Optimising Visual Solutions for Complex Strategic Scenarios

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I. Abstract

Attempts to pre-emptively improve post-disaster outcomes need to reflect an improved understanding of cognitive adaptations made by collaborating researchers and practitioners. This research explored the use of visual logic models to enhance the quality of decisions being made by these professionals. The research looked at the way visual representations serve to enhance these decisions, as part of cognitive adaptations to considering the complexity of relevant pre-disaster conditions constituting community resilience. It was proposed that a visual logic model display, using boxes and arrows to display linkages between activities and downstream objectives, could support effective, efficient and responsive approaches to relevant community resilience interventions being carried out in a pre-disaster context.

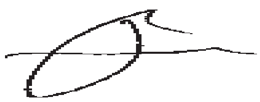
The first of three phases comprising this thesis used Q-methodology to identify patterns of opinions concerning building a shared framework of pre-disaster, community resilience indicators for this purpose. Three patterns identified helped to assess the needs for applied research undertaken in phase two. The second phase of this thesis entailed building an action-focused logic model to enhance associated collaborations between emergency management practitioners and researchers. An analysis of participant interviews determined that the process used to build this logic model served as a catalyst for research which could help improve community resilience interventions. The third phase used an experimental approach to different display formats produced during phase two to test whether a visual logic model display stimulated a higher quality of decisions, compared with a more conventional, text-based chart of key performance indicators. Results supported the use of similar methods for much larger scale research to assess how information displays support emergency management decisions with wide-ranging, longer-term implications.

Overall, results from these three phases indicate that certain logic model formats can help foster collaborative efforts to improve characteristics of community resilience against disasters. This appears to occur when a logic model forms an integrated component of efficient cognitive dynamics across a network of decision making agents. This understanding of logic model function highlights clear opportunities for further research. It also represents a novel contribution to knowledge about using logic models to support emergency management decisions with complex, long term implications.

II. Preface

This thesis is based on three research manuscripts. The first manuscript was published in the Journal of Contingencies and Crisis Management in 2015, following two rounds of peer review. The second manuscript was published in the International Journal of Disaster Risk Science in 2015, following two rounds of peer review. The third manuscript was published in Disaster Prevention and Management in 2015, following one round of peer review.

The ideas presented in this thesis are completely my own. My supervisors helped me to refine my arguments. They provided me with advice regarding methods and statistical analysis and they helped to edit each of the three manuscripts. For these reasons, Dr Robin Peace, Dr Stephen Hill, Dr David Johnston and Dr Alicia Cuevas Muñiz have been acknowledged as co-authors for the three publications comprising this thesis.



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III. Acknowledgements

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[1] This is the official trading name of the organisation formerly known as the Institute of Geological and Nuclear Sciences.

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VI. List of Abbreviations

ICoE:CR	International Centre of Excellence: Community Resilience
IFRCRCS	International Federation of Red Cross and Red Crescent Societies
IKM4DRR	Information and Knowledge Management for Disaster Risk Reduction
IRDR	Integrated Research on Disaster Risk
UNISDR	United Nations Office for Disaster Risk Reduction
VMEP	Visual Monitoring and Evaluation Planning
WREMO	Wellington Region Emergency Management Office

1. Introduction

The development of resilience at a community level has become an aspirational goal for a broad range of emergency management practice both in New Zealand and internationally. Examples include an explicit focus on community resilience documented by the New Zealand Ministry of Civil Defence and Emergency Management (2015) and by the United Nations' 2013 Global Platform for Disaster Risk Reduction (United Nations Office for Disaster Risk Reduction (UNISDR), 2013). There are many aspects of this domain that are complex for emergency management because developing capacities for community resilience depends on multiple interactions between human and environmental systems.

This thesis was developed in the context of emergency management practitioners and researchers tasked with working collaboratively to support the development of community resilience but also struggling to communicate and collaborate effectively amongst themselves in this complex domain. The thesis argues that increased use of visual information displays can help both practitioners and researchers to make more useful sense of complex interactions which characterise the problem scenarios they share. Distinctly visual representations incorporate the use of colour, shape, symbols and placement in addition to standard text (Crilly, Blackwell & Clarkson, 2006). According to Blackwell (2011), the use of these visual elements distinguishes information presented in diagrams from purely text-based information formats. On the basis of existing work in cognitive psychology, including Hutchins (1995), Tversky (2011) and Blackwell (2011), this thesis assumes that a diagram incorporating several visual elements could enhance awareness of pragmatic implications and support a more widely collaborative approach to the complex domain of community resilience. The thesis primarily aims to develop a more specific body of evidence to inform the use of distinctly visual, diagram-based information displays, for developing a suite of strategic community resilience interventions.

This overall research aim is addressed by answering the principal research question: How can a logic model display, which uses boxes and arrows to show linkages between activities and downstream objectives, be used to help researcher and practitioner groups pragmatically address the complexities of community resilience? For the purposes of this research question, a logic model is a "…picture of how your program works – the theory and assumptions underlying the program" (W.K. Kellogg Foundation, 2010, p. 35) which "links outcomes with program activities/process and the theoretical assumptions/ principles of the program" (W.K. Kellogg Foundation, 2010, p. 35). In this context and the context of this thesis, *program*[2] refers to any "…set of interventions, marshalled to attain specific….development objectives" (Development Assistance Committee, 2015, p. 26). This concept of a program is further defined in 1.4.

The principal research question is primarily examined in the context of planning, monitoring and evaluating community disaster resilience across the Wellington region of New Zealand. Note that for the current thesis, *monitoring* refers to the routine collection of data concerning changes in a program-related situation. Much of this thesis is focused on the role of monitoring within performance monitoring systems which, according to Poister (2010), "are designed to track selected measures of program, agency, or system performance at regular time intervals and report these measures to managers or other specified audiences on an ongoing basis" (p. 101). *Evaluation* refers to assessing "a set of interventions, marshalled to attain specific….objectives" (Development Assistance Committee, 2015, p. 26). In the Wellington emergency management context, evaluation

[2] This reflects the United States of America spelling of 'program', which is used to describe the professional evaluation of government and not-for-profit programs.

refers to a visual, diagram-based approach to using monitoring and other data to identify potential improvements to community disaster resilience interventions.

A virtual research centre called the International Centre of Excellence: Community Resilience (ICoE:CR) is being developed to promote collaborations between practitioners and researchers in order to improve community resilience to disasters across the region, by improving the Wellington Region Emergency Management Office (WREMO) community resilience strategy. Note that, in this context, the term disaster refers to a serious disruption in functioning that exceeds the capacity of communities to respond (UNISDR, 2009). The intensive form of these events, faced by many developed countries, are typically infrequent and hard to predict for any one location and particular point in time (Masys,Ray-Bennett, Shiroshita & Jackson, 2014). Focusing on WREMO's place-based approach to reducing the risk of these events permits the current thesis to explore the practical usefulness of a logic model framework for planning, monitoring and evaluating a working community resilience strategy. Considering the unpredictability of complex systems and scenarios and the consequent need to continually adjust any program of responsive interventions, the use of indicators of community resilience within performance monitoring systems that have visual or diagrammatic elements are of particular interest. It is suggested that visual materials can facilitatemore responsive monitoring of unexpected changes which can be observed and adjusted for, as the community resilience programme develops.

Examining the usefulness of a logic model in this emergency management context helps to further develop theoretical arguments for using richly visual information displays. There are a number of relevant theoretical arguments concerning how information displays can help support effective understandings of a complex domain. Examples include psychological literature on the advantages of diagrammatic reasoning from Blackwell (2011), literature concerning the importance of external cognitive representations from Tversky (2011) and literature from Hutchins (1995) concerning how information displays can help people to think together. Much of this thesis is therefore based on a foundation of cognitive psychology and organisational psychology literature.

There is also a clear need to consider the multi-disciplinary domain of program evaluation. This means that a range of relevant research and theoretical literature from philosophy, political science, and sociology and other disciplines is also drawn upon during the course of this thesis. By expanding on the boundaries of a single academic discipline, this generally iterative approach to other relevant background theories has the potential to help inform emergency management in a range of complex strategic domains. This is because the thesis is primarily focused on practical issues, rather than theoretical contributions alone. Contributions back to parts of this broad theoretical background may nonetheless help inform a wider range of attempts to address complex human-environment interactions not directly related to emergency management.

The remainder of the current chapter provides a broad background to the thesis, concerning the community resilience approach to emergency management mentioned above. A gap in knowledge regarding this area is outlined before a detailed description of the specific research context is outlined in 1.2. The chapter then outlines a more detailed theory in 1.3, as applies to both the identified knowledge gap and the specific research context. Additional key concepts are defined in 1.4 before the overall aim of this research is detailed alongside the principal research questions, in 1.5. The overall research design that addresses these research questions are outlined in 1.6 before the thesis structure and an overall summary of this chapter are provided, in 1.7. As outlined below, background issues concerning the concept of community resilience in emergency management remain paramount throughout.

1.1 Thesis Background

This background section outlines a contemporary approach to emergency management focused on community resilience. Several issues concerning this approach are outlined to illustrate the need for a more sophisticated approach to emergency management collaborations between practice and research specialists. The community resilience approach to improving post-disaster outcomes attempts to address a complex combination of systems interacting in a timeframe between pre-disaster conditions and post-disaster outcomes. As outlined in 1.1.1 below, the complexity of these interacting dynamics highlights the need for particular approaches to monitoring and evaluating community resilience programs. As also outlined in 1.1.1, it is important to consider how the complexity of community resilience dynamics can demand contributions from a broad range of knowledge and expertise. The core concept of community resilience is therefore also characterised by a high degree of disagreement, between popular understandings and the technical understandings produced by very different academic disciplines. For some, including the Integrated Research on Disaster Risk (IRDR) (2014) collective, a community resilience approach to emergency management appears to exemplify potentials for integrating research analysis alongside policy and practice interventions. However it also appears to exemplify potentials for misunderstanding and even friction between these collaborating groups.

1.1.1 Community resilience concepts. *Community resilience* has become a common and popular term in the field of disaster risk reduction. The near ubiquity of this term was illustrated when the UNISDR (2013) named community resilience as the main focus of the 2013 Global Platform on Disaster Risk Reduction. This made community resilience the main concept used to review the 2005-2015 Hyogo Framework for Action, which had aimed to better coordinate emergency management among United Nations member states. In this international context for emergency management, community resilience has been primarily defined as processes that take place at various levels of geographic communities during emergency management which constitute an "ability to resist, recover from, or adapt to the effects of a shock or a change" (Mitchell & Harris, 2012, p.2). This technical definition has been closely aligned with the extant definition of disaster-related resilience provided by the United Nations: "The ability of a system, community or society exposed to hazards to resist, absorb, accommodate to and recover from the effects of a hazard in a timely and efficient manner, including through the preservation and restoration of its essential basic structures and functions" (UNISDR, 2009, p. 24).

Considering commentary from Béné, Godfrey Wood, Newsham, and Davies (2012) concerning the need for more transformative approaches, alongside the focus on reduction within the New Zealand Civil Defence and Emergency Management Act 2002, the current thesis considers an expanded concept of community resilience that includes the ability to mitigate disaster-related impacts before they occur. Likewise, as expanded on below, the successful recovery of a resilient community would ideally preclude returning to the same state of disaster vulnerabilities. Facets of community resilience concerning mitigation and adaptive recovery therefore complement the established definitions of community resilience and resilience provided by Mitchell and Harris (2012) and UNISDR (2009) as outlined above. The current thesis therefore assumes that community resilience can include the ability of a community exposed to hazards to mitigate, resist, absorb, accommodate to and recover from the effects of a hazard in a timely and efficient manner, including through the preservation, restoration and adaptation of its essential basic structures and functions.

Patton (2011) referred to the general concept of resilience as an overall property of *complex adaptive systems*, characterised by the following characteristics: non-linear, emergent, dynamic, adaptive, uncertain. Patton’s (2011) understanding of resilient systems also encompasses the characteristic of being co-evolutionary, due to systematic interactions both within and between scales. This concept of resilience as a property of complex adaptive systems will be further discussed in 1.3. According to Patton (2011), developmental evaluation usefully addresses the complex fluidity of a resilient, complex adaptive system, by using evaluative processes to check and adjust early stage planning. At its core, it refers to shortening cycles of assessing and adjusting new programs of social interventions. These shortened cycles also address a need raised by Stacey (2007), to check for hard-to-predict dynamics and adjust organisational planning to suit. In the emergency management domain, developmental evaluation may be supported by the routine collection of performance-related data, through robust monitoring practices. This is likely to be a marked improvement on waiting until a disaster occurs to evaluate and improve resilience programs.

A key assumption under-pinning the current thesis therefore concerns the ongoing developmental evaluation of emergency management programs, through robust monitoring and short cycles of performance-related evaluation. It is assumed that developmental evaluation, involving effective and efficient communication between practitioners and researchers, greatly enhances anticipatory approaches to disaster risk reduction such as community resilience interventions. Another assumption underpinning this thesis is that logic model displays used as part of developmental evaluation form part of a cognitive adaptation, allowing researchers and practitioners to co-develop community resilience interventions long before the onset of a disaster event.

