their lives. So when it happens, it's obviously important. Even information like flood warnings, that's important. When it's about to happen, when the warning level is raised to appropriate levels. So having a little bit of warning that it's about to happen, so that long term warning or the potential risk information and that it is actually happening, and then after its impacted your house. There's a lot of information that they need to know. And then there's insurance and where do you go, maybe your house is destroyed. Where do you go from there? How do you rebuild and all the rest of it. A lot of information in different stages.

R so you think a 5?

I Yes

R What about learning from previous disasters? Do you think this has much impact on social resilience?

I Yeah, it's a good tool. Obviously as engineers we use that information to predict about what might happen in the future. We gathered a lot of information after the flood about what heights things got to where. And picked up flood marks on all the properties and use it in our flood models. It's important from a technical point of view. But now every year they remember what happened. So that I guess becomes in time, that knowledge that personal knowledge drops off so you have to replace it with historical knowledge. That's important as well.

R So you already answered my next question, the sharing of information via social media, television… so the information like the warnings, so it's really important. And you strongly agree with that? Am I right?

I Yes

R The next question is about the social support. But when I'm talking about social supporting from the neighborhood. Not from SES or emergency organization, just from the neighborhood. Do you think support from neighbors is impactful on social resilience?

I Yes, that's obviously really important. Lots of time they want to share their experiences with others and get support from people who…. All their friends and family and neighbors in general. You obviously need the government support as well as the community support. Community support is… I was lucky I didn't get affected personally, but I can imagine it would be really important

R so how about the sense of community, the public feeling of belonging to that place. Do you think it has impact on resilience? That people feel they belong to the community that they need to give back and get back to the normal situation? Do you think that sense of community can increase the social resilience?

I Umm, yeah, I guess so. Obviously the more people you know in the community the more support you'll get. If you're in a house and don't know anyone in the area, sure people probably would come to help you in a time of disaster, but if you have previous knowledge and connection beforehand that all makes it easier. It can make it easier.

R So what about trust. If a disaster happens or before it happens if you trust, the public trust within the neighborhood. Do you think this might increase social resilience?

I Yeah I'm not sure. Trust – whether you're abandoning your house? People don't want to leave. We really had flash flooding so people couldn't really leave. It just happens and just runoff from the local catchment. They couldn't evacuate and got smashed. But I mean if you're in a river system like the Hudson, and you get the floods there, people get prior warnings a day or two and they have time to evacuate although they don't want to evacuate. As you say that trust, some of them are concerned there might be looting.

R So, so far, you strongly agree that all the things I've mentioned strongly impact social resilience. So I have more things that I want to ask you. Like coordination among community. Do you think that coordination among people, happens during the disaster during the response time or after that might impact social resilience? And how much?

I can you give me that question again

R When a disaster happens, during the response phases. So the coordination between the people in that community, do you think that might impact on the social resilience, so we might say for example that coordination might make people less .. so it might impact on social resilience or not at all?

I Yeah, I mean we had a lot of stories about people who went out of their way to help people. And I guess that's people who take that coordination role on, they could have just kept to themselves. All of that is sort of definitely helpful.

R But you're not really agree? Do you give a number 3 to that?

I I think because it all comes… the type of flooding we have just happens. It's raining all day and you get these peaks in the rainfall and you get flooding. It's so adlib that that coordination at the community level is just a human response. Some people save other peoples lives and help them. I don't know if that's the sort of coordination you mean. There's no way you could put that event, there was no real organized community response. I mean there could be, I guess you could.. the trouble is that people's whole property is going under water, and it's hard for them to help others. It all depends. There's definitely something, there's merit, but how practical it is,

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depends on the type of disaster. Because really, I don't know if you're aware but we had an earthquake in 1989 in New Castle. It was the biggest earthquake Australia's ever had.

It was about 1,000 people or so killed. A large number of buildings destroyed.

The New Castle flood, it was more than a billion dollars of damage. Similar the earthquake was probably a billion. So I guess there was a lot of that. New Castle already had that exposure to a big disaster.

R What do you think about demographic information. Do you think that demographic info like age, gender, socioeconomic status, culture, religion, population, special needs, and do you think this kind of info can impact social resilience?

I Yeah definitely. Generally the poorer communities, their properties are often more flood prone. Located in more flood prone areas. Cheaper housing. They tend to be uninsured. Areas where there is bad flooding, public housing. All their belongings can be on the streets.

Language, if you don't know what's happening or can't understand the warnings, that doesn't help you.

R so you agree with that, and you're giving it a score of 4 out of 5?

I Yes.

R What about the communities' belief in their own capabilities in completing the job. Do you think it helps them get back to their normal positions they had?

I Completing the job? What do you mean?

R No, community efficacy, it's the communities belief in their own capability in completing a job. For example during a disaster they believe they can actually respond to a disaster, and believe they have the capabilities to resist the disaster losses.

I Umm, I think that most communities want help. They don't expect help. I think they can and do help each other.

R getting back to a normal situation, if they believe that they have their own capabilities, do you think that this kind of feeling helps them to get back to the previous situation than if they don't think that?

I to get over the disaster, to sort it out? To get back to their lives, yeah. The other thing it comes down to, it obviously varies for different people. I mean some people are more adaptable and more resilient. Some people will be more scared by it than others. There is a lot hurdles they have to get over to get back on track and get it all cleaned up. It happens over time, but it can take people I guess, some can manage to get back quicker than others. Obviously insurance is a big one, if you're insured you can get on a lot faster. If you have no insurance you have to write off that loss and rebuild and repair. If you haven't got the money it's going to take you a long time. That's one of the biggest ones, having the money to come back.

R So what about the improvisation? The community creative and innovative to devise a solution. Does any improvisation, like they create a solution to increase the resilience? Do you think it impacts social resilience?

I Umm, yeah. For instance the flood thing, any risk, it's really hard to engage the community in anything meaningful when there's no flood. We have run public meetings for flood studies or works we are proposing to do, and we get hardly anyone maybe 20 people. For a city-wide plan with 100,000 residents. People just don't engage, they just expect government to look after these things. You can obviously do things and build up the resilience and be creative, but it's hard to get real rules impacted. If you have a community that gets flooded on a regular basis then it gets more important. But if it's just once every 100 years, then people will just get on with their lives quickly and just hope it doesn't happen again.

I probably got off track from your question, but it's quite hard to get people to be innovative before the event.

R So what about the coping style. I mean adoptive capacity or developing a strategy. Do you think coping styles among communities among public impacts social resilience?

I Coping style?

R I mean the capacity to adopt to the situation that happened to them. If they adapt to the loss of the disaster, very soon, do you think it impacts social resilience?

I Umm yeah, that support through that period through the community and insurance companies. That all sort of helps, medical psychological support is really important. That community is very professional. You might have a whole community that 's been flooded but obviously some people re more impacted than others. Their house could be completely destroyed and others can just move back in over the weekend. It might take others years and be a lot harder for them to cope. You could have family members killed. There's ways of helping them through that coping process.

R So what about leadership, within a community. Do you think that leadership might impact the social resilience? Do you think it increases the resilience?

I Yeah, definitely they need leadership whether it's from the major or counselors or their individual community leaders. You would expect them to represent people who are affected. And to help them make claims and get appropriate attention.

R so is there any other thing that might impact social resilience that I haven't mentioned?

I so you're really focusing on the community rather than government input. Obviously those are different parts.

R Because you are a subject matter expert in flooding, so your point of view is very valuable for us, but we would like to find a program to increase social resilience among the community. So if you think there are other parameters that might help communities be resilient?

I I was thinking about – the rebuilding. That can be a big problem in itself. Often the community can't cope with that amount of damage. The builders can't cope. When there are major disasters, builders and handymen will come from all over Australia.

I guess that's often the problem in terms of what are their qualifications, how good are they? Are they shoddy builders or are they good? But that's just another part of it. That demand on resources and materials.

R So do you guys measure resilience in the community?

I Do we measure it? From an engineering point we don't really measure it. We are aware that there are people that do that sort of thing; I'm aware that after the 2007 floods there was a study undertaken.   I think through the SES about community resilience in the Hunter valley and in New Castle. Steve Molino, is that his name?

R I can't remember the name.

I or Molino Stewart, I remember him talking about a study of the resilience.

R But you're not actually measuring the resilience in the community? Do you have any plan or program to increase the resilience in the community?

I We do have social planners, and I'm sure they have. I wouldn't be surprised if they've done studies about disaster but I'm not personally familiar with it. You might want to talk to one of our social planners. I'm more the technical side.

R Just last question – how does counsel involved in community resilience? How did their involvement start, finish.   For example when 2007 flood happened how was the counsel involved in the community response? You started coordinating the SES, do you remember starting the process with other emergency organizations or how did you start that process.

I Well we have in terms of flooding, there is state government and flood plain development manual. Obviously flooding is something that happens all the time in different parts of the state and country. The state government has a manual that provides guidelines to councils for what they should do to prepare for floods. As part of that and our funding, we have to form a flood committee. There is also another committee that is more disaster oriented, not flood committee. They get the emergency players in place. We in the flood committee are only focused on flooding. Before 2007 we had all the flood mapping, and we were looking at flood management plans to try and address and better manage the flood risks. Those plans include community education components and flood warning systems and larger pipes and basins and river widening. There's more than just the physical and structural components. Since the flood we, like a lot of places, we have fast tracked what we've been doing. Since then, we've completed citywide flood management plans. It's on our website.

R Even the manual?

I Yes, there's the flood risk management plan for New Castle on the website. That prioritizes what we have to do. The funding in this area is really very poor from the federal and state government. The NSW government gets $16 million per year for all the studies. If someone wants a new levy that has to come out of the $16 million. The 2007 storm was $1billiion, so that's a lot compared to the budget. They probably spend a lot more money mopping up afterwards, just fixing the roads and the bridges than actually preparing and trying to reduce the risks.

R Great, so I can find these documents on your website. Thank you very much for your time. Your point of view is very important for us. I might publish our research result soon. I will send you an email when it is published.

I Good luck with what you're doing.

Greg Perry

R As you know I am a PhD student of University of Sydney, and doing research on community resilience to flood. The aim of this research is enhancing or building social resilience within a community. What I mean from social resilience, the ability of community to withstand social external shock in a way that minimizes social disruption and building and enhancing social capacity to resist disaster losses.

One of the case studies we have chosen June 2007, country region and central coastal. I notice you were the region controller at that time, right?

I Yes

R I have a few indicators that might impact social resilience. I am telling you these indicators that they collected and I'm asking you to tell me how much you agree with them. Before that do you mind if I record your voice?

I That's fine

R You can tell me that for each parameter, you strongly disagree, disagree, neither agree or disagree, agree or strongly agree about that parameter. Based on the event that happened in 2007, they collected some of these parameters

The first is community participation, which means the involvement in a community. Do you think that people involved in a community and the participation has an impact on social resilience?

I Before we go ahead, I think those questions that you're going to ask me, you're probably directing at the wrong person. I think even though I was the region controller, I had the operation control of SES in the Hunter, but I think you'd be better to speak to community engagement coordinator Amanda Hyde. Amanda used to work for the Hunter River Center's catchment management authority.

And she did 3 days a week with them and 2 days with us at the SES. We were putting together a community engagement strategy and we did that, and it was very successful in so much that it won a reward from a premier's dept. I think some of the questions that you would ask me.. I know for instance that we did 2 surveys of a community, and I would think that she might be a better person to talk to. She has a lot of the information in relation to those surveys. I don't have info especially since I've returned

R I totally understand that. But you were regional controller so your idea and opinion is very valuable for us. If you remember if you agree or have a comment you can tell me. It is not very strict. Your response is very valuable for us, but doesn't mean you should put pressure on yourself.

Amanda is still with SES?

I Yes she is the community engagement coordinator.

R I had a n interview with Andrew who is the manager of community engagement. I'll talk to Amanda as well. If you don't mind giving me an answer about the parameters I'd appreciate it.

About the community participation – just belonging to communities. Because you were the regional controller, you know the community very well and how people cope with disasters. Just imagine you are one person in the community. Do you think that community participation impacts on social resilience?

I Yea, I think it does

R what about education, the knowledge they have about flood?

I I extremely agree with that

R what about exchanging information between people before, during or even after the disaster, does this impact?

I that's a good question. I would agree. Most people couldn't care what happens day to day and as soon as it happens to them, that's when they worry.

R What about learning from previous disasters which happened before. Do you think this would impact resilience?

I I would strongly agree especially since we've been through an event in the past 3-4 weeks that was bigger than the 2007 event

R what about the sharing of info on social media, tv radio?

I And can you rephrase the question?

R do you think that sharing information among communities, such as social media, tv and radio impacts social resilience?

I Very strongly agree

R what about social support, from neighborhoods, does this impact social resilience?

I No I don't think so. I think when it happens most people are looking after themselves. I don't think any support from their neighbor does much good for them

R Like when a disaster happens, if any roof is damaged, do you think if the neighbor will help each other, there is any carpenter near you

I No.

R what about the sense of community? The feeling of belonging to the community of place. If people think they belong to that community or place, does this impact resilience?

I I agree

R What about trust in the neighborhood?

I No

R what about the coordination between people in a community? Not emergency organization. How they coordinate with each other when a disaster happens? Like volunteers..

I Yes, I would agree

R What about he demographic info such as age, gender, income their health, education, religion?

I No that's probably the furthest thing from their minds when their house is uprooted. It doesn't matter whether you earn $1 million a week or $5 a week, I don't think that has much bearing on it. I wouldn't agree with that.

R what about he community efficacy. It means the community belief in their own capabilities of performing a job when a disaster happens?

I Strongly disagree

R what about the improvisation, the community creative and innovation to devise a solution for increasing resilience? Does that impact resilience? If for example they create a new solution?

I No, disagree. Normally the community won't come up with anything at all they will ring for assistance. I didn't see many examples of people that were helping themselves in 2007.

R what about he coping style and adoptive capacity? Does this impact resilience?

I Yes

R What about the leadership in community? Do you think the leadership concept might impact resilience in a community?

I No, I wouldn't agree with that

R Apart from all of these parameters is there any other parameter that might impact resilience or it might increase the resilience?