Psychological literature indicates a key challenge for taking this approach to developing community resilience programs. *Dynamic complexity* offers a more succinct alternative to the concept of complex adaptive systems outlined by Patton (2011). This term was used by Diehl and Sterman (1995) to define the psychological challenges of working with systems created by interactions between two or more dynamics, for example: interactions between environmental hazards and social factors such as social ties (Norris, Stevens, Pfefferbaum, Wyche, & Pfefferbaum, 2006) and hazard awareness (Paton et al., 2010) constituting the resilience of communities facing disaster risk. The cognitive difficulties of working with complex interactions between system components are of particular interest to the current thesis.

According to Diehl and Sterman (1995), individual decision making is worsened with each interacting dynamic which is added to a decision making scenario. Certain information displays have been able to improve on this situation, by helping leverage particular skills and knowledge to arrive at solutions that are both technical and practical. For example, Sehlke and Jacobsen (2005) documented the way that diagrams of the Bear River Basin helped engineers and allied professionals work with interactions between human water consumption and hydrodynamics in the surrounding environment. The potential for display-based decision making aids to support solutions from diverse collaborators has also been outlined by Hutchins (1995), Huggins and Jones (2012) and Owen et al. (2013). Commentary from these authors is discussed alongside commentary on the diversity of emergency management collaborators in the remainder of this chapter.

Kapucu (2012) and Owen et al. (2013) outlined how diverse collaborations are needed to resolve many complex emergency management problems. Kapucu (2012) used complex urban disasters as an example to illustrate how many hazards cannot be effectively managed by any emergency management agency in isolation. Owen et al. (2013) illustrated how effective emergency management collaborations are made among a variety of organisations, and among diverse personnel within those organisations. The challenging domain of community resilience appears to demand collaborations between emergency management agencies and institutions which are accustomed to analysing the dynamic complexity and complex adaptive systems of this domain. Research institutions accustomed to analysing complex social, ecological, and socio-ecological dynamics can therefore become key emergency management partners, to ensure that community resilience concepts are used in a way which supports pragmatic benefits among disaster-affected populations. Bringing researchers and practitioners together in this way can generate tensions as neither group may readily understand the practices, including decision making processes, of the other group. It is in this context of imperfect understandings between different groups that this thesis argues for the facilitative value of visual, diagrammatic displays.

There are many research disciplines which can inform contemporary approaches to emergency management. However, as mentioned above, it is not easy to find a common ground between these disciplines and emergency management practice specialists. The challenge of facilitating contributions from social science researchers is particularly relevant in the case of community resilience programs. As outlined by Setiadi and Chang Seng (2012), valuable contributions to community resilience theory have been made from social science domains such as psychology, anthropology, and human geography. Social scientists and researchers from related academic domains have continued to play a particularly important role in helping to understand community resilience dynamics. As outlined by Deeming and Fordham (2012), these dynamics revolve around the inherently social nature of communities which, for the purposes of community resilience in emergency management, represent distinctly social entities gathered by common locations, interests, circumstances, support, or identities.

These complex social aspects of community resilience may be far from obvious for many emergency management partners. Much less socially-orientated concepts such as the engineering-based concept of *resilience as resistance* (see Setiadi & Chang Seng, 2012) appear to be much more particularly popular amongst emergency management practitioners. This engineering-based concept of resilience focuses on a rapid return to a pre-disaster state and appears to be popular among New Zealand emergency managers. For example, a review of community resilience literature and practice guidelines by Britt et al. (2012) received a high profile launch to emergency management agencies and their collaborators at Canterbury University. I personally attended this launch where an academic setting did not prevent Paul Fleming, the Pro-Vice-Chancellor of Canterbury University, from introducing the Britt et al. (2012) review with the assurance that disaster-related resilience was simply a case of “bouncing back”; in other words, a case of resilience as resistance.

This highly simplified concept of community resilience has not only existed among emergency managers. Nor has it existed in some kind of communications vacuum. Resilience as resistance has also been a popular feature of New Zealand media’s coverage of the Canterbury earthquakes. For example, newspaper articles by Carville (2011), Anderson (2011) and Eleven (2013) have made repeated use of terms related to resilience as resistance such as *bouncing back* and *stoic*. The resilience as resistance concept has also become popular outside of the Canterbury recovery context. The Wellington Region

Emergency Management Office (2012) Community Resilience Strategy stated that community resilience includes the ability to: “bounce back rapidly from an emergency event” (p. 6).

In a more analytical sense, the concept of bouncing back has been heavily criticised for promoting an often counter-productive view of community resilience. According to Béné et al. (2012), the concept of bouncing back assumes that rapidly returning to a risk prone pre-disaster state is an ideal outcome of community resilience. This concept of resilience may have been useful for engineers strengthening infrastructure networks so that water, electricity, communications and transport can resume functioning after a disaster event. However, community resilience can be a much more profoundly social concept, which also includes capacities to transform and adapt in the face of shocks (Béné et al., 2012). Returning to the New Zealand emergency management context, a research-based commentary on the Canterbury earthquakes by Mooney et al. (2012) outlined how a resilience-based approach to disaster recovery needs to include efforts to mitigate future vulnerabilities to the original disaster event, rather than simply bouncing back to the same disaster prone state.

Other, potentially problematic understandings of community resilience among New Zealand based emergency managers have included an apparent reference to social Darwinism in the WREMO (2012) Community Resilience Strategy: “It is not the strongest of the species that survives… it is the one that is most adaptable to change” (Darwin, 1859, cited in WREMO, 2012, p. 2). The inclusion of this statement may have represented a simplistic understanding that community resilience can also be reduced to natural selection between species. Assuming that this is the case, this forms one more example of how practitioners’ understandings of community resilience can become divorced from a research-based attention to detail, theory and outcome-based evidence.

These kinds of divisions between resilience concepts appear to form part of wider issues with collaborations among emergency management researchers and practitioners in the English speaking world. A survey of New Zealand, United States and Canadian emergency management agencies by Sinclair, Doyle, Johnston and Paton (2012b) suggested that research had been largely absent from, or considered irrelevant to, emergency management decision making. Seventy one percent of the 48 agencies responding stated that they needed further support before being able to use existing research materials (Sinclair et al., 2012b).

This lack of research-informed emergency management has become a particularly important issue for usefully deploying community resilience concepts. The lack of recourse to existing conceptual, theoretical or applied research by emergency managers may mean it is difficult to usefully deploy community resilience concepts because basic concepts are unfamiliar or not well understood. This issue appears to be part of ongoing discrepancies between emergency management research and practice that are unlikely to be resolved by the current set of interfaces between emergency management researchers and practitioners. The current thesis therefore assumes that attempts to address community resilience require problem definitions and solutions from a larger catchment of research disciplines. Research-based solutions need to be sourced from academic disciplines and specialities from outside of the emergency management research domain.

1.1.2 The knowledge gap. Prior to the current thesis, emergency management research has already examined circumstances where emergency management practitioners and researchers attempt to collaborate in a conceptually demanding domain. Findings from Doyle, Johnston, McClure and Paton (2011), about differences between researcher and practitioner interpretations of risk, inform many assumptions made as part of this thesis. Doyle et al. (2011) found that participants from a diverse sample of 92 scientists and 85 emergency managers interpreted disaster risk analyses in very different ways.

As outlined above, the community resilience approach to emergency management can reflect another conceptually demanding focus of researcher-practitioner collaborations. The particular complexity of human and environmental systems interacting within the community resilience domain is likely to generate even more issues for useful collaborations between these groups. Furthermore, disaster risk assessments are only one component of an anticipatory, community resilience approach to emergency management, alongside a range of efforts to mitigate and prepare for identified hazards. This means that the current thesis needs to consider a whole layer of complex community dynamics in addition to complications outlined by Doyle et al. (2011).

At the time of writing this thesis, there has already been a large body of white, grey and peer-reviewed literature providing sets of community resilience metrics. For example, a working database of indicator frameworks outlined in Huggins (2013) had grown to include over 270 distinct measures of community resilience drawn from existing indicator sets and related research. However, this quantity of indicator sets could be misleading and it certainly does not ensure the quality of existing indicators for gauging community resilience. Efforts to coherently link indicators of community resilience with a range of theoretical foundations have only been developed more recently, including publications by Béné et al. (2012), Birkmann et al. (2012a), Birkmann et al. (2012b), and Ostadtaghizadeh, Ardalan, Paton, Jabbari and Khankehhave (2015).

Neither these recent efforts to address background concepts of community resilience nor relatively established indices appear to have been matched by research into the applied uptake of community resilience indicators and other metrics among New

Zealand emergency managers. Instead, accounts of indicator development and implementation appear to have remained largely anecdotal. For example, Morgan and Begg (2013) outlined how researchers and disaster recovery agencies were collaborating to identify and monitor certain components of community resilience during recovery from the Canterbury earthquakes. Another emergency management initiative was briefly summarised by Thomas (2013) and looked at negotiating metrics for monitoring community resilience between the interests of emergency managers and of a relatively isolated community affected by a number of disaster risks. Both Thomas (2013) and Morgan and Begg (2013) outlined progress on important practical initiatives. According to their reports, these initiatives managed to build indicator frameworks used to monitor and adjust the development of complicated community resilience interventions. These interventions involved activities ranging from community response planning and flood mitigation before a disaster to community-based mental health support and political engagement activities in the aftermath of a major earthquake.

The importance of these incremental, analytical approaches to program development cannot be overstated – especially given the complex unpredictability emerging from community resilience systems. This is a characteristic of complex adaptive systems outlined earlier in this chapter, with reference to Patton (2011). However, initiatives summarised by Morgan and Begg (2013) and Thomas (2013) had only been documented in terms of their indicator frameworks and selected statistics resulting from those frameworks. There does not appear to have been any research into the processes of constructing these kinds of frameworks in the New Zealand emergency management context. At the time of beginning this thesis, there was certainly no published research concerning how those frameworks have been documented.

There have been a range of studies concerning the challenges of complexity which have clearly documented program objectives at the individual and/or group scale. These studies have included a range of research into how conceptual challenges posed by interacting dynamics can be better addressed by using conceptual diagrams. As mentioned above, Sehlke and Jacobsen (2005) showed how a diagram of interactions between humans' water use and various environmental sub-systems can help to usefully understand and manage ground water in the Bear River Basin. Margoluis, Stem, Salafsky and Brown (2009) documented how box and arrow diagrams can be used to usefully understand the overlapping complexities of marine conservation. Stoll and Bengaz (2015) illustrated the important, albeit largely unrealised, potential of conceptual diagrams to help communicate multi-faceted cyber-security policies. Among other precedents outlined by McCormick, DeFanti and Brown (1987) and Card, Mackinlay and Schneiderman (1999), a large body of prior research has shown how diagrammatic displays can help identify opportunities for useful action in complex domains.

One kind of diagrammatic display, called a visual outcomes model or logic model, may help enhance both social and cognitive capacities for working with complexity. As illustrated in the experiment by Diehl and Sterman (1995) outlined above, this complexity otherwise threatens to exceed internal cognitive capacities to usefully understand the scenarios in question. In order to help understand how logic models may help resolve these issues of cognitive capacity and similar issues, it is important to define just what kind of logic model is being considered.

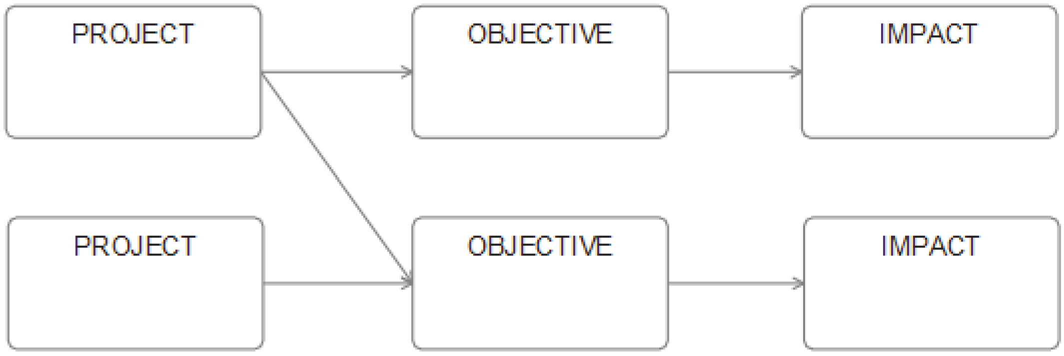

Figure 1. Simplified example of a logic model displaying linkages between program activities and downstream objectives.

Logic models use boxes and arrows to display linkages between organisational and program activities and downstream objectives. A very simplified example is shown in figure 1. This kind of diagram-based approach to planning, monitoring and evaluating social interventions has been used and discussed by evaluation professionals for many years. McLaughlin and Jordan (2010) outlined how diagram-based logic modelling had already been a popular part of program evaluation for more than a decade at the time of writing their summary of logic model practice.