I No I think it's pretty comprehensive, but at the end of the day, most people to be honest, in terms of resilience, they couldn't give a hoot. If it's not happening to them day to day then they couldn't care even down to the point of preparing a home readiness kit with matches and candles. But as soon as something happens, then they expect to put in a call to the SES and people will be there straight away.

This is why some of those questions would be good for Amanda. We carried out a survey before the 2007 event and one after the event. If I remember, the results of the survey far outweighed any other surveys in NSW because we had done so much to tell people about flooding.

Amanda Hyde, have you heard of her? She's very good, and you'll get her on 49 313 222. She's excellent. We didn't have a community engagement organizer until 2007.

Most people thought that the people in SES looked after the levy in mainland, but we started a program of educating people… telling people this is the role of the CMA and this is the role of the SES and it went from there.   We had a very good arrangement with them. In February we had our 60th commemoration of the 1955 flood. Public awareness has certainly gotten higher

and higher on flood but the nitty gritty and getting down to the fact of them having their own home emergency kit, they can't grasp that until it actually happens.

I think she would have some data to add as well.

R Do you mind if you introduce me to Amanda? I can call her, but she might be shocked.

I I will shoot her an email this week and tell her what it's all about.

R perfect thank you very much. How is your house now?

I we are back to normal. It's better being on the inside looking out instead of coordinating from the outside. Our phone went off on the 21st of April and back on may 16, so limited internet and phone. Then we had to do battle with Telstra. But yeah, there is still a lot water lying around. Every flood is different.

R I know it is very difficult coping with disaster.

I We had water in our outdoor area that couldn't get away, and probably 8 inches of water in there. We had to get rid of that and the clothes dryer blew up, but otherwise we came out alright. Probably threw out $200 worth of food from freezer as well. But a lot of other people are worse off than us.

R It's a good point that everything goes well now. Hopefully next time we wont be faced with this kind of disaster

I How will this be produced?

R It's my PhD research, and probably in the future I'm publishing a paper. If you don't mind I will mention your name as one of my candidates I interviewed. We are working on a paper to publish in the next couple of months. When it's published I'll email you a soft copy. I really appreciate your time. I know it was a good time to talk about resilience especially considering the disaster from last month.

Sandra Feltham

R Can I just record your voice for my archive

I Yes

R Thank you. Have you received my email in regard to the question I want to ask you?

I Yes, and I'm working on it. I'm a little busy up here.

R One of the case studies is during 2007 hunter region and central coastal and it's about the social resilience which referring to adjust back to the normal situation after the disaster happens. The aim of our research is to enhance the social resilience within a community

Have you been involved with the response in 2007?

I not to any great extent because of the role of the council in those events. Council's response was largely the emergency response as to what's known as a disaster plan, we have DisPlan on our website. Because council is mainly an asset-based role, and we had do to asset recover. So

there's an initial emergency response by the police when we say, yes there's an emergency happening, and then there's the domain recovery. When the community side of things, FACS now has a recovery team to get community remains

R that group works in council or in other emergency organization

I DOCS is the Department of Community Services – or Family and Community Services. They have a disaster recovery team. What happened in 2007 floods, DOCS took over a large site, building in Hunter Street.

R Can you spell this for me?

I DOCS – Department of Community Services. That's what they were in 2007. Today they are called Family and Community Services. It's a NSW government. agency. They have the capacity to coordinate a significant response that would be required because council doesn't have that capacity. They set up a once stop shop in Hunter Street because lots of people lost a lot of stuff. So they had lost basic things like id. This one stop shop allowed them to get their id sorted and access a number of NGOs who had set up for things like meals and clothing.

That was the initial response, and DOCS was set up for several months after the initial response.

R Your role is social planner, but what about then?

I I was a community planning project officer.

R Is it possible that you nominated one person to DOCS to me to have me talk to them about my research. Do you know anyone?

I They are a team that get around. The same sort of response would probably be unfolding in Dungog at the moment. You would probably be best off talking to … because the personnel have changed. The guy has now retired since then. I would actually go back to FACS and ask them the story and see if you can get a contact.

Suzanne might be good, but not sure what her role was.

R Can you introduce me to her?

I I don't have her contact details it seems. I will try to track her down. There have been quite a lot of change here at council and one of the very few people left here during the storm in 2007.

R If you find it, I'd really appreciate her contact details

Have you had a chance to look at question number 3? In our research we would like to identify all the indicators that might impact social resilience. So far we have found all of these indicators.. Can you tell me how much you agree or disagree on tier impact on social resilience?

I Community participation I agree

Education when specifically about floods, we've also had earthquakes here.. it's an uninteresting thing how people can know a lot about some thing but how they respond varies from individual to individual. We would be keen to promote community…. You'll see it a lot in social media that what's unfolding in the current event. There have been a lot of people

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checking in with each other asking if they're okay. Of course we encourage the physical over the fence to the neighbor to make sure people are okay.

Often we have flood prone land and people still buy houses there and not realize how much impact that will have when it happens.

Its not just info about flooding but also what not to do and where to go to be safe. Getting info exchange amongst the community so long as it's good and not misinformation, I agree

We do learn from pervious disasters. The 1233 – our local ABC radio - they went into emergency mode very quickly and they are a key deliverer about what is actually happening in live time and keeping an eye on twitter and social media is good if you have power.

If power goes out, their internet and phone stops and people become angry about it. If power is not on it has a significant impact how much info you can get out

Social support from neighborhood is good. I agree. But it comes down to individuals. Some people are not helpful and other are

Sense of community and belonging. It's an interesting question. Community identity can be very multi layered. And the community they feel they belong to may not be the street they live on.

Trust- goes with sense of community. I know personally I couldn't trust people across road; I would likely be the one to help them. That's just how they are.

Coordination amongst the community – they look to authorities like SES or council to provide that coordination. It can be difficult for ... depends how long 2 or 3 days..

R Coordination here means coordination among the community.

I That comes back to that how well do they know neighbor, will they go talk to them?

Demographic – it's really imp in how info can be conveyed both pre post and during a disaster. A lot of that info that gets spread out through social media is not relevant to perhaps senior who are sitting there with an iPhone- they are likely to have a radio. Radio with batteries is a key way.

We knew last time that there were a number of vulnerable groups and hearing stories about old people stuck in their homes for days until someone got there. And one African refugee family who were terrified and had to be carried out of the house because they didn't understand what was happening. And people turn up in uniform and try to take them away and it was terrifying because it brought back memories of what happened in their home countries.

For a group with poor English how do we manage that? They have so many other things getting settled and going to the shops etc.

Community efficacy – what do you mean

R They believe in their own capabilities, they can fix their home or roof.

I That's interesting. In an urbanized context in 21st Century context in Australia, you wouldn't be able to fix your own home because the insurance claim. You have to get an assessor come

out and have it fixe properly. There's a government structure behind that, even the tree removal.. because most people wouldn't have chain saws. In an urban setting it's difficult

R It's not specifically for physical things. For example they lose their home and their assets but they believe they can get all of these assets again mentally

I That will come back to the individual as well. We've had plenty of people ringing to the radio with a heavy rainfall. People say they get really nervous about what might happen, and that's just an individual response to trauma. Even though they might know their neighbor can rescue them, individual if the rain is hitting the roof it's an anxiety response.