However, like the use of indicator frameworks by emergency management agencies, very few studies have looked at the experiences of individuals and groups using these information displays. In an attempt to address this research gap, Huggins and Jones (2012) conducted research into the experiences of conservation managers building a logic model diagram of New Zealand's national conservation strategy. A logic model was used to detail the relationship between a range of conservation activities and multiple objectives outlined in the Conservation Act 1987. Likewise, Huggins and Peace (2014) conducted a study into the experiences of researchers using a logic model diagram to plan and monitor collaborative sustainability initiatives. Both of these studies provided relatively in-depth findings about potentials and pitfalls for the logic modelling approaches in question. Findings included the need for a structured but flexible approach to facilitating the logic modelling process and the potential for logic models to promote pragmatic discussions between disparate groups. However, both of these studies were limited to very small samples of only three individuals. Furthermore, these studies did not assess the role of logic model displays in improving strategic decisions or other aspects of individual and group performance.

Although these studies specifically helped to motivate the current thesis, Huggins and Jones (2012) and Huggins and Peace (2014) are only two of many studies documenting the use of logic model displays for developing interventions in complex domains. Among many other examples, Savaya and Waysman (2005) documented logic models used to develop and evaluate a range of social interventions and Margoluis et al. (2009) provided a case study of logic models for evaluating marine conservation. These case studies and many others have documented how logic models are used in complex domains. However research literature appears to have focused on directly observable practice rather than theoretical explanations and implications. In the interests of assessing how logic models help diverse groups and individuals to better meet the demands of complexity, there is still a need to align logic model practice with relevant theories of complexity and cognition. Furthermore, although Huggins and Jones (2012) and Huggins and Peace (2014) outlined several advantages of using a combination of logic model elements such as shape, colour, symbols and positioning, the benefits provided by these elements, over apparently simpler text-based alternatives, have not yet been clearly defined. As outlined in the following section, these benefits can be considered at group and inter-group, as well as individual, levels.

1.1.3 The need for pragmatic pluralism. In the absence of a robust, unified and commonly accepted definition of community resilience, it seems that researchers need to take an entirely different tack for collaborating with community resilience practitioners.

One such approach, called pragmatic pluralism, has existed in the multidisciplinary domain of evaluation for several years (see Taket & White, 1996). The useful application of this approach to community resilience appears to require a shift in conventional assumptions about what knowledge represents. The vast majority of community resilience theory being applied to emergency management and the wider domain of disaster risk reduction appears to have been developed and informed by the natural sciences, including a natural science approach to psychology. These approaches have been backgrounded by a positivist epistemology which usually focuses on building knowledge based on absolute, verifiable data that can then be used to develop universal or near-universal truths. Determining which of these truths are universally applicable to community resilience as a part of emergency management could take several decades. There is a need for a much more pragmatic set of knowledge assumptions, which are more closely linked to actual and potential, place-based emergency management activities.

The specific, pragmatic pluralist approach to knowledge focuses on three key questions: “What is to be done?” “How shall we decide what to do?” and “What can guide our actions?” (Taket & White, 1996, p. 574). These questions highlight the value of analysis for improving any program of interventions (Taket & White, 1996). The pragmatism of this approach is based on principles from Rorty’s (1980) pragmatism, which can be thought of as a meta-theory of philosophy. For the purposes of analysing theoretical statements, this contemporary version of pragmatism rejected the relationship between object, sign and interpretant in Peirces’ original pragmatic philosophy. Rorty (1980) stated that is because the notion of objects in Peirce’s account of pragmatism could not apply to many theoretical statements.

Rorty (1980) used the example of the statement, “the universe is infinite” (p. 723). According to Rorty (1980), this is a sign that could not possibly correspond with a unitary object in the world that is independent of the sign itself. Even assuming, as highlighted by Dewey (1946), that many objects in Peirce’s linguistic account are themselves a sign, there is unlikely to be any unitary sign to which a complex theory corresponds. This includes the complex body of theory surrounding community resilience. Contributions to community resilience theory have been made from anthropology, economics, engineering, political science, psychology and sociology (see Birkmann et al., 2012b). These disciplines draw on very different understandings of what an object is and how we can develop any kind of knowledge about those objects. Cumulative concepts of community resilience are therefore unlikely to refer to any unitary and theory-independent characteristic of a particular community.

At a much smaller and less analytical scale, the same pragmatic concept applies to highly localised community resilience theory contained within the WREMO (2012) Community Resilience Strategy. This strategy can be interpreted as an initially opaque *theory of change* which, according to Carman (2010), details a relationship between the design of program interventions and specific social objectives. Consistent with Rorty’s (1980) critique of correspondence between signs and objects, it is not assumed that this theory of change corresponds with changes that will occur independently of the actual strategy and the practitioners implementing that strategy.

Any logic model developed to represent and further develop this community resilience strategy also represents a theory of change. According to Hernandez, Hodges and Cascardi (1998), McLaughlin and Jordan (2010), Rogers (2008), and Carman (2010), logic models have been used to depict and refine many theories of change. Examples include logic models used by Barnes, Sullivan and Matke (2003) and Douthwaite, Delve, Ekboir and Twomlow (2003) that have been used to depict and refine theories of change in the complex domains of public health and sustainability. The current thesis involves developing a logic model to more transparently depict and refine WREMO's theory of change, as outlined in their Community Resilience Strategy. It follows that any logic model developed during the course of the current thesis constitutes a theoretical sign, to which Rorty's (1980) critique of sign and object correspondence readily applies.

Rorty's (1980) philosophy of pragmatism appears to invite an atheoretical approach to research and program evaluation concerning community resilience. However, this is not necessarily so. For the purposes of this thesis, Rorty's (1980) approach to pragmatism demands that each theory, including theories of change, is assessed on its own practical merits. As alluded to above, contemporary pragmatic philosophy constitutes a call to focus on the effects of a theory, rather than essential correspondence between theoretical knowledge and a factual object. As stated in an editorial on the relevance of pragmatism to conceptually modelling information systems: "the true value of knowledge is seen to lie in its practical usefulness and its ability to bring about informed change" Agerfalk (2010, p. 251). According to Agerfalk (2010), this pragmatist approach has been a substantial departure from a representation assumption, that conceptual models for information system research and development must form a faithful "representation of a real-world system as perceived by users" (Date, 2004, p. 291). This assumption appears to suffer from the descriptive fallacy which, according to Holm (1996), involves misconceiving that communications are only used to describe a state of the world, and neglecting that many communications are used to bring about changes in that world.

It follows that a pragmatic pluralist approach to program evaluation assumes that a pragmatic focus on useful action is more important than attempting to ensure that a logic model represents a social or socio-ecological system state at a given point in time. Taket and White (1996) stated that the *pluralism* implicit in this pragmatic approach to program evaluation acknowledges the possibility of more than one useful answer to the same practical dilemma. This suggests that pragmatic pluralism only distinguishes between analytical approaches, including academic disciplines, by their ability to usefully develop practical interventions. This evaluative approach to knowledge provides a coherent avenue for researchers to help improve community resilience trajectories already being pursued by many emergency managers. Both monitoring and evaluation aspects of such an approach provide promising opportunities for research-practice collaborations in the community resilience domain. For community resilience approaches to emergency management, the pragmatically pluralist questions become:

1. Which components of community resilience need to be improved in this geographic area?

2. How shall we decide what to do to support those components? and

3. What can be used to guide the planning and adjustment of relevant interventions?

1.1.4 Monitoring and evaluating community disaster resilience. For the current thesis, monitoring and evaluation forms a substantial answer to the third pragmatic pluralist question outlined above: What can be used to guide the planning and adjustment of relevant interventions? As defined at the start of the current chapter, monitoring comprises the routine collection of data (Poister, 2010). As also defined at the start of this chapter, evaluation analyses monitoring data and other information to ask: “Who, in what circumstances, and in what way, did or didn't benefit from the thing you are evaluating, who learned what from that, and what does this imply for the future?" (Williams, 2015, p. 1). A thorough monitoring and evaluation process may therefore also provide answers to the first and second questions outlined above: Which components of community resilience need to be improved in this geographic area; and how shall we decide what to do to support those components?

As also outlined above, the WREMO community resilience strategy represents a relatively novel, pre-disaster approach to community resilience. Resilience at this anticipatory stage of disaster management is assumed to lead to an improved rate and quality of recovery after a major disaster. For example, Twigg (2009) used 28 elements categorised into seven components, to define an ideal state of pre-disaster community resilience. According to Twigg (2009), these elements lead to improved responses to, and recovery, from disasters. Twigg's (2009) framework was developed through a wide-ranging synthesis of pre-existing indicator frameworks, related research, and other documentation. According to Thomas (2013), this particular framework has already been adapted to plan and gauge local community disaster resilience activities as part of WREMO's ongoing activities. Twigg's (2009) seven main framework components were:

1. ... .policy, planning, priorities, and political commitment;
2. Legal and regulatory systems;
3. Integration with development policies and planning;
4. Integration with emergency response and recovery;
5. Institutional mechanisms, capacities and structures…
6. …Partnerships;
7. Accountability and community participation.

(p. 28)

Other approaches to monitoring and evaluating community resilience are focused on the quality of services delivered by emergency management agencies and their collaborators. Rather than attempting to define the entirety of an ideal resilience state, the International Federation of the Red Cross and Red Crescent Societies (IFRCRCS) (2008) community resilience framework provides an example of how the effectiveness of community resilience programs can be measured. This approach is therefore aligned, to some extent, with the philosophically pragmatic approach outlined in 1.1.3. According to Birkmann et al. (2012a), the IFRCRCS framework is also closely aligned with the original UNISDR (2005) Hyogo Framework for Action 2005, as a guide for all Red Cross disaster risk reduction and emergency management initiatives.

IFRCRCS (2008) stated that vulnerabilities would be addressed as a result of related safety and resilience activities. They also assumed that community resilience would enhance wider development goals, which would in turn enhance resilience. Birkmann et al. (2012a) provided their own summary of IFRCRCS framework objectives, that communities:

> a) understand disaster risks, assess and monitor these and protect themselves to minimize losses and damage when a disaster strikes,
>
> b) be able to maintain basic community functions in times of disaster,
>
> c) build back after a disaster and work towards ensuring that vulnerabilities continue to be reduced for the future,
>
> d) understand that building safety and resilience is a long-term, continuous process that requires on-going commitment, and to
>
> e) be aware that being resilient increases chances to meet development goals
>
> (p. 9)

The assertion by IFRCRCS (2008), that building community knowledge is a core part of community resilience, appears logical at face value. IFRCRCS were referring to practical knowledge which included both awareness of a hazard and the knowledge of potential behaviours in response. Even the most practical knowledge, however, does not appear to be sufficient for ensuring that communities can resist, recover from, adapt to, or mitigate the effects of a shock event. Even if the state of community-based knowledge is improved, there remains a need to match community knowledge with practical means, through particular emergency management and collaborating agency supports. For example, knowledge about a flooding hazard remains largely latent unless a community is engaged with responsive changes to local urban planning and infrastructure development.

Furthermore, as highlighted by Béné et al. (2012), it seems pointless to allocate support without assessing the tangible vulnerabilities and particular needs of each community. Cutter, Burton and Ermlich (2010) produced a framework for benchmarking and evaluating both the resilience and vulnerability of communities affected by disaster risk. Their framework includes social, economic, institutional, infrastructural, ecological, and community components. Cutter et al. (2010) were focused on potentials to support resilience both within and between relatively fluid social groups. Like the IFRCRCS (2008) framework, the Cutter et al. (2010) taxonomy of community resilience indicators could help assess the completeness of community resilience planning and re-planning. This taxonomy also makes direct reference to built infrastructure and other environmental aspects, which may not be included in exclusively social frameworks of community resilience. Like the overarching adaptive capacity model of community resilience, the Cutter et al. (2010) framework was still being refined and validated by the original group of researchers. Subsequent additions to the Cutter et al. (2010) framework include

Burton's (2012) inductive statistical analysis, which compared pre-disaster census data with rates of housing infrastructure recovery following Hurricane Katrina. This research has further developed aspects of Cutter's ongoing programme of research in this area, by taking an inductive approach to comparing pre-disaster conditions with tangible signs of post-disaster recovery.

Like other frameworks for assessing community resilience, the Cutter et al. (2010) framework may nonetheless remain fundamentally incomplete. Their framework was critiqued by Birkmann et al. (2012a) for an over-reliance on national data sources which lacked environmental and spatial indicators. This short-coming was only partially overcome by Burton (2012) who used highly localised reconstruction activities as an indicator proxy for down-stream recovery impacts. Photography using a different global positioning system (GPS) coordinate for each data site was used to gauge very different rates of recovery across an area of New Orleans. However Burton's (2012) pre-disaster resilience data was still based on much larger aggregates, using much larger geographic zones.

More spatially orientated pre-disaster indicators and a greater diversity of data could be incorporated into the Cutter et al. (2010) framework without necessarily disrupting the integrity of the framework as a whole. This would use community resilience data to promote a genuinely place-based approach to emergency management. For example, national census data could be augmented with more regular data from local service providers and collaborating researchers. This finer grained approach to data is likely to include much wider variability, compared to averages concerning much larger geographic zones.

Relatively robust census instruments and statistical records kept by a range of New Zealand's governmental and non-governmental service providers mean that the incorporation of data from service providers may be particularly appropriate for New Zealand based emergency management initiatives. To a large extent, this has already occurred. Morgan et al. (2015) stated that this kind of approach to spatialized data collected and shared by several local service providers formed the Community Wellbeing Index that was used to monitor and evaluate community recovery from the 2010-2011 earthquakes in Canterbury, New Zealand.

As stated by Birkmann et al. (2012a), spatially mapped, geo-coded resilience-related data helps to more usefully understand the ways that social aspects can affect spatially diverse hazard scenarios. This appears to have helped the Community Resilience Index initiative to identify needs and potentials for community-based interventions at both large and highly localised scales. Although this kind of mapping approach lies outside the scope of the current thesis, community resilience metrics refined during action research to develop a dedicated logic model may help Wellington-based emergency managers and partners prepare for a comparable approach to social indicators.

Another framework for measuring community disaster resilience outlined by Norris et al. (2008) focuses on a set of primary adaptive capacities including economic development, social capital, information and communication, and community competence. Like Cutter et al. (2010), Norris et al. (2008) appear to have provided a holistic pre-disaster framework which incorporated the built and natural environment, together with social and economic dynamics. Elements of this framework have been used to represent multiple systems of community resilience, including post-disaster community health (Norris et al., 2008). The Norris et al. (2008) framework also appears to have received considerable support from emergency management researchers. For example, this framework helped New Zealand's Joint Centre for Disaster Research provide advice to agencies working on recovery from the Canterbury earthquakes (see Mooney et al., 2012). Furthermore, Birkmann et al. (2012a) included several of the indicators from Norris et al. (2008) in their large-scale synthesis of 81 community resilience components.

Large-scale syntheses of community resilience indicators by Twigg (2009) and Birkmann et al. (2012a), for example, seem particularly relevant to action research carried out as part of the current thesis. As further detailed in 1.6, this phase combines with preparatory research to form an applied approach to research that incorporates a range of data and other information into community resilience decisions being made at various levels of the WREMO organisation. Components from Twigg (2009) and Birkmann et al. (2012a), alongside other frameworks referred to in the current chapter, still need to be adapted for the Wellington context, with consideration to which data is most accessible, reliable and most likely to inform WREMO decisions.

Indicator adaptation is not a new approach to establishing and implementing community resilience frameworks. Twigg (2009) recommended adapting his pre-existing schedule of disaster reduction indicators to specific contexts. Likewise, Buckle, Marsh and Smale (2003) stated that their own list of disaster-related indicators were best used as an "aide memoir" (p. 95), rather than assuming that any one analytical guide is necessarily exhaustive.

Selecting and adapting pre-existing indicators can complement an iterative approach to community resilience indicators. As further detailed in 1.4.2, with further reference to Patton's (2011) developmental model of program evaluation, a deliberately iterative approach to monitoring and evaluation appears to better address the uncertainty implicit in the complex adaptive systems of resilience. According to Patton (2011), iterative approaches to evaluation form an inseparable extension of the complex adaptive systems which they aim to improve. It is therefore assumed that most existing frameworks for the relatively unpredictable, multi-systematic domain of resilience will always need to be further developed and adapted for particular geographical, institutional and historical contexts. Rather than outlining a strict set of rules for measuring the status of community resilience and the need for further support, existing schedules are guides to consider what could be relevant and reliably gauged within the particular geography of an identified hazard. It is this selective uptake and adaptation of indicator framework components which is of particular interest for action research conducted during as part of this thesis.

1.2 Specific Research Context

In addition to promoting more collaborative approaches, Kapucu (2012) also called for a geographically-focused, place-based approach to emergency management complexities. Many hazards such as flooding, earthquakes, storms, and industrial accidents affect particular geographic zones. It follows that community resilience programs may benefit from an acutely place-based interest in areas affected by potential disasters. This approach to focusing on community resilience in specific geographical areas has also been promoted by Cutter et al. (2008), Deeming and Fordham (2012), and Local Government New Zealand (2014). A place-based approach does not exclude hazards with potential impacts across and between geographic areas. For example, many seismological analyses of earthquake risk depend on comparisons between diverse locations with similar geological characteristics. Likewise, the geographic areas affected by single hazard may be as large as an entire region, nation or group of nations. The current thesis focuses on a regional approach to place-based emergency management. This is the approach taken by WREMO, to community resilience across the Wellington region of New Zealand.

The WREMO (2012) Community Resilience Strategy document nonetheless provides an intriguing example of an information format which could limit the effectiveness of shared decision making. The limitations of this document may extend beyond unhelpful simplifications such as resilience as resistance and apparent references to social Darwinism. The text-based version of this strategy outlines several community resilience objectives and outcomes, none of which are outlined with reference to research evidence. Furthermore, the brochure-like format of the strategy document means that the WREMO community resilience strategy is also unlikely to attract attention from emergency management researchers. Key performance indicators have not yet been finalised to match the strategy. Once finalised, key performance indicators drawn from the current document are unlikely to represent effective efforts to systematically support community resilience in the region, unless they also refer to research-based models of community resilience.

In sum, the WREMO (2012) Community Resilience Strategy aims to address a highly complex domain without explicitly considering prior scientific analyses of that domain. As stated within the strategy document itself, efforts need to be made to enrich the strategy through taking a more evidence-informed approach to the definitively complex domain of community resilience. This thesis therefore seeks to examine what might comprise useful evidence, how this evidence could be more clearly articulated through the use of logic models, and how strategic planning, monitoring and evaluation might bridge the researcher practitioner divide in this area of emergency management.

The following sections provide a theoretical argument for focusing on these aspects of monitoring and evaluating community resilience.

1.3 From Linear Coherence to Workable Complications

A number of indicator frameworks outlined above have been used to gauge community resilience components which interact at individual, social, and environmental scales. As explained in 1.1, these interactions within and between scales make community resilience a characteristic of definitively complex scenarios. Furthermore, according to Cote and Nightingale (2012), resilience is a phenomena which was initially observed within complex ecological and socio-ecological systems. As also outlined by Cote and Nightingale (2012), it is important to distinguish between resilience in ecological and socio-ecological systems because social systems are marked by social values which do not influence ecological systems in the absence of humans. In the social, value bound context of program evaluation, Patton (2011) stated that resilience is a property of complex adaptive systems. As outlined in 1.1.1, this type of complex system is typically dynamic and co-evolutionary and also non-linear, emergent, adaptive, and uncertain (Patton, 2011). Implications of resilience complexity include the way that the outcomes of interacting dynamics can be very hard to predict (see Diehl and Sterman, 1995) and that dynamics emerging from such interactions can be very difficult to influence (Stacey, 2007).

According to Sargut & McGrath (2011) and Poli (2013), the words complicated and complex are easily confused with one another in everyday language. For the current thesis, the use of the term complicated follows Rogers (2008) who referred to the social challenges of working with complexity as *complicatedness.* According to Rogers (2008), complicatedness occurs when the complexity of a social issue requires collaborations among a range of interested parties. It follows that, where complexity describes systems constituted by interactions between multiple component dynamics, complicatedness represents a challenge for planning, monitoring and evaluating interventions for such systems (Rogers, 2008).

According to Rogers (2008), policy complicatedness is epitomised when there are multiple institutions and interdependent causal strands required for the success of a social intervention. This means that complicatedness relates to coordinating interventions, as opposed to characteristics of the complex adaptive system of interest. It follows that systems exhibiting community resilience can be complex and that interventions for these systems can be very complicated. The concept of complicatedness appears particularly relevant to the collaborative model which WREMO aspire towards. Researchers are only one of many stakeholder groups WREMO (2012) have undertaken to collaborate with. There is therefore a clear need to consider both the complexity and complicatedness affecting their community resilience initiatives.

Respective claims from Patton (2011) and Rogers (2008), that systematic interventions need to embrace higher degrees of both complexity and complicatedness, need to be met with a strong sense of caution. Antonovsky’s (1993) sense of coherence theory illustrates how some organisational leaders have needed to limit their own understandings of social complexity to a coherent but syntactically restricted set of assumptions. According to Antonovsky (1993), people generally need to work in a situation which has the coherent characteristics of being comprehensible, meaningful and manageable. Richardson and Ratner (2005) found that these sense of coherence factors had a significant moderating effect (t=2.24, p < .025) on self-reported health amongst 6505 Canadian adults facing substantial life stressors. Higher self-reported scores on these sense of coherence factors also mediated the negative impacts of workplace demands amongst 270 South African public sector professionals studied by Rothmann, Jackson, and Kruger (2003).

Complex scenarios faced by many organisational leaders may not be comprehensible or manageable as a matter of course. It may also be difficult to assign existential meaningfulness to many contingencies and challenges faced in high level management. This led Antonovsky (1993) to suggest that organisational leaders often impose their own set of arbitrarily simplified schemas to maintain a sense of coherence concerning their own organisational leadership context. Perhaps this is why DiMaggio and Powell (1983), Srikantia and Bilimoria (1997) and Heugens and Lander (2007) found that many organisational leaders take an isomorphic approach to new challenges, copying what other organisations have already done instead of developing a more locally responsive organisation. This is only one example of highly simplified and arguably ineffective schemas imposed on organisational decisions in the face of uncertainty.

Another example is the ongoing popularity of Lewin's (1951) simplified freeze-unfreeze-freeze theory of organisational change. This theory has been very popular among organisational leaders despite being superseded by a number of more contemporary and complex iterations, such as theory outlined from Weick & Quinn (1999). The enduring popularity of Lewin's (1951) relatively rudimentary understanding of organisational change may relate to narrative coherence theory from Klein (2003), which suggests that individuals under pressure maintain psychological wellbeing by breaking challenging scenarios down into highly linear causality. This highly linear syntactical approach to understanding causality assumes a narrative chain of events, where component A causes component B which causes component C and so on. For an example of the psychological benefits of narrative coherence, Spera, Buhrfeind and

Pennebaker (1994) found that 63 adults in the USA were better able to cope with unemployment when writing a sequential narrative about consequences of their recent job losses.

In order to satisfy requirements for narrative coherence, complex dynamics such as organisational change and community resilience need to be represented by a series of steps where each step occurs solely as a result of the previous one. This may be especially limiting among managers whose role often concerns a particularly systematic level of the organisation where un-systematic views are likely to become counter-productive. The same could be said for the high level of simplification which Antonovsky (1993) observed among leaders trying to impose arbitrarily simplified schemas onto complex social phenomena. Both sense of coherence and narrative coherence theories therefore suggest that issues of complexity and complicatedness is difficult to discuss at the management level of community resilience initiatives such as the WREMO community resilience strategy.

Psychological needs for both sense of coherence and narrative coherence among organisational leaders can be problematic for many organisations, even when they engage with relatively less complex systems. The need to limit systematic thinking to the individual logic and narrative of a single voice can make managerial strategy a shallow fiction which is completely disconnected, or even outright rejected (see Ford, Ford & D'Amelio, 2008), from actual programs and projects. Certain simplifications constituting part of individual managers’ narrative coherence and sense of coherence may therefore persist due to relatively arbitrary preferences. These simplifications may have little to do with the way these simplifications lead to more effective decisions, concerning programs in particular.

Not all simplifications are counter-productive. *Ecological rationality* occurs when mental shortcuts out-perform more elaborate decision making strategies in ill-defined domains (Todd & Gigerenzer, 2003). These mental shortcuts, or *heuristics*, constitute ecological rationality when they help make a decision which is useful within a certain context. For example, a baseball player is much more likely to catch a baseball by simply adjusting their running speed to reflect the ball's trajectory, rather than trying to calculate exactly where the ball will land before they start running. This is an example of how a particular heuristic, used by skilled baseball players, is a simple but effective way to catch a high flying baseball. Implicit in this understanding of heuristics in ecological rationality is the way that useful decisions are those which achieve useful objectives in particular contexts.

The term heuristic has been used to describe short-cut cognitive processes which are relatively fast and frugal (Gigerenzer, Todd and the ABC Research Group, 1999). Rather than requiring a detailed representation of the surrounding world, heuristics focus on aspects which directly facilitate what a person wants to achieve (Todd & Gigerenzer, 2003). Contemporary additions to cognitive heuristic theory by Kahneman and Frederick (2002, 2005) mean that cognitive heuristics now tend to be differentiated in three different dimensions: low or high effort, rapid or slow speed, and high or low capacity (Evans, 2008). This multi-dimensional view of cognitive heuristics highlights that heuristics are not always limited to fast ways of dealing with limited information, and which require minimal effort. It appears that cognitive heuristics could also extend to relatively slower processes incorporating a larger volume of information.

Although the concepts of heuristics and ecological rationality are central to this thesis, community resilience provides an example of how desired outcomes can become much more challenging outside the relative simplicity of a baseball game. The team with the most home runs wins a baseball game. Community resilience outcomes are much more varied and, as outlined by Béné et al. (2012), may also be conflicted with one another. These varied outcomes, and the complex interactions leading to them appear to contrast with managers' needs for more linear, algorithmic understandings and the way these understanding may help maintain coherence within managers' day to day working lives. Given sufficient numbers of managers depending on these kinds of understandings, a highly linear, narrative approach may even lead to career advancement, among likeminded peers. This potential would parallel research in Sidanius and Pratto (1999), which found that individuals supporting highly vertical hierarchies are most likely to be selected for promotion by managers holding similar beliefs.