R What about improvisation? Like before a disaster happens they think about it and devise a new solution to withstand the disaster. Not something from an emergency organization

I they are probably more reliant on emergency organizations.   I'm very conscious of walled in community where they have flash flooding. They spent their energies harassing the authorities to get them a flood warning system. It costs a lot of money and they are still totally reliant on someone else doing it for them. They wouldn't even consider a community response.

R What about the coping style?

I That's very individual thing again. Depends on how devastated they are.

But we are talking about the New Castle area. You know how much they have coped having been here a long time

I that's a very individual things. I remember listening to the radio; we didn't have power for 3 days. In first 48 hours people were resilience and then on day 3 people were starting to complain. The power had been off and they were complaining how poorly there was a response.. I actually switched off the radio when that was happening. They weren't coping well. There was an expectation they would be rescued

R what about leadership?

I I think it's very imp on a number of levels for a community. That can unfold at diff levels too. It can range from police to local people in the community in the street. It's a very imp thing and can unfold in a number of different ways

R Is there other indicators that makes the community resilience that I didn't mention?

I No, I think you covered most of them.

R Do you all measure the resilience?

I no.

R Do you have any plan or program to increase the resilience?

I the only thing that's being considered by this organization… up until recently was the DisPlan, but now this organization has been restructured. Since 2007 we've had several restructures and lost corporate knowledge on how council response to these types of disasters. There is currently a neo-economic response.

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R If you have any plans or would they consider the different phases of disaster?

I only in the DisPlan and from council's perspective it will be very interesting to se how it unfolds at this out. The community response was led by DOCS. But once that immediate emergency and asset response was completed it was up to the state agencies to deal with the ongoing community needs.

R How the council is involved in community responses?

I There have been no funding or resources put to that. It has been considered as an area to be funded. That may change.

R So you guys are informed by emergency organization? If any coordination needed you try

I Yes.

R you have no special program or plan?

I There is a 123 program associate d with the DisPlan .. I've seen DL fliers but not much else going on for that, which is partially because of the reorganization and what's considered a priority.

R If disaster happened today, like rain and storm, what does council do for community now?

I We are chopping up a lot of trees and there's an update on our website about what's opening. Emergency info refers people to SES, ambulances, and tune into 1233.

R At a high level, you all distribute the info among the public and are liaising with emergency organization and at some point helping them to assist people from the disaster?

I Yes

R Two main things 1 distributing info 2 liaising with emergency organizations

I yes, you can see that through the DisPlan. There's a clearly laid out response that council gets involved in once an emergency plan in triggered

R but no funding or resources for this process. How are you liaising with this organization?

I we are only clearing trees from our own fallen trees, in the parks and streets. SES will deal with ones on houses because power lines are involved in that.

R for trees in the streets. SES informs you and you all coordinate that and send some resources? Is that right?

I No, not necessarily . the coordinator the local emergency management officer LEMO. Depends if they have declared it a disaster and they haven't yet. Today I see council cleaning up parks and streets and I'm not sure about the info flow because policy and council and SES. I'm not involved

R thank you. It's very helpful. We will publish our research probably in a few months. Your responses will be very valuable. If you can do me a favor to find Suzanne's email or contact details then I can talk to her as well.

I It would be worth looking at the DisPlan because in the very early pages, page 3, there's a huge who's who in the emergency management committee. You can find it in council's website

R Thanks again. And if I can write your name in my PhD thesis that's fine?

I yes.

Sandie Pitter

R Can I record your voice for data archive

I Yes

R Thank you. Have you received my email in regard to the question I want to ask you?

I Yes, and I'm working on it.

R The aim of this research is enhancing the social resilience within a community to natural disaster such as flood and storm. One of our case studies is 2007 hunter region and central coastal and it's about the social resilience which referring to adjust back to the normal situation after the disaster happens. Have you been involved with the response in 2007?
I No

R In our research we would like to identify all the indicators that might impact social resilience. So far we have found all of these indicators. Can you tell me how much you agree or disagree on their impact on social resilience? The first one is community participation?

I Community participation I strongly agree

When people are connected to their community they are more likely to help each other

R what about education

I Agree nor disagree

We know that information does not increase community connectedness

R what about Exchange information

I Agree with it

Information disseminated through local community members tends to be seen as more credible than advice from government bureaucrats.

R What about learning

I I strongly agree with learning

Many people learn from doing and by redressing mistakes they made in the past. This is why capturing the personal stories of people who have been through disasters tend to motivate others.

R What about shared information

I I agree with it

Information during an emergency is important but as we experienced in the recent storm and flood event many households lost power & mobile phone coverage.

R What about social support

I I strongly agree with it

People helping each other cope with adversity is very powerful in building resiliency.

R How about sense of community

I I strongly agree with it

When people feel that they are connected to their community they start to see themselves as having responsibilities to others.

R How about trust

I I strongly agree with it

Same as what I have been told about sense of community.

R What about coordination

I I strongly agree with it

There needs to be trusted leaders in communities that can coordinate efforts. Leadership in this respect is not because of the title of your job but the esteem and trust that the person is held in by others in the neighbourhood.

R What about demographic details

I agree with it

Understanding the demography of a particular community is crucial to building social connectedness and the reason why some communities are not as cohesive as others.

R What about community efficacy

I strongly agree with it

Confidence in our ability to do what we need to do is crucial to success.

R What about improvising

I strongly agree with it

Over-management of issues by all levels of government has created an environment where people look to someone else to fix their issues. We are now trying to return to a time when individuals and communities take more responsibility for their own safety and circumstances

R What about coping style

I agree

Important but people can learn from others and as they do they develop more confidence in their own ability to cope with adversity.

R What about leadership

I strongly agree

As told before above community leaders are very important – they are the people who others listen to and look up to – not necessarily people in paid positions of authority.

R What other indicators or parameters involved in making communities more resilient that not mentioned in above question?

I It is really important to include community members in planning and developing responses to community issues, rather than government coming up with a plan and trying to tell people in a particular community why the response if good for them. Whilst we need to include subject experts we also need to include community experts – those who understand the unique characteristics of their place and can contribute this expert knowledge into the mix.

R Did/Do you measure resilience or vulnerability in the community? If yes, how did/do you measure it? did/do you consider disaster phases like pre-disaster, response and recovery once measuring resilience? And why?

I As well as the usual community surveys that are undertaken by LMCC, the Sustainability Department through its various programs does include measures of community resilience and vulnerability. The annual survey of Environmental Attitudes asks respondents to indicate their level of confidence in their household feeling well prepared to cope with environmental threats such as to severe storms, floods, bushfires and heatwaves. We also ask if people take actions that will help them be prepared. In our Sustainable Neighbourhoods Program we ask respondents to indicate their level of agreement with a range of measures that indicate connectedness such as social contacts, able to get help if they need it, knowing their neighbours etc. We also cover this area in community workshops by asking people what they like about their place, and overwhelmingly its more about the people characteristics such as good neighbours, people look after each other, different generations mixing outdoors and so on…

LMCC has a role in disaster response and in disaster prevention, preparedness, and recovery.

R Did/Do you have any plan or program for increasing resilience or reduce vulnerability within a community? If yes, please explain it?