The much broader goal, which is highly relevant to the current thesis, has been made explicit at an organisational level through the publication of the WREMO (2012) Community Resilience Strategy: to more effectively support the resilience of communities affected by disaster risk. Converting resilience science into a tidy narrative about how much non-systematic change one single individual can set in motion is unlikely to result in the effective emergency management planning and re-planning required to meet this objective. Community resilience refers to social systems (Deeming and Fordham, 2012), not just one individual agent. The flexible, systematic and sometimes paradoxical thinking required for working in this kind of complex domain (see Stacey, 2007) may therefore challenge more linear, narrative understandings held amongst certain managers party to the WREMO strategy.

More balanced solutions can be drawn from the academic discipline of business and management studies. Stacey (2007) promoted an organisational development solution for coherently working with paradoxes, beyond more simplified, linear approaches to top-down management. He suggested that *complex responsive organisations* enjoy improved performance amongst the hard-to-predict evolution of complex domains. Stacey (2007) stated that these organisations seek to accommodate paradoxes, rather than always trying to resolve them. He also recommended that organisations develop a more fluid and responsive view of human interaction, an appreciation that individuals are interdependent rather than autonomous, and an appreciation that individuals are inseparable from their interactions.

All three components of a complex responsive organisation outlined by Stacey (2007), fluid responsiveness, an appreciation of interdependence, and of social interactions, appear highly relevant for organisations working with unavoidably complex domains. These aspirational components of a complex responsive organisation call for more flexible and iterative modes of interaction, between interdependent decision-makers at all levels of such organisations. The remaining question is: Just how can organisational members and their collaborators actually interact with each other, to share their assumptions and make decisions that have been more widely and deeply considered? Without appropriate tools for supporting these interactions, the responsibility for thinking about complexity and its complications could rest, once again, on relatively isolated individual minds struggling to maintain a sense of relatively narrative coherence.

Observations constituting the theory of distributed cognition (see Hutchins, 1995) and distributed situation awareness (see Owen et al., 2013) suggest that failing to distribute the cognitive demands of thinking about complexity may place unrealistic demands on managers in particular. As detailed above, these demands are particularly likely to become unrealistic amongst managers who depend on linear and purely internal mental shortcuts for their own personal sense of coherence. In the emergency management field, in the space between the work of researchers and practitioners, the need to extend and distribute thinking about complex community resilience interventions forms an important motivation for the current thesis.

1.3.1 External representations. In psychological terms, Stacey's (2007) ideal of a complex responsive organisation largely concerns group cognition. Group-based understandings of cognition have the potential to transform the general concept of a complex responsive organisation into pragmatic changes to the way a work-place operates. Schraagen, Klein and Hoffman (2008) defined this kind of, extended understanding of cognition in terms of *macrocognition*: cognition which occurs amongst groups of individuals attempting to work with complexity. This definition of macrocognition explicitly refers to the need to expand on overly linear logic and the limited capacities of isolated internal cognition (Schraagen et al., 2008). It seems important to note that, while individual cognition is a necessary component of macrocognition, this is only one part of broader, macrocognitive processes (Kozlowski and Chao, 2012).

Hutchins' (1995, 2000) theory of distributed cognition is one approach to the broad area of macrocognition. This approach focuses on the tools which allow diverse teams to think together more effectively. According to Hutchins (1995), these tools are exemplified by crews working together to navigate large ocean-going vessels. Navigators, engineers, pilots and ships' captains all have different skills and knowledge to contribute. Charts, documents and instrumentation act as communication tools which bring these crew members together to manage the complexity of running their ship from port to port (Hutchins, 1995). These external representations of complex information are referred to as *computational media*, because they help extend the power of individual decision making to include contributions from other minds, constituting information stored externally of the brain (Hutchins, 1995, 2000).

These external representations of complex information can also be thought of as *boundary objects* for spanning a gap in information available to diverse collaborators. Owen et al. (2013) stated that any technology used to share information between collaborating emergency management teams forms a boundary object. According to the organisational definition of boundary objects, outlined by Bechky (2003), this form of information sharing can help collaborators with diverse roles and professional backgrounds to focus on the same set of issues and concepts. This means that the concept of a boundary object can apply to diverse collaborations both within and between teams, where boundaries are constituted by different professional backgrounds and roles. Owen et al. (2013) highlighted how the boundary object approach helps understand diverse emergency management collaborations in particular. These boundary objects may be interpreted differently by people with different emergency management roles. This characteristic of boundary objects is outlined in more detail as the thesis progresses through Chapters 3, 6 and 8.

For the thesis as a whole, logic models for monitoring and evaluation represent both computational media and boundary objects which help emergency managers and their collaborators to share their thinking about demanding interventions. As outlined at the beginning of this chapter, community disaster resilience is a complex domain because resilience is a characteristic of complex adaptive systems. Complicated, systematic interventions are often required to address this complexity. WREMO need a monitoring and evaluation framework which works as an effective computational medium and boundary object to represent the complexities of working with community resilience. In the pursuit of a philosophical pragmatic, community-centric ecological rationality, this set of external representations will draw the thoughts of team members and other collaborators together, rather than reinforcing arguably insular approaches to using other types of heuristic components.

1.3.2 VMEP in macrocognition. VMEP (see Duignan, 2012a) represents one example of how an external representation can function as both a computational medium and a boundary object. As documented by The Ideas Web (2010), VMEP and VMEP-like processes have helped organisations build and adjust a working computational medium, to help coordinate complicated decisions about working with complex systems. This process produces a logic model diagram of linkages between projects and several levels of outcomes. Priorities and indicators are depicted on these logic models, to form an external representation of intervention objectives and potential impacts. As outlined in Huggins and Jones (2012), VMEP-like processes can maintain coherence even while illustrating and then assessing many-to-many links between several layers of systematic interventions.

VMEP, as outlined by Duignan (2012a), can be broken down into five stages which are used to produce logic models resembling figures 3 and 4. The first stage of VMEP involves drawing the components of an outcome hierarchy. In figure 2, projects are represented by green blocks to the left of the initial diagram. More immediate objectives are shown in yellow in the middle, while down-stream impacts are shown in beige towards the right. Figure 2 provides an example of this first stage. When interpreting this diagram, it can help to note that VMEP and the theory reinforcing this approach to logic models do not usually differentiate objectives from impacts (see Duignan, 2012b). Instead, objective and impact components are collectively referred to as *outcomes*. For the current thesis, outcomes are referred to as *components* - to mark the role of these elements within a complex adaptive system of community resilience.

Figure 2. Simplified illustration of a VMEP logic model after stage one.

VMEP users then link diagram components in terms of which projects are assumed to lead to which of the outcome boxes to the right. Likewise, outcome components are linked to one another, to show which outcomes are assumed to lead to outcomes further to the right. Relative priorities are also assigned to each component at this stage. Potential indicators are added at the following, third stage of VMEP. These indicators record potential ways to gauge the achievement for each of the components. The fourth stage of VMEP requires users to plan actual monitoring projects, in order to provide the data needed for working indicators. Evaluations which make use of these data are also planned at this stage. The fifth stage involves gathering results from indicator and evaluation projects, before reporting them as a dashboard of intervention progress on the original logic model. Duignan (2012a) suggested that a VMEP logic model is likely to be revised and improved as a result.

This thesis will extend into the third stage of VMEP with WREMO, during action research carried out as part of this thesis. Figure 3 provides a simplified example of a VMEP logic model looks like at the end of this third stage. Green components to the left still refer to intervention projects. Likewise, the yellow components at centre still refer to project objectives and the beige components to the right refer to down-stream impacts.

Indicator markers, shown as coloured rulers underneath some boxes, and the small round circles showing priorities are standard features of VMEP diagrams. Arrows are usually hidden from immediate view in larger models. Particular colours have not been stipulated in Duignan's (2012a) guidelines. These distinctions are my own, to provide a more rapid explanation of how outcomes can be ordered from left to right in the VMEP diagram format. This approach to placing outcomes is explained in more detail in 1.4.2.

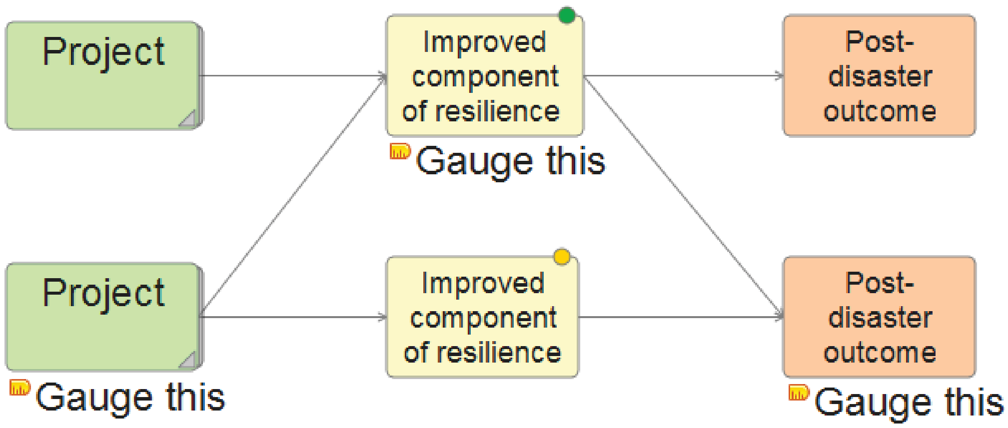

Figure 3. Simplified illustration of a VMEP logic model after stage three.

A central hypothesis of this thesis is that the syntax of VMEP diagrams may provide particular advantages over more definitively text-based alternatives. As outlined in research by Huggins and Jones (2012), into the development of a VMEP-like framework for the New Zealand Department of Conservation, these types of visual logic models require a minimum of text-based syntax. This prior research referenced commentary by Delorme (2010) concerning the challenges of usefully representing complexity. It was concluded that avoiding an over-reliance on text-based syntax has the potential to generate more defensible outcomes due to the increased ease of collaborations between diverse fields of knowledge. It follows that information displays which are not overly reliant on text based information may represent heuristic components contributing to a greater degree of ecological rationality. In other words, the current thesis assumed that VMEP logic models provide a very selective component of heuristic processes. They may nonetheless provide a more effective representation of certain domains, compared to more elaborate or text-based alternatives. Information displays which do not require users to read large bodies of text-based information, and which are less constrained by traditional rules for text-based syntax, may be more efficient heuristic components for guiding useful action. As outlined at the beginning of the current chapter, this relates to a number of cognitive advantages inherent in the use of visual representations rather than text-based equivalents. These advantages, and further advantages at the group level, are explored in more detail in Chapters 6 and 9, concerning the latter two of three studies comprising the current thesis.

The VMEP process closely resembles a type of performance monitoring called results-based management. According to Cummings (1997), results-based management is a method of gauging the relationship between organisational activities, outputs, outcomes and impacts. By contrast, program logic models are usually focused on the relationship between resources, objectives, outputs, and outcomes (Cummings, 1997). The former focus on program effects rather than resource inputs is echoed by the VMEP focus on multiple levels of outcomes. Although VMEP also depends on the development of logic model diagrams, this process of deriving and building a logic model is more closely aligned with contemporary results-based management approaches, rather than pre-existing approaches to program logic models.

This does not mean that results-based management provides the ideal precedent to follow. Among other issues, Mayne (2007) stated that results-based management usually struggles to link financial inputs with performance. Cummings (1997) suggested that the absence of explicit financial and other resource inputs in results-based management frameworks makes it difficult to gauge the efficiency of programs being monitored. The same limitation may apply to VMEP logic models because there is no one step of the VMEP process which requires costs and other resource inputs to be allocated to activities on the logic model. A number of other potential pitfalls and limitations of the VMEP process are outlined below.

1.3.3 A need for caution. Adaptations of VMEP process and diagram formats need to consider existing critiques, from a program evaluation standpoint. A New Zealand based critique by Roorda and Nunns (2009) suggested that diagram-based logic models have relied upon an unrealistic depiction of one-way, linear causality. According to Roorda and Nunns (2009), this has not represented the complicated coordination of collaborating institutions which is required for genuinely systematic interventions. Roorda and Nunns (2009) recommended a more expansive and openly collaborative approach to diagrams, to depict a greater depth of conceptual information, together with variations between parts and levels of the program being considered. Although they recommended the use of conceptual systems diagrams, Roorda and Nunns (2009) had reservations about the depth of system detail which could be represented on any one diagram of systematic interventions.

VMEP could resolve some of the issues raised by Roorda and Nunns (2009), to some extent. As outlined in Huggins and Jones (2012) and Huggins and Peace (2014), a more collaboratively grounded approach has been built into VMEP-like logic models through a multi-level approach to many-to-many modelling. Multiple drill-down levels can help maintain the coherence of any one view of an overall logic model, without cluttering summary representations shown on any one page. Modelling many-to-many causation also means that program logics can remain plural and multi-layered, right up until the highest level of strategic outcomes. In brief, this means that any model component can be said to lead to any other model component, without needing to display all components at once. Furthermore, depicting higher levels of this many-to-many causation without causal arrows can be used to represent more holistic, systems-orientated understandings of the intended interventions. Certain outcome components of VMEP diagrams can also refer to feedback processes, without needing to detail the full feedback logic on all views of the VMEP model.

None of these, relatively standard, aspects of VMEP models avoid the need for VMEP logic models to refer to surrounding knowledge concerning the complex systems of interest. Like the imaginary borders of a backyard garden ecosystem, complex systems naturally expand well beyond the boundaries of any particular intervention logic. Apparently external considerations can include background assumptions about even more diverse fields of knowledge (see Huggins and Jones, 2012) and ethical imperatives such as social justice. For example, Sen's (2009) capabilities theory of social justice focuses on supporting people to enjoy aspects of their lives which they have reason to value. This broadly ethical imperative was a particularly important consideration for the logic model used to create the Canterbury Wellbeing Index discussed earlier in this chapter and outlined by Morgan et al. (2015).

As an ethical imperative, the consideration of social justice highlighted societal concerns for an extended recovery period of gathering, collating and disseminating governmental monitoring data between agencies party to the Canterbury Wellbeing Index. Furthermore, establishing an ethical context meant that collaborating agencies were not led to assume that tangible recovery ends justified any of the possible means of achieving those ends. This approach to ethical framing reinforced the difference between pragmatic and more rigid philosophies concerning the consequences of knowledge about social systems. According to Lee and Nickerson (2010), a pragmatist philosophical approach typically considers social practices affected by knowledge in terms of a surrounding value system. This is in vivid contrast with the popular philosophy of act-utilitarianism which, according to Bales (1971), can be used to focus on the direct influence that actions have on a population's happiness, without explicitly considering any other ethical criteria. Note that my personal experience in the Canterbury Wellbeing Index project has complemented information from the public presentation by Morgan and Begg (2013) and the academic paper by Morgan et al. (2015). As a result of considering certain strengths of this indicator framework precedent, it is assumed that ethical issues need to be addressed as part of the VMEP process used in the action research component of the current thesis outlined in 1.7.

Further caution surrounding the use of VMEP-like logic models has been prompted by Huggins and Jones (2012). This study of logic model user experiences concluded that logic model formats appear to suit some communication objectives more than others. As stated by Armstrong (2010), concerning the use of logic models for developing and communicating results-based management: "there is no magic bullet here" (p. 1). Furthermore, indicator frameworks can often be challenging to build and implement regardless of the format being used to display them (Armstrong, 2010). Rorty (1980) suggested that, as part of a pragmatist approach to any theory, procedure cannot take the place of dialogue and deliberation. These latter two aspects of theory development need to be carefully facilitated as a more iterative dimension of any VMEP-like process constituting action research as part of this thesis.

As also highlighted by Armstrong (2010), software used for VMEP-like processes provides only one approach to building and using logic models for organisational development. Although Duignan (2012a) has recommended using DoView (Version 4.0, 2013) software for the VMEP process, other software provides similar functions. The current thesis therefore focuses on the VMEP process rather than the software used to facilitate it. As a result, this thesis contributes to an evidence base concerning the use of VMEP-type processes and the display formats produced by those processes. According to Armstrong (2010), the evidence base informing such processes has been largely self-referential, within the bounds of Duignan's own work. The current thesis therefore builds on the work of Huggins and Jones (2012) and Huggins and Peace (2014), in an effort to better illustrate the potentials and limitations of VMEP-like processes. The thesis also marks an effort to link research into VMEP-like processes with related bodies of relevant research and theory, as outlined in the preceding sections and in 1.4 below.

1.4 Additional Key Concepts

In order to build an understanding of some of the conceptual and theoretical gaps that discourage effective analysis of community resilience in the WREMO context, this thesis incorporates concepts from a range of disciplines, including political science, sociology of science, program evaluation, and organisational psychology. This thesis therefore depends on the use of several key concepts, in addition to the concepts outlined previously in this chapter. Many of these additional concepts can be expressed in terms that have multiple definitions in academic, professional, and more common usage. For this reason, and for overall clarity, it has been best to use these early sections of the thesis to define what these key terms mean for the thesis in particular. Five additional key terms are defined below, under the categories of inter-group dynamics and evaluation-related. In addition to terms already defined in the remainder of this chapter, these definitions help provide a background, rather than an exhaustive glossary for the rest of this thesis.

1.4.1 Inter-group dynamics. The political science term, *viewpoint* was used by Brown (1980) to explain how differing individual opinions appear to conform to certain patterns within groups of individuals. Considering the potentially divisive nature of community resilience concepts, it is assumed that identifying viewpoints is an important preliminary to developing a collaborative logic model of community resilience interventions. It is assumed that identified viewpoints help define the types of decisions which a logic model needs to facilitate, in order to be useful to participating stakeholders. As further detailed in 1.6, this is a core assumption concerning preparations for action research carried out as part of this thesis.

The sociological term, *technical rationality* is highly relevant to interpreting results from any analysis of viewpoints among researcher and practitioner groups. According to Schön (1995), technical rationality is a persistent belief within research institutions concerning researcher-practitioner interactions: that researchers should identify a research problem, analyse the problem and provide the results for practitioner uptake. Implications of assuming this one-way research process from researchers to practitioners is discussed in more detail in Chapters 2, 3 and 4, concerning the first study comprising this thesis.

The concept of *double demotivation* was developed by Carr and MacLachlan (1995, July), Carr and MacLachlan (2005) and MacLachlan and Carr (1993) to describe escalating cycles of friction and apathy between local practitioners and external humanitarian experts. Interactions between these groups can be mutually misinterpreted, leading to a mutually destructive dynamic between local and external collaborators, with few if any useful outcomes. This dynamic was originally observed, by MacLachlan and Carr (1993), when differences in viewpoints held by local practitioners and local experts meant they were unable to constructively work alongside one another. Apparently, this was due to a lack of shared representations and the misinterpretations that followed. The resulting concept of double demotivation is discussed in Chapter 4, as a way of conceptualising interactions between community resilience practitioners and the external researchers aiming to assist them.

1.4.2 Evaluation-related. As briefly introduced earlier in this chapter, the academic domain of evaluation concerns analyses which directly inform practical interventions, such as researchers' analyses aiming to examine and improve a specific program of community resilience interventions. The term itself, *evaluation* can have various definitions, depending on the disciplinary or practical context in which it is being used. The current thesis concerns evaluation in terms of program evaluation which, according to the Development Assistance Committee (2015) concerns: "evaluation of a set of interventions, marshalled to attain specific…. development objectives" p. 26). According to Wholey, Hatry and Newcomer (2010), program evaluation provides "feedback on program expenditures, program operations, or program results" (p. xvii). As outlined by the Development Assistance Committee (2015), program evaluations often relate to a particular program timeframe. In a practical sense, they seek to answer: "Who, in what circumstances, and in what way, did or didn't benefit from the thing you are evaluating, who learned what from that, and what does this imply for the future?" (Williams, 2015, p. 1).

The current thesis takes an approach to evaluation which is based on outcomes theory from Duignan (2010). This theory includes two key terms which help clarify how logic models work. Firstly, *outcomes hierarchies* are used to:

> make claims about what are the cascading sets of causes and effects in the real world in the domain in which someone is trying to intervene in such causal

> systems. Such hierarchies, whether explicit or implicit, in narrative, tables, databases or visualizations, underlie all outcomes and performance management systems.
>
> Duignan (2010, para 3)

According to Duignan (2010) *outcomes systems* “attempt to provide monitoring or facilitating frameworks within which interventions occur … directed at maximizing the achievement of higher-level outcomes as specified in one or more explicit or implicit outcomes hierarchies.” (para. 4). Visual monitoring and evaluation planning (VMEP) logic models outlined by Duignan (2012a) form one kind of outcomes system. This approach to using monitoring and evaluation to improve socially complex programs forms a central focus of this thesis, as outlined in 1.3.

1.5 Aim and Research Questions

This thesis systematically applies the ecological rationality concept introduced in 1.3 to a set of abbreviated, external heuristic components concerning community resilience in the Wellington emergency management context. For the purposes of this thesis, visual logic models form the external heuristic component of interest in this context. Particular attention is paid to examining the assumption that decisions about complex systems can be improved by using visual logic models rather than predominantly text-based heuristic components. As a response to this need, a logic model design is developed and examined for its capacity to improve decisions about intervening in a particularly complex domain. Any findings regarding the way that logic model contributes to ecological rationality mark a contribution to theory concerning the importance of external representations for improving decisions made by groups and individuals in complex scenarios.

As outlined at the start of the current chapter, this thesis primarily aims to develop a more specific body of evidence to inform the use of distinctly visual, diagram-based information displays, for developing a suite of strategic community resilience interventions. Findings from this thesis may also be important to a range of researchers and practitioners in more practical terms. For emergency management researchers, this thesis has the potential to highlight elements of building and using a logic model which facilitates their active involvement in complex emergency management domains. For emergency managers, this thesis has the potential to detail management processes which can be used to better support community resilience in the face of disasters. For disaster-affected communities, with reference to Béné et al. (2012), the current thesis has the potential to help facilitate emergency management efforts to support communities' capacity to resist, recover from, adapt to, or mitigate the effects of a shock.

In sum, this thesis is important to a range of researchers, practitioners and communities in domains within and outside of emergency management. It is important to these groups because of the way that a range of pre-existing theory and research findings are being orientated towards the development, assessment and improvement of documentation which aid, rather than hinder, efforts to address the complexity of community resilience. These applied achievements also reflect back on theories concerning philosophical pragmatism, external representations, and ecological rationality, to improve linkages between logic model practice and complexity theories which may otherwise remain superficial.

As outlined earlier, and in order to address these threefold potentials, the overall aim of this thesis is: to develop a more specific body of evidence to inform the use of distinctly visual, diagram-based information displays, for developing a suite of strategic community resilience interventions. The primary research question is: How can a logic model display, which uses boxes and arrows to display linkages between activities and downstream objectives, be used to help research and practitioner groups pragmatically address the complexities of community resilience? The information display in question is a visual logic model produced through a VMEP-like process, to outline a set of program objectives, the steps required to achieve them, and the metrics used to assess the achievement of those objectives. Pragmatically addressing the complexities of community resilience refers to efforts to improve community resilience outcomes which are explicitly useful to at least one identifiable group.

A visual logic model is constructed during the course of this thesis to help provide a highly selective representation of a complex community resilience system which helps to facilitate these outcomes. This approach is informed by how the concept of ecological rationality defines the potential usefulness of this abbreviated representation as part of efficient decision making within a certain practical domain. The primary research question incorporates a number of assumptions to be refined during the course of three separate studies. Questions and assumptions for each of these studies are outlined below.

1.5.1 First research question: What are the strong patterns of opinion that need to be considered when implementing an information display for collaboratively monitoring and evaluating a regional community resilience strategy? At a very practical level, answering this question helps to ensure that emergency management practitioners and researchers are motivated to help construct a relevant monitoring and evaluation framework. Continuing research as part of ICoE:CR development is not feasible without engaging these professionals on their own terms. Establishing viewpoints held by these professionals also helps establish how any logic model produced can help promote useful decisions, as part of ecological rationality.

This first research question depends on two assumptions. Firstly, it is assumed that the usefulness of decisions made using a monitoring and evaluation framework can be defined by analysing patterns of opinions among two very different groups of professionals. In other words, it is assumed that the analysis of strong beliefs concerning the use of indicators for monitoring community resilience provides insights concerning the potential usefulness of those indicators. It is assumed that these beliefs represent elements of organisational and profession specific culture which, according to Hutchins (2008, 2014), form an essential aspect of distributed cognition dynamics.

Question one also depends on a second assumption, that viewpoints about monitoring and evaluating community resilience can be coherently identified. This second assumption is based on methodological theory from Brown (1980), which outlines how factor analyses of opinion data can provide a relatively objective analysis of opinion structures. This theoretical assertion is supported by more than 1,500 pieces of Q-methodological research (see Thomas & Watson, 2002), including recent organisational studies by Gottshalk (2001), Sostrin (2008) and by Thomas and Watson (2002). This latter assumption, concerning the importance of considering culture as part of distributed cognition, is nonetheless considerably novel in the current monitoring and evaluation context. More details are provided in Chapter 2.

1.5.2 Second research question: How can a logic model support collaborative efforts to usefully monitor and evaluate a complex community resilience strategy?

This research question is central to the aim of this thesis as a whole, because it frames a potential exemplar of logic model usefulness, in a definitively complex scenario. Based on the broad range of research and theoretical literature discussed in 1.1, 1.2, 1.3 and 1.4 above, it is assumed that a visual logic model can be usefully embedded within WREMO as part of the ICoE:CR, to address objectives identified while answering the research question outlined in 1.5.1. This assumption is specifically based on a tentative finding from Huggins and Jones (2012), that a richly visual approach to monitoring and evaluation for complexity can resolve the syntactical limitations of many external representations by focusing on pragmatic objectives rather than text-based narrative language structures.

Answering this research question depends on support from WREMO and the ICoE:CR, for using a visual logic model as part of their organisational development. Failure to attract these organisations' support for developing the logic model makes it impossible to answer any question about the way the logic model functions as part of their program development.

1.5.3 Third research question: How can experimental methods help define the advantages of using a visual logic model for addressing strategic aspects of a complex emergency management scenario? In analytical terms, this research question asks whether using a richly visual logic model can lead to an observable improvement in decision making quality, compared to using a status quo summary of the same strategy. Decision making quality is assumed to characterise the functions of both the logic model and any status quo summary as part of ecological rationality. This third research question broadens the scope of the previous research question, by focusing on implications beyond the Wellington context. It is assumed that rich visual displays can support a demonstrable improvement in ecological rationality among a range of emergency management professionals working with community resilience. In this case, demonstrable improvement refers to observable and systematic improvements under experimental conditions compared to a status quo, predominantly text-based, information display.