Councils Sustainability Department works directly in the arena of disaster preparedness and resiliency through its Be ready Be Safe Campaign. The aim of this campaign is to assist our community (residents and workers) to be better prepared and more resilient to threats from the environment such as severe storms, floods, bushfires etc. In this Campaign we work in partnership with the emergency response agencies to encourage people to adopt the behaviour that will make the job of the response people easier and increase personal and community safety. We are currently working with community members and the response agencies to develop a community safety plan from the groundroots up. We are also working with existing volunteer agencies to train them to help their vulnerable clients make a household safety plan.

R did/do you consider disaster phases like pre-disaster, response and recovery once making a plan for increasing resilience? And why?

I Yes, because in order to develop solutions to an issue you first need to understand it and the cycle for most interventions include preventative strategies (reducing the risk and impact if something goes wrong) , managing the crisis (direct intervention to increase safety), and recovery (getting back to normal as quickly as possible). The pre disaster actions can decrease the risk and impact and get things back to normal more quickly.

R How the council involved/involve in the community's responses? How did/does the involvement start, progress and finish?

I We have been rolling out various programs under the banner of the Be Ready Be Safe Campaign for three years and will continue to work in the arena whilst we have the funding to do so.

R What organizations or communities were/are involved in the process? How did/does the involvement start, progress and finish?
I We work at the whole of local government area for general awareness and information, and through tailored programs with specific target groups that may be particularly vulnerable through their geographic location or by personal characteristics such as age, social isolation, lack of mobility, disability, or proficiency in the English language.

R Any other comments?
I No

R Thank you. It's very helpful. We will publish our research probably in a few months. Your responses will be very valuable. Thanks again. And if I can write your name in my PhD thesis that's fine?

I no problem and yes.

David Gibbins

R Can I record your voice for data archive

I Yes

R The aim of this research is enhancing the social resilience within a community to natural disaster such as flood and storm. One of our case studies is 2007 hunter region and central coastal and it's about the social resilience which referring to adjust back to the normal situation after the disaster happens. Have you been involved with the response in 2007?
I yes

R what was your role at that time?

I Now, I am retired. At that time I was senior strategist integrated flood planning the city of Newcastle and director technical floodplain management association and had a few papers at conferences.

In 2007, first primarily was obtaining funding for and heading the development of a city wide floodplain risk management strategy & plan for the city of Newcastle (for the full spectrum of potential flood risks) implementing the principles of the NSW government floodplain risk management policy and manual. Second was managing the Newcastle floodplain risk management committee as part of the above. This committee included community representation. third, as part of the above, obtaining funding for and managing the collection of city wide 2007 flood data after the 2007 floods.

R In our research we would like to identify all the indicators that might impact social resilience. So far we have found all of these indicators. Can you tell me how much you agree or disagree on their impact on social resilience? The first one is community participation?

I I strongly agree. The community at large is the very entity in which we desire to capacity build social resilience. Without community participation in a given region and social environment, it would be impossible to gauge the social resilience starting point, strengths and weaknesses, and to develop and implement an adaptive program to maximise and maintain social resilience (and most of the other floodplain risk management measures).

R what about education

I strongly agree. It is essential that the community at large have the opportunity - through education - develop a good knowledge and acceptance of the full potential flood risks to life, property and social well-being as relates to their individual circumstances as individuals and also collectively as a society. This would include psychological and social recovery preparedness for after a flood, and knowledge of where to get this help in the event of a flood. Without this, individuals and the community cannot: one is prepare themselves mentally in advance; two is decide to live / work elsewhere before the next flood if they decide the potential risks and consequences are unacceptable to them; three is to know what to do when floods do happen so that they are not responding in total panic, and they reduce as a far as practicable loss of life and property so there is less to recover from; and forth to understand

fully the purpose and limitations of flood risk management measures both in place and future especially those that seek to modify flood behaviours such as levees so their expectations are not unrealistic.

R what about Exchange information

I strongly agree. Individuals in the community will potentially be better able to appreciate the wide differences in community attitudes, expectations and abilities to respond if there is interchange of information within the community itself. Hopefully this will collectively enhance better overall responses and ability to collectively recover.

R What about learning

I I agree with learning. It is very helpful but can be misleading. People and communities do tend to base their beliefs on their personal experiences of real events and how they interpret these or of those who they trust. However, every flood is different, and people can innocently impose fanciful interpretations on what they have experienced, that are not based on the physical reality of how floods work. Because it is almost certain most peoples' experiences of real floods do not cover the full range of potential floods, relying alone on past experience without the extension of this experience by scientific simulations of all the full spectrum of flood behaviours, risks to life, property and social wellbeing can in fact increase the flood consequences and reduce social resilience and other resilience. A real example of this is the Nyngan floods of 1990. The community relied on past experience for setting township encircling levees with addition height provided and these were catastrophically overtopped with the township still occupied. The physical and physiological impacts were overwhelming. I spoke to the mayor some years after and he was like a shell shocked soldier and was still clearly grieving.

R What about shared information

I Agree. It is very helpful as social media is becoming more important at the onset and during floods. It is scanned and used by emergency services - sometimes replacing the emergency services normal means of self-commendation. Social media is more robust and doesn't crash. Research has been carried out to develop mathematical algorithms to filter social media and find what is relevant for emergency management.

R What about social support

I I strongly agree with it. Where realistically achievable after an event, it appears to me this is very important "mates" and "I am not alone". It may commute to "pooled anger" however, and I am not sure how helpful this is to social resilience.

R How about sense of community

I I agree with it. Just my intuition that recovery will be promoted where people feel they belong to a location. However, this may also be counter to recovery if it is not appropriate for human safety or economic viability for example to remain. There are examples of move the town eg Goulbourn, Nowra, Grantham residential.

R How about trust

I Agree. Trust will promote recovery, provided the trust is not misplaced, similar to education.

R What about coordination

I I agree with coordination. This would be effective in speeding recovery responses, and reducing frustration. Communities seem to adversely respond to interagency / intra community inconsistencies and unfairnesses for example flood insurance.

R What about demographic details

I strongly agree with it. Demographics are critical. Dungog aged care facility in the immediate past flood. An aging demographic is obviously less able to cope and survive a flood event that has significant risk to life, for example. Aggregations of the socially and economically disadvantaged will also present challenges in terms of emergency response and recovery.

R What about community efficacy

I Agree. It is Important however can make things worse. The community belief in their own capacity can be misplaced. For example, after the 2007 floods in Newcastle, one community group organised their own warning and emergency response plan. In principle this could have been excellent if they had worked in collaboration with the experts and been realistic in what was technically achievable with today's technology. However, in this example, they potentially put more lives at real risk because they did not take into account more severe flood events, or acknowledge the impossibly high rates of rise of flood waters up to 7m in one hour.

R What about improvising

I strongly agree with it. With the proviso that it is done in collaboration with expert advice.

R What about coping style

I strongly agree with it. Being able to adapt and not expect things can just be restored to what they were or were hoped for before the event would promote responsible flood plain risk management for example the mayor of Grantham creating a new residential subdivision on high ground and giving people at severe risk to life the opportunity of relocating - which most have.

R What about leadership

I Agree. Provided the leadership is inclusive of expert flood plain risk management professionals and takes on board their advice. Political or informal leadership can be well intentioned but can be counterproductive and sectional for example pro-development no matter what.

R What other indicators or parameters involved in making communities more resilient that not mentioned in above question?

I It is really important to include community members in planning and developing responses to community issues, rather than government coming up with a plan and trying to tell people in a particular community why the response if good for them. Whilst we need to include subject

experts we also need to include community experts – those who understand the unique characteristics of their place and can contribute this expert knowledge into the mix.

R What other indicators or parameters involved in making communities more resilient that not mentioned in above question?

I 1) risk to life. It's hard to be resilient when you are dead. the more the extreme event the greater the potential risk to life for example in Newcastle, one of the areas hit hard by the 2007 flood event has a potential loss of life of about 3000 souls on a busy business day. 2) Planning and implementing in advance: social resilience and breaking point should be and was in the development of the Newcastle city wide floodplain risk management plan a consideration in the development of an overall risk management strategy. Recovery should not just be reactive. Social resilience is just one element in the overall management of disasters, and should not be seen as a cop out or soft solution to avoid the very large, difficult and costly measures needed to manage natural disasters. 3) Community acceptance: it is almost universally reported that large sections of the community reject what government and the emergency management organisations develop and advise. The root causes of this needs to be identified and managed. The political: our political system represents our community. my hard experience is the political community generally don't recognise flood management between floods, but like to be involved during and after. For example the NSW planning doc for great Sydney did not even mention floods or the NSW government's own flood policy. The floodplain management associated was able to get this element in overtime. But it was a huge time before the executive could even see the relevant minister's representative.

R Did/Do you measure resilience or vulnerability in the community?

I No. we wanted to, but weren't to have it included under the SES grant. We focused on observed flood levels and economic impacts as much as the community were prepared to give.

R Did/Do you have any plan or program for increasing social resilience or reduce social vulnerability within a community?

I No, Not at the 2007 flood event however, we tried as much as possible to incorporate social vulnerability identification and resilience into the ongoing development of a City Wide Floodplain Risk Management Plan (CWFPRMP).

R Can you please explain it?

I In the CWFPRMP potentially more adversely vulnerable social groups For example aged, Dept of Housing ….. were mapped using census and Dept of Hsg information, overlaid with full flood risk hazard to life and property category mapping.

R If yes, did/do you consider disaster phases like pre-disaster, response and recovery once making a plan for increasing resilience? And why?

I not to a full extent. would like to have more rigorously, but the concepts were too nebulous and difficult to confidently assess and pursue in management options, had already spent more than $1m in consultant's fees and were running out of money. Mainly pre-disaster planning via land

use planning for future development over a long time maybe hundreds of years to ensure only compatible land uses with full flood risk. For example no aged care in high risk to life areas - and replacing residential with industrial where there were alternative residential areas. Large scale purchase of high risk existing development or relocation, desirable as it is was not seen as immediately achievable.

R How the council involved/involve in the community's responses? How did/does the involvement start, progress and finish?

I constant to the point of questioning whether we were over consulting. This was for many years prior to the 2007 flood even for example in 1993, before the 2007 flood event, various flood studies in the early 200's, and 2006 in the catchment with potentially 3,000 lives at risk. After the 2007 flood event, data collection and community meetings. In the development of the CWFPRMP is right across the city over a 4 year period.

R What organizations or communities were/are involved in the process? How did/does the involvement start, progress and finish?

I All these were started, progressed and finished by the city of Newcastle. In the 19900's these were in collaboration with the hunter catchment management trust. The communications and consultation strategy for the CWFPRMP, incorporating the response to the 2007 flood event, but not limited to this, was developed as a joint effort by council's communication group, the Newcastle floodplain risk management committee with councillor, state government, SES, community, council land use planning, social strategy, engineering, and community commercial and community group representation. The communications and consolation program was approved by the full council

We tried to incorporated all relevant organisations - including the NSW dept of health and local hospitals, as well as the more obvious like public utilities etc.

The post flood 2007 data collection was enabled by the engagement of specialist consultant.

R Any other comments?

I Management of the potential risk to life for the full potential flood risk is the greatest responsibility of any society. If this is overlooked or swept to one side for example political intervention, or high level government administration only interested in the immediate needs of society then in my opinion a society's greatest responsibility in disaster management has been violated. It is a quote from the American FEMA, Federal Emergency Management Association: We humans do not want to deal with, either in our thoughts or in our decision making processes with low probability / high consequence events such as seat belts, firearms, unsafe sex, DUI. This has been my experience.

A society is severely emotionally and socially compromised when a natural disaster happens that was a surprise to most. The grief that was expressed to us by many after flood events including the 2007 event was often introduced by "we didn't know this could happen - why weren't we told". It appears to me the involuntary risks, those we choose to take, are the hardest to recover from.

Managing the full flood risk at the lesser floods which are more frequent on average is also extremely important. The cumulative impact on people as people who are frequently flooded

albeit by smaller events can be significant and be the main focus of a community if that is all they have experienced.

We tried to have mechanisms in place at council's enquiry counter after the 2007 flood event to offer to those community members who seemed to suffering stress and emotional trauma information on where they could seek professional help if they wished to.

Professionals who are part of natural disaster events should not be overlooked. Council staff and others involved in the post 2007 responses were observed to be suffering emotional reactions and adverse responses. Counselling was also offered to Council staff involved in the response and recovery.

Getting people to accept risks they have not experienced or choose to deny is a major cause of death and loss in flood disasters. This is such a great factor that some SES managers I have talked to have despaired even to the point of questioning if it is worth trying the help people.

Long term stress after disasters, flooding, has been linked to long term psychological impacts and even increase rates of hospital admissions and physical illnesses.

The opinions and views that I have expressed are my own and do not necessarily reflect the position of policies of the organisations I have worked for, nor the NSW Government whose policies I sought to implement. I cannot accept any liability for the opinions and interviews herein expressed although I do trust they might contribute in some way to the research at hand and floodplain risk management best practice.

Appendix D: Quantitative Online Survey

Social Resilience Questionnaire
We're conducting research on enhancing resilience to natural disasters. This questionnaire aims to better understanding the ability of people in your local area to withstand external social shock and stresses and adapt changing to resist disaster losses. The information gathered in this survey will help us to focus on people's activities that minimize social disruption and enhance social resilience in three different disaster phases: before, during and after disaster. The question guide has been attached. We would appreciate you taking the time to complete the following survey. It should take about fifteen minutes of your time. Your responses are confidential and will not be identified by individual. All responses will be compiled together and analysed as a group. If you have any queries about this survey, please feel free to contact Sanaz Khalili: sanaz.khalili@uni.sydney.edu.au ***Please answer below questions as being a member of the community, and not as a member of the SES and assess the people in your area***

Section A: General	
1. Gender: ☐ Male ☐ Female	
2. Age: ☐ 18 to 29 years ☐ 30 to 49 years ☐ 50 to 59 years ☐ 60+ years	
3. Which Council area do you live in?	
4. How long have you been living in this area? ----- years	

5. How long have you been a volunteer of the SES? ----- years

6. Were you resident in the area during any of below flood and storm disasters? – If not, Please clarify the latest disaster time and location you faced with it in your local area. (All section B responses should be based on the disaster that you choose in this question)
☐ Wagga Wagga 2012   ☐ Kempsey 2009   ☐ Hunter region 2007
☐ Other   Where? ------------ When? ---------------