The assumption that both displays result in some degree of improvements in decision making without any external representation is principally based on the work of Hutchins (1995), which outlines the value of information displays for groups addressing the cognitive challenges posed by complex scenarios. Hutchins (1995) documented the role of instrument panels and other displays for helping crews work together to ensure the safe passage of large marine vessels and aeroplanes. It is also assumed that quasi-experimental analyses of these kinds of dynamics, by the United States Naval Sea Systems Command (2005), can be adapted to suit the longer timeframe of a regional community resilience strategy. This adaptation is necessary because Naval Sea Systems Command (2005) precedents have typically focused on much shorter-term scenarios, faced during military combat. As outlined in Chapter 8, there is nonetheless no guarantee that all measures can be successfully adapted from tactical to strategic decision timeframes.

1.6 Overall Research Design

This thesis is based on three distinct phases of research, with one study for each of the research questions outlined above. This reflects a sequential mixed-methods approach, as defined by Bamberger, Rugh, and Mabry (2006). To fit with this approach, the three studies use slightly different sets of epistemological assumptions to develop insights about three different dimensions of using visual logic models for developing a program of community resilience interventions. Studies One and Three use slightly different interpretations of post-positivist epistemology while Study Three uses critical realism.

Each of these epistemological theories is outlined in a methodology chapter preceding each of the main study chapters.

Despite differences between the epistemologies used, particular findings and/or data from one phase is used to inform, or contribute materials to, a subsequent phase. These particular findings and/or data are assumed to pass over the epistemological threshold from one study to another because, as shown in figure 4, they constitute particularly active elements of one study's findings, with pragmatic effects which are observable using more than one methodology.

This approach to linking different epistemologies by pragmatic effects does not assume that background epistemologies about each piece of knowledge are equivalent. Instead, it is assumed that different epistemologies can be used to observe the pragmatic effects of certain phenomena, regardless of the epistemology originally used to detect those phenomena. As outlined in 1.1, Rorty's (1980) pragmatism provides the philosophical foundation for the practice of interest, being program evaluation using logic models. This theory of pragmatism is also used to synthesise findings between thesis phases. Although three different sets of epistemological theory are being used to develop different parts of this thesis, the knowledge produced by each of these approaches is synthesised by what Reason and Bradbury (2001) called a focus on *practical knowledge*, or knowledge "that is useful to people in the everyday conduct of their lives" (p.2).

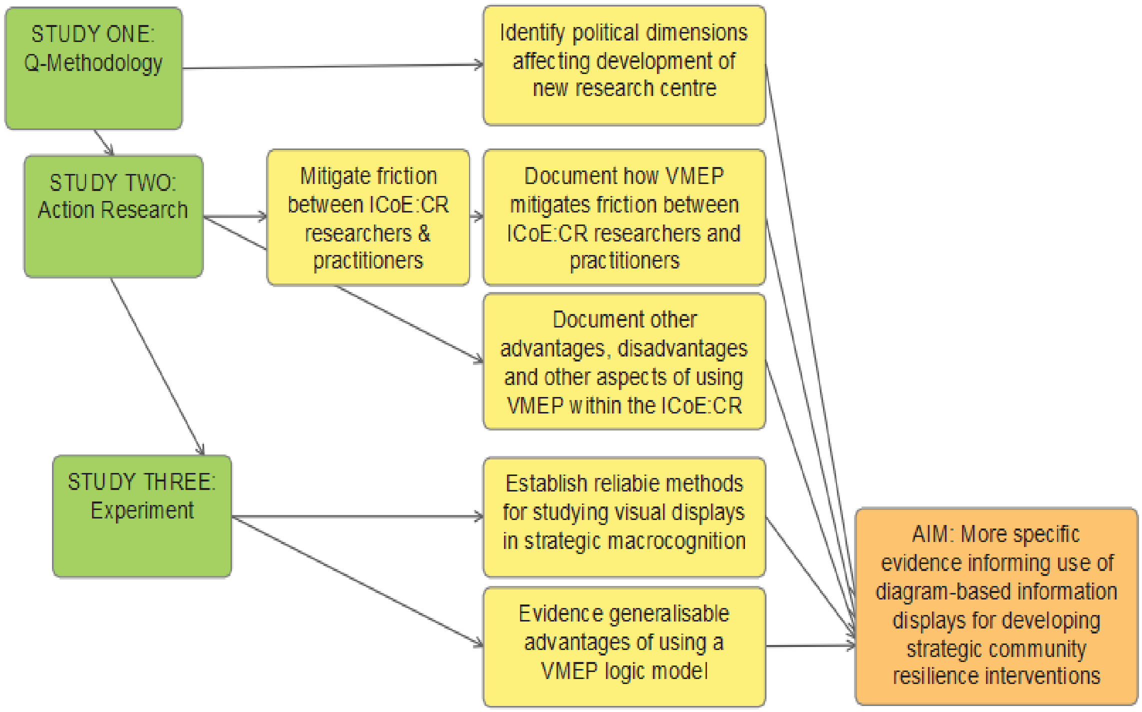

Figure 4. Relationship between different studies and common objectives.

This common thread, of generating practical knowledge, is most obviously applicable to action research carried out in Study Two. As detailed in 1.6.2 below and in Chapter 5, this phase of the thesis has the potential to promote the development of a community of inquiry. According to Reason, (2003), this community of inquiry is a purpose of action research which is distinctly aligned with Rorty's (1980) pragmatism. Both other phases of this thesis are also principally concerned with highly practical issues and applied circumstances. A pragmatic approach to synthesising between different epistemologies is based on how the same overarching potential is shared by each study, for improving emergency management and related planning, monitoring and evaluation practice. At the onset of this thesis, it is assumed that the experimental methods of Study Three outlined in 1.6.3 form what Bamberger et al. (2006) referred to as the *dominant* methodology of the chosen mixed-method approach. This means it is assumed that experimental methods can be used to test certain pragmatic effects identified using any other methodology in the previous two studies.

The first two studies combine to form a generally abductive approach to the overall research question: How can an information display help research and practitioner groups to pragmatically address the complexities of community resilience? This is because abductive inferences made over the course of Studies One and Two are then used to inform hypotheses made during Study Three. This thesis therefore depends on a largely abductive approach to research-based inferences. According to Levin-Rozalis (2004), an abductive approach to social science research takes an initial set of assumptions before revising and adjusting those assumptions as research data is collated and analysed.

At this stage, it is important to define exactly what I mean by an abductive approach to the overall research question, with reference to extant literature concerning the background philosophy of science. This need for definition is based on Blaikie (2004) who stated that, although the term abduction has often been used to describe researchers' analysis of participants' accounts, it has only been vaguely defined in research literature.

Peirce (1935) wrote that abductive logic can provide a useful understanding of the world. This appears to be achieved through tentative predictions, or hypotheses, used to account for the discovery of surprising phenomena. According to Peirce (1935), this marked the way we ought to think, rather than the way we do. The current thesis reflects the latter part of Peirce's (1935) writings on the subject of abduction. This is where, according to Burks (1946), Peirce began to discuss the implications of abductive logic for making inferences as part of research methodologies in particular. Based on his apparent support for iteration and the value of researchers' interpretations, it could be argued that Peirce's (1935) theory of abductive research rests on the assumption that humans have an instinct for truth (Burks, 1946). However, according to Peirce (1935), abductive logic is simply an effective response to the discovery that our prior beliefs are in some way flawed (Peirce, 1935). Under these conditions, abductive logic demands the formulation of new hypotheses, to help account for new and surprising observations –rather than some internal intuition which is innately correct.

This means that abduction is a form of inference, which generally uses a set of observations to arrive at a logical conclusion. Inductive inference is another form of inference characterising research methodologies. However, abductive methodologies differ from inductive approaches to research. According to Peirce (1935), induction accounts for generating, rather than testing, hypotheses. Both induction and abduction run in the opposite direction of deductive logic, which is used to predict observations in an effort to test pre-existing hypotheses. Both inductive and deductive logic are nonetheless employed at discrete stages of the current thesis.

It is therefore important to state how abduction helps to bring all three studies together. This approach to methodology allows me, as a researcher, to respond to surprises which are likely to emerge while studying a relatively novel and highly specific research topic: visual solutions for the complex strategic scenario of community resilience approaches to emergency management. New hypotheses are formed to help account for these surprises.

The relationship between methodological abduction and philosophical pragmatism marks a strong potential for applied research which, according to Adler and Norrgren (2004), focuses on improvements within explicitly practical domains. This is precisely the target of practical knowledge in pragmatic inquiry, as outlined earlier in this chapter with reference to Reason and Bradbury (2001). Abductive methodologies are used to both formulate and iterate tentative assumptions about the practical domain of emergency management in particular (Huggins & Johnston, 2015). This appears to be achieved once researchers are willing to accept that surprising results require the reformulation of prior beliefs through the generation of new hypotheses. The current thesis begins by assuming that external, information display components form part of ecologically rational approaches to improving community resilience approaches to emergency management. This initial assumption is iterated over the course of the current thesis, into new hypotheses which can be used to guide further practice.

The three distinct phases are also directly linked to one another in more immediately practical terms. Study One provides a background analysis of the Wellington emergency management context. This is used to inform the design of VMEP processes to be implemented during Study Two action research. Opinion factors identified in Study One are also used to analyse participants' accounts of the VMEP process. Likewise, the VMEP process implemented during Study Two action research produces the displays to be assessed in Study Three. The use of displays co-created through genuine practitioner-researcher collaborations means that experimental conditions reflect real displays which are actually being used for emergency management in New Zealand.

1.6.1 Study One: To identify a range of viewpoints from both researchers and practitioners in relation to developing an ecologically rational approach to community resilience. This study uses Q-methodology – a research approach that enables a range of viewpoints to be identified and statistically verified. Q-methodology is used to more clearly identify how differences in points of view could make it difficult to produce community resilience measures which are mutually understandable across researcher and practitioner user groups. Commonalities are also identified, as a cue to building collaborative approaches between the two groups. The main research question to be answered during this study is: What are the strong patterns of opinion that need to be considered when implementing an information display for collaboratively monitoring and evaluating a regional community resilience strategy?

1.6.2 Study Two: To complete and document the development of a VMEP logic model as a heuristic component for decisions concerning community resilience.

In the light of better understanding the viewpoints of different contributors to the logic model process, existing VMEP logic model processes are adapted to build an operationally relevant framework of community resilience activities, objectives, indicators and evaluation questions at a regional scale. The process of adapting and applying VMEP to reflect the regional community resilience strategy constitutes the continuation of applied research within the ICoE:CR. The main research question for this phase is: How can a logic model support collaborative efforts to usefully monitor and evaluate a complex community resilience strategy? This research question is broken down into two parts for Study Two: How can existing processes for indicator framework development be adapted for improving community-driven disaster risk reduction at a regional scale; and in what ways can the usefulness of VMEP be demonstrated, as a tool for working across diverse viewpoints?

Study Two action research is personally facilitated as part of a collaborative action research arrangement with WREMO and the ICoE:CR. This participative approach to Study Two depends on existing organisational expertise within the ICoE:CR. It also uses feedback from core ICoE:CR members to ensure that the VMEP process and resulting logic model meet practitioners' and researchers' needs. The main output for this phase is a report documenting the process leading from a draft version of the WREMO community resilience strategy and an initial draft set of key performance indicators to the subsequent iteration of a visual logic model. This report is based on a set of critical realist assumptions detailed by Frauley and Pearce (2007), concerning the value of longitudinal accounts referring, but not limited to, observed events. As outlined in Chapter 5, this theory of research based knowledge backgrounds the use of documented VMEP iterations as observed events within a narrative account of the Study Two action research process.

1.6.3 Study Three: Piloting methods to compare practitioners' responses to the resulting visual framework with responses to a standard table of key performance indicators. This phase involves an experimental comparison of visual and text-based framework formats generated during Study Two. This comparison is performed to test claims by Hutchins (1995), Huggins and Jones (2012) and Owen et al. (2013): that certain information displays improve collaborative engagement with complex decision making scenarios. The main research question for this phase is: How can experimental methods help define the advantages of using a visual logic model for addressing strategic aspects of a complex emergency management scenario?

1.6.4 Overall Research scope. The current thesis is set within the expansive domain of community resilience. It is focused on the question of whether visual logic model can provide an external heuristic component for supporting strategic decisions within emergency management. As highlighted in a commentary by Prior and Roth (2015) on the new Sendai Framework for Disaster Risk Reduction 2015-2030, national and sub-national policies are an essential aspect of disaster and emergency management. The current thesis, however, examines dynamics at a sub-policy level. This research assumes that practitioners and researchers assisting them often need to do what they can with existing legislation and policy - whether or not they simultaneously advocate for policy level amendments.