Section B: Social Resilience

****Please answer below questions respective to the disaster that you have chosen in question 6.**

Please rate your agreement with the following statements on a scale of 1 to 5, where: 1 = Strongly Disagree, 2 = Disagree, 3 = Neither Agree nor disagree, 4 = Agree, 5 = Strongly Agree and 6= Don't know	1 Strongly disagree	2 Disagree	3 Neither Agree nor disagree	4 Agree	5 Strongly agree	6 Don't know
B.1. Pre-disaster: *The following questions help us to understand the situation in your area before disaster occurred.*						
7 People in my area have participated in local activities, events (e.g., festivals, fetes, fairs) or public meeting						

8	People in my area have participated in disaster management activities (voluntary activities, community meeting, seminar, public activities) or trained by emergency organizations in order to learn how to face disasters						
9	My community tried to identify weak points within the community such as high risk areas and vulnerabilities, as well as disasters occurrence and probabilities						
10	My community tried to identify disaster scenarios then develop the strategies to facing with it						
11	People in my area meet each other in different places such as social clubs(RSL), service groups, sports teams, churches, library or ethnic/ multicultural club						
12	People in my area have learnt from previous experience and repeated disaster occurrences to have adequate and appropriate coping strategies to face future hazards						
13	People in my area had access to social media and internet before disaster						
14	In general people in my area were happy to support each other						
15	People in my area trusted each other prior to the disaster						
16	People in my area generally got along with each other and cared about each other						

17	A mixture of cultures, ages, genders, wealth, health, education level within the people in my area made it difficult to cope with the disaster						
18	Before the disaster, people in my area had been thinking about what is going to happen and came up with new ideas about what to do if disaster occurred						
19	People in my area made a plan of action for how to deal with the disaster						
20	In my area, community leaders developed effective communication and provide direction on disaster preparedness strategies						
21	People in my area had undertaken specific activities that involved working together to limit disaster damage or loss to protect the community						

B.2. During the Disaster:

The following questions help us to understand the situation in your area during disaster.

22	People in my area tried to help each other and make a positive difference to the community						
23	People in my area communicated and exchanged information with each other during the disaster						
24	During the disaster, people in my area shared information about the disaster with their neighbours through different channels (social media, face to face, etc.)						
25	During the disaster people in my area supported each other						

26	People in my area trusted the information distributed by neighbours and trusted the advice from their neighbours during disaster						
27	People in my area worked together to respond to the disaster						
28	People in my area shared the same values during the disaster						
29	People in my area thought about how we might best handle the problem and the next steps to take						
30	In my area, community leaders coordinated with neighbours and emergency organizations to meet the community's needs during the disaster						
31	During the disaster, people worked well and under control so managed the stress well.						
B.3. After the Disaster:							
The following questions help us to understand the situation in your area after disaster.							
32	People in my area have been involved in volunteer activities intended to benefit the community (e.g., fundraising, clean-up days, etc.) or have contributed money, food or clothing to local causes, charities, or others						
33	People in my area discussed problems and issues caused by the disaster with their neighbours after the disaster						
34	People in my area learnt to absorb the disaster impacts and learnt to adapt to changes after disaster						

35	People in my area have been actively involved in community groups and sporting, scouts/brownies, religious groups, etc.						
36	People in my area lent things and helped each other after the disaster						
37	People in my area trust each other to respond to meet the needs of its residents						
38	People in my area expect to live in this neighbourhood for a long time (even after disaster)						
39	People in my area had enough power and ability to adapt to change after the disaster by themselves without helping from other emergency organizations						
40	People in my area believed in their collective capabilities of performing and completing jobs						
41	People in my area became stronger through connecting with each other						
42	People in my area had the ability to devise a solution for the disaster issues and problems in ways that are consistent with community needs, attitudes perceptions and beliefs						
43	People in my area had the ability to adapt to change after disaster and cope with the disaster losses						
44	In my area, community leaders lead people on how to cope with the disaster						

45	People in my area were able to do all social activities in a sensible time during and after disaster to back to previous situation						
46	Any additional comments?						

Social Resilience Questionnaire Guideline

In this research, we are focusing on **social resilience indicators** in different phases of disaster (**Pre-disaster, During disaster, After disaster**) in order to identify the most essential indicators then developing strategies or plans to enhance social resilience.

- **Community Participation**
  The questions 7, 22, 32 help us to understand the level of your community participation before, during and after above chosen disaster.

- **Education**
  The questions 8, 9, 10 help us to understand the level of your community's knowledge about the disaster, its impact, occurrences in the area and the community weaknesses.

- **Exchange information**
  The questions 11, 23, 33 help us to understand how information has been exchanged in your community before, during and after the disaster chosen above.

- **Learning**

The questions 12, 34 help us to understand the level of learning in your community before and after the disaster.

- **Shared information**
  The questions 13, 24, 35 help us to understand how the information about the disaster shared in your community.

- **Social Support**
  The questions 14, 25, 36help us to understand the level of support in your community before, during and after disaster.

- **Trust**
  The questions 15, 26, 37 help us to understand the level of trust within your community.

- **Coordination**
  The question 27 helps us to understand the level of coordination in your community during disaster.

- **Sense of community**
  The questions 16, 28, 38 help us to understand the feeling of belonging and level of attachments to the community.

- **Demographic information**
  The question 17 helps us to understand the impact of demographic details on coping with the disaster and social resilience.

- **Community efficacy**
  The questions 39, 40, 41 help us to understand the level of empowerment within your community after disaster.

- **Improvisation / Inventiveness**
  The questions 18, 42 help us to understand the level of innovative and improvisation within your community.

- **Coping Style**
  The questions 19, 29, 43 help us to understand how your community deal with the disaster.

- **Leadership**
  The questions 20, 30, 44 help us to understand the role of leadership in your community.

- **Outcome expectancy**
  The questions 21, 31, 43, 45 help us to understand your view about the level of resilience in your community before, during and after the disaster you have chosen above.

Appendix E: Email Template to Collect Data

From: Sent: Wednesday, 21 October 2015 6:29 PM
To:
Subject: Assistance Required - Research Project into Enhancing Social Resilience to Disasters.

All

I would like to invite you to participate in a research project aimed at enhancing resilience to natural disasters. The research is being undertaken by Ms Sanaz Khalili as part of a PhD at the University of Sydney. It seeks to better understand the ability of people to withstand external social shock and stresses, and adapt to disaster losses.

I support Ms Khalili's research, and encourage you to contribute to the research project. It will only take 15 minutes of your time to complete the questionnaire and your responses will remain confidential. Individual responses will not be identified.

Please click on the following link to commence the questionnaire https://www.surveymonkey.com/r/socialresilience

For any queries regarding the involvement of the NSW SES in this research project, please contact Heather Stuart, Manager Knowledge and Lessons Management at heather.stuart@ses.nsw.gov.au

regards

Greg Newton
Deputy Commissioner
NSW State Emergency Service
P (02) 4251 6111   F (02) 4251 6500   E greg.newton@ses.nsw.gov.au

6-8 Regent St Wollongong NSW 2500
FOR EMERGENCY HELP IN FLOODS AND STORMS CALL THE NSW SES ON 132 500
www.ses.nsw.gov.au

CELEBRATING 60 YEARS OF THE NSW SES

Appendix F: Survey Screen Shots

Page1: Cover Page

Social Resilience

Social Resilience Survey

This study is about enhancing resilience within a community to natural disasters. This questionnaire aims to better understanding the ability of people in your local area to withstand external social shock and stresses and adapt changing to resist disaster losses. The information gathered in this survey will help us to focus on people's activities that minimize social disruption and enhance social resilience in three different disaster phases: before, during and after disaster.
It takes about ten to fifteen minutes of your time. Your responses are confidential and will not be identified by individual. All responses will be compiled together and analysed as a group.

***Please answer following questions and assess the people activities in your local area as being a member of the community, and not as a member of the SES ***

This survey has four sections: General section then three different sections for each phase of disaster (Pre-disaster, During disaster, After disaster).
Please choose the latest disaster occurred in your local area and answer the following questions respective to it for each phases of disaster.

We would appreciate you taking the time to complete the following survey. Your feedback is important.

Next

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See how easy it is to create a survey.

Page2: General Questions

Social Resilience

General

1. What is your gender?

○ Female

○ Male

2. What is your age?

○ 18 to 29

○ 30 to 39

○ 40 to 49

○ 50 to 59

○ 60 or older

3. Which Council area do you live in?

4. How long have you been living in this area?

Years

5. How long have you been a volunteer of the SES?

Years

* 6. Were you resident in the area during any of below flood and storm disasters? (All the answers to the next questions should be respective to the disaster that you chose in this question).

○ Wagga Wagga - Flood on 2012

○ Kempsey - Flood on 2009

○ Hunter region - Flood and storm on 2007

○ Other- Please clarify the latest disaster time and location you faced with it in your local area.

Location and Year

Prev   Next

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See how easy it is to create a survey.

Page3: Pre-disaster Questions

Page4: During disaster Questions

Social Resilience

During the Disaster:

The following questions help us to understand the situation in your local area during the disaster (chosen in previous question).

22. People in my area tried to help each other and make a positive difference to the community.

Strongly disagree	Disagree	Neither Agree nor disagree	Agree	Strongly agree	Don't Know
○	○	○	○	○	○

23. People in my area communicated and exchanged information with each other during the disaster.

Strongly disagree	Disagree	Neither Agree nor disagree	Agree	Strongly agree	Don't Know
○	○	○	○	○	○

24. During the disaster, people in my area shared information about the disaster with their neighbours through different channels (social media, face to face, etc.).

Strongly disagree	Disagree	Neither Agree nor disagree	Agree	Strongly agree	Don't Know
○	○	○	○	○	○

25. During the disaster people in my area supported each other.

Strongly disagree	Disagree	Neither Agree nor disagree	Agree	Strongly agree	Don't Know
○	○	○	○	○	○

26. People in my area trusted the information distributed by neighbours and trusted the advice from their neighbours during disaster.

Strongly disagree	Disagree	Neither Agree nor disagree	Agree	Strongly agree	Don't Know
○	○	○	○	○	○

27. People in my area worked together to respond to the disaster.

Strongly disagree	Disagree	Neither Agree nor disagree	Agree	Strongly agree	Don't Know
○	○	○	○	○	○

28. People in my area shared the same values during the disaster.

Strongly disagree	Disagree	Neither Agree nor disagree	Agree	Strongly agree	Don't Know
○	○	○	○	○	○

29. People in my area thought about how we might best handle the problem and the next steps to take.

Strongly disagree	Disagree	Neither Agree nor disagree	Agree	Strongly agree	Don't Know
○	○	○	○	○	○

30. In my area, community leaders coordinated with neighbours and emergency organizations to meet the community's needs during the disaster.

Strongly disagree	Disagree	Neither Agree nor disagree	Agree	Strongly agree	Don't Know
○	○	○	○	○	○

* 31. During the disaster, people worked well and under control so managed the stress well.

Strongly disagree	Disagree	Neither Agree nor disagree	Agree	Strongly agree	Don't Know
○	○	○	○	○	○

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Page5: After disaster Questions

Social Resilience

After the Disaster

The following questions help us to understand the situation in your local area after the disaster (chosen in previous question).

32. People in my area have been involved in volunteer activities intended to benefit the community (e.g., fundraising, clean-up days, etc.) or have contributed money food or clothing to local causes, charities, or others.

Strongly disagree	Disagree	Neither Agree nor disagree	Agree	Strongly agree	Don't Know
○	○	○	○	○	○

33. People in my area discussed problems and issues caused by the disaster with their neighbours after the disaster.

Strongly disagree	Disagree	Neither Agree nor disagree	Agree	Strongly agree	Don't Know
○	○	○	○	○	○

34. People in my area learnt to absorb the disaster impacts and learnt to adapt to changes after disaster.

Strongly disagree	Disagree	Neither Agree nor disagree	Agree	Strongly agree	Don't Know
○	○	○	○	○	○

35. People in my area have been actively involved in community groups and sporting, scouts/brownies, religious groups, etc.

Strongly disagree	Disagree	Neither Agree nor disagree	Agree	Strongly agree	Don't Know
○	○	○	○	○	○

36. People in my area lent things and helped each other after the disaster.

Strongly disagree	Disagree	Neither Agree nor disagree	Agree	Strongly agree	Don't Know
○	○	○	○	○	○

37. People in my area trust each other to respond to meet the needs of its residents.

Strongly disagree	Disagree	Neither Agree nor disagree	Agree	Strongly agree	Don't Know
○	○	○	○	○	○

38. People in my area expect to live in this neighbourhood for a long time (even after disaster).

Strongly disagree	Disagree	Neither Agree nor disagree	Agree	Strongly agree	Don't Know
○	○	○	○	○	○

39. People in my area had enough power and ability to adapt to change after the disaster by themselves without helping from other emergency organizations.

Strongly disagree	Disagree	Neither Agree nor disagree	Agree	Strongly agree	Don't Know
○	○	○	○	○	○

40. People in my area believed in their collective capabilities of performing and completing jobs.

Strongly disagree	Disagree	Neither Agree nor disagree	Agree	Strongly agree	Don't Know
○	○	○	○	○	○

41. People in my area became stronger through connecting with each other.

Strongly disagree	Disagree	Neither Agree nor disagree	Agree	Strongly agree	Don't Know
○	○	○	○	○	○

42. People in my area had the ability to devise a solution for the disaster issues and problems in ways that are consistent with community needs, attitudes perceptions and beliefs.

Strongly disagree	Disagree	Neither Agree nor disagree	Agree	Strongly agree	Don't Know
○	○	○	○	○	○

* 43. People in my area had the ability to adapt to change after disaster and cope with the disaster losses.

Strongly disagree	Disagree	Neither Agree nor disagree	Agree	Strongly agree	Don't Know
○	○	○	○	○	○

44. In my area, community leaders lead people on how to cope with the disaster.

Strongly disagree	Disagree	Neither Agree nor disagree	Agree	Strongly agree	Don't Know
○	○	○	○	○	○

* 45. People in my area were able to do all social activities in a sensible time during and after disaster to back to previous situation.

Strongly disagree	Disagree	Neither Agree nor disagree	Agree	Strongly agree	Don't Know
○	○	○	○	○	○

46. Any additional comments?

Prev   Done