Although much of this research is focused on cognitive theories, very few references have been made to tacit, internal cognitive processes. The majority of data used in the current thesis is drawn from observations of participants’ behaviours and explicit interview accounts. During Study One, Q-methodology is used to take a more tacit approach to identifying background opinion factor structures. However, the opinions being analysed concern technical, non-personal aspects of monitoring and evaluating community resilience. Likewise, Study One is not concerned with trying to reveal individual cognitive structures representing participants’ personal understandings of their work with community resilience. The Q-methodology process is kept as transparent and non-projective as possible and is focused on opinion structures at an inter-subjective level of participating groups and sub-groups. These are some of several efforts to ensure that findings produced by this thesis are as transparent and non-threatening as possible, for a range of potential end-users, including current research partners and other audiences. The current approach to analysis therefore takes a relatively superficial view of consciousness and group dynamics related to cognition in complex scenarios. More methodological detail on each of the studies is provided in dedicated methodology chapters prior to each of the main study chapters.

1.7 Conclusion

This thesis aims to develop a more specific body of evidence to inform the use of distinctly visual, diagram-based information displays, for developing a suite of strategic community resilience interventions. Community resilience has become an increasingly popular focus for emergency management. This does not mean it is a focus that is easily defined or agreed upon. Research-based literature describes community resilience as encompassing a community’s capacity to resist, recover from, adapt to, or mitigate the effects of a shock event (Béné et al., 2012). However, practice based understandings appear to be based on much more simplistic understandings of community resilience. For example, the concept of rapidly bouncing back to a pre-disaster state has been particularly popular amongst some New Zealand based emergency management stakeholders. Relatively less simplified understandings of community resilience may promote transformations required to lessen the impacts of future disasters. Relatively less simplified understandings may also acknowledge the inherently social nature of community resilience, rather than reducing related emergency management to an engineering concept of resilience as resistance. It appears that contributions to improving the practical uptake of these, apparently more useful, community resilience concepts can be made from political science, sociology, organisational psychology, evaluation and cognitive psychology.

However, as outlined in 1.3, the complex systems characterised by community resilience will inevitably be simplified to some extent. This is because fluidity and emergence within these systems typically overcome our ability to definitely describe them at any one point in time. As outlined by Huggins and Jones (2012), simplified heuristic components can include both internal mental models and external displays for dealing with complexity. The WREMO (2012) Community Resilience Strategy for the Wellington region of New Zealand provides a good example of a text-based external heuristic component that describes multiple interactions comprising the complexity of community resilience. However the predominantly text-based syntax of this document may not usefully connect WREMO activities with community resilience objectives and downstream impacts. In the terms of ecological rationality, this means the original document may not be capable of supporting effective and useful decision making.

This thesis assumes that richly visual logic model displays can enhance awareness of pragmatic implications, and support a more collaborative approach to complex domains, to enhance strategic decision making with long term implications. Three separate studies combine to form a generally abductive approach to further refine these and other assumptions as the research progresses. Study One uses Q-methodology to ask: What are the strong patterns of opinion that need to be considered when implementing an information display for collaboratively monitoring and evaluating a regional community resilience strategy? Study Two documents implementation of VMEP within the ICoE:CR to ask: How can a logic model support collaborative efforts to usefully monitor and evaluate a complex community resilience strategy? Study Three uses an experimental design to ask: How can experimental methods help define the advantages of using a visual logic model for addressing strategic aspects of a complex emergency management scenario?

As outlined in 1.6, each of these studies is used to formulate pragmatic implications. In some cases, findings directly inform the subsequent study. For example, findings from a study of strong opinions in Study One inform the action research approach taken in Study Two. Study Two in turn informs the media used as experimental stimuli for Study Three. These relationships between studies provide one example of pragmatic implications extending beyond the bounds of epistemological diversity.

The remainder of this thesis comprises chapters for each of the three studies outlined above, and an overall conclusion. An academic paper summarising each study is included in the form of a peer-reviewed research manuscript. Each of these papers is preceded by a chapter outlining the methodology used to design the study in question. Each academic paper is followed by a chapter of reflections on how the study contributed to the thesis as a whole, and to my learning as a doctoral student. The final reflection chapter is followed by an overall conclusion chapter which synthesises current research findings from both practical and theoretical viewpoints. A list of figures is provided on page ix and a list of tables is provided on page x.

As outlined in 1.5 and 1.6, the first phase of research involves identifying strong patterns of opinion which inform subsequent research within the ICoE:CR, by asking: What are the strong patterns of opinion that need to be considered when implementing an information display for collaboratively monitoring and evaluating a regional community resilience strategy? A Q-methodological analysis of communications circulating amongst Wellington-based community resilience researchers and practitioners is used to answer this initial research question. Methodological considerations surrounding this approach to opinion analysis are outlined in the following chapter, as is relevant literature concerning Q-methodology and its critique.

2. Methodology for Study One

This chapter outlines the methodology for Study One that used Q Method to identify strong opinions about community resilience, held by researcher and practitioner members of a new collaborative research centre. The principal aim of this study was to identify differences and similarities in their opinions about building a shared framework of community resilience indicators. Study One was an important precursor to building such a framework in Study Two, by building trust with the host organisation while showing the value of analytical approaches to the development of their community resilience strategy. As a researcher, Study One also offered me an opportunity to better understand the lived experience of WREMO managers, personnel and their collaborators, to help ensure that any subsequent research with the ICoE:CR would be both relevant and appropriate to their emerging needs.

A detailed explanation of Q-methodology is provided because this approach may be less familiar than the use of other techniques to gather opinion-related data, for example, in-depth interviewing or surveying. The chapter begins by outlining the highly plural context being researched and the consequent need to identify strong patterns of opinion before beginning action research. To ensure that the Study One summary in Chapter 3 can be more clearly understood, the current chapter then works through a number of key methodological considerations. This is followed by an explanation of all data collection and analysis methods applied in the first study of this thesis.

The timing of Study One coincided with the development of a new collaborative research centre introduced in 1.2 and called the ICoE:CR. This research centre was focused on bringing emergency management researchers and practitioners together to develop and improve approaches to community resilience against disasters. The main focus of the ICoE:CR was the WREMO (2012) strategy for developing community resilience to disasters across the Wellington region of New Zealand. This strategy took a relatively innovative approach to emergency management. Where emergency management offices throughout the world had traditionally focused on emergency response, the WREMO community resilience strategy reflected the shift towards a more comprehensive approach outlined by Waugh and Streib (2006). For example, the WREMO (2012) strategy used the concept of social capital to highlight how strengthening pre-disaster social ties could improve the recovery phase of emergency management.

In adopting an approach that was so different from the usual response-focused approach to emergency management, WREMO was relying on effective communication with other ICoE:CR members to ensure effective implementation. Different groups within the ICoE:CR had different interests in the new WREMO strategy and WREMO managers were looking for ways to increase engagement and understanding. At this time, I was in communication with the WREMO team and advocating for research that could uncover some of the internal ICoE:CR politics resulting from differences between emergency management researcher and practitioner groups. Although it had been agreed that the WREMO (2012) Community Resilience Strategy should be research informed, there was a remaining question of just how this could occur. It was unclear whether the two initial ICoE:CR groups, of researchers and practitioners, would be able to work together to communicate and make decisions concerning potential improvements to the WREMO strategy.

To help clarify this situation, Study One explored some of the intergroup dimensions of WREMO’s anticipatory, community resilience approach that were likely to affect the strategic direction and development of the ICoE:CR. Study One specifically aimed to identify differences and similarities in practitioners' and researchers' opinions about building a framework of community resilience indicators that would be shared within the ICoE:CR. As outlined in 1.5, the overall research question being answered by this study was: What are the strong patterns of opinion that need to be considered when implementing an information display for collaboratively monitoring and evaluating a regional community resilience strategy?

It was assumed that the potential usefulness of a monitoring and evaluation framework could be defined by analysing patterns of opinion amongst a group of researchers and a group of practitioners who already formed part of the ICoE:CR. For the purposes of examining distributed cognition as part of the current thesis, strong patterns of opinion represented a cultural dimension of how these groups were likely to incorporate a VMEP information display as part of goal driven interactions. Hutchins (2008) defined cultural dimensions of distributed cognitions as, "things people do and their learned ways of being in the world… in a cognitive ecology that is constrained or coordinated with the practices of other persons" (p. 2012). This definition backgrounded Hutchins' (2008, 2014) argument, that cultural dimensions determine how symbolic representations of the world are incorporated as part of human thought.

Identifying cultural perspectives and the way they varied among practitioner and research groups was therefore an important part of designing a logic model that would be incorporated within decisions concerning ICoE:CR development. This approach had the potential to produce research findings which were both theoretically and practically relevant to improving the WREMO strategy and other ICoE:CR concerns. Identifying inter-subjective patterns in the assumed usefulness of a logic model framework was an essential part of identifying how that logic model could contribute to the ecological rationality. As outlined in 1.3, this meant that the logic model framework could be constructed to support the quality of decisions concerning the complex domain of community resilience interventions.

This is how Study One formed an important point of departure for the VMEP process adapted and implemented in Study Two. The latter stage of this thesis focuses on using a combination of processes to construct a framework for monitoring and evaluating certain aspects of the WREMO strategy. Study One primarily helped prepare Study Two by involving “intended users and other stakeholders” which, according to Bryson and Patton (2010, p. 36), was the ideal way to begin assessing the evaluability of a set of interventions. The current approach to opinion research, using Q-methodology, meant that the viewpoints of these intended users and stakeholders were systematically considered when designing action research for Study Two.

The remainder of this chapter outlines assumptions about the relevance of Study One to the research domain, Study Two and the thesis as a whole. This Q-methodological approach to intergroup opinions provides certain advantages over survey-based approaches. These advantages are outlined below alongside epistemological assumptions providing the background for Q-methodology. A number of potential limitations of Q-methodology are also outlined in the current chapter, followed by efforts being made to overcome these limitations. These efforts address statistical sampling, data collection, factor analysis and the need to account for researcher interpretations made during the Q-methodology process. Assumptions regarding the Q-methodology approach to factor analysis are also detailed. In sum, the current chapter links a research question concerning strong patterns of opinions within the new research centre with a theoretically robust set of methods for identifying patterns in those opinions.

1.1 Background Assumptions

As outlined above and in Chapter 1, Study One depended on an assumption that views about the usefulness of monitoring and evaluating community resilience could be coherently identified, using Q-methodology rather than survey based research. The comparative strengths of Q-methodology are highlighted by considering certain limitations of survey based research, including the disaggregation of data to individuals rather than social groupings. This is where my argument for using Q-methodology begins, with a discussion of survey based opinion research.

Survey based research has often been used to identify patterns of opinions concerning socially complex domains. Examples include opinion survey analysis linking economic reforms to other political changes, by Wang, Rees and Andreosso-O'Callaghan (2008), and similar research linking climate change perceptions with government funding preferences, by Mumpower, Liu and Vedlitz (2015). These examples form part of a long history of survey based precedents which have been documented at least as far back as the 1950s, when a survey of health-related opinions was designed by MacMillan (1957).

Survey based approaches to opinion analysis offer an established and apparently uncomplicated way to analyse opinions within an identified group. However, the current thesis avoided using surveys due to two important critiques. The first critique is from Law (2009) who identified what he called a *hinterland* in survey-based research, where survey data treats each individual as an isolated entity whose data will be aggregated at the level which a researcher decides. According to Law (2009), assumptions reinforced by this approach to social science result in demand for more survey based research, to address problems which are persistently understood in terms of aggregating survey data from isolated individuals. However, opinions about more social matters involve dynamics within and between a variety of relevant groupings.

According to Law (2009), it does not make sense to aggregate a series of survey data which have no sub-aggregate relationship to each other. In other words, it can be problematic when research disaggregates social issues at the individual level without regard to context and social linkages. For example, evidence of a strong, collective opinion may be held by people with very different demographic characteristics such as males from the South Island of New Zealand and females from the Auckland area who might both, for arguments sake put a high value on environmental aesthetics. An analysis which looks for trends within groupings imposed by a researcher, based on demographic characteristics, is unlikely to identify this otherwise pertinent pattern of opinions.

There is also an issue of political agency here. Breaking political groupings down into segregated individuals does not reflect the potential agency of actual and potential social groupings, to act on their collective viewpoints (Law, 2009). Agency becomes analysed and promoted at the individual level or arbitrary levels of aggregate individuals. This does not reflect important actions by emergent social factions grouped together by common interests, activities, identity or location. This limitation of survey-based research was thematically relevant to the WREMO approach to emergency management because this community resilience approach could not exist without some notion of collective communities. It was additionally relevant to the ICoE:CR because, according to the Joint Centre for Disaster Research (2014), groups within this developing structure were clearly employed by either research or practice based organisations. Aggregated opinion analysis focused on more arbitrary or abstract groupings may have therefore made little workable sense for these members of the emerging ICoE:CR.

A second critique of survey based research was highlighted by Ellenberg (2014). Apparently there are several ways to calculate a group's aggregate preference from survey items with three or more non-scalar choices. Ellenberg (2014) provided the example of voting systems which use head-to head, instant run-off or single transferrable voting calculation systems. These apparently objective calculations can arrive at very different conclusions about the same effectively survey based data, leading to paradoxical conclusions about what should form a neatly aggregate, majority opinion (Ellenberg, 2014).

Considering criticisms from Law (2009) and Ellenberg (2014), it appeared that simplistic approaches to aggregating opinions needed to be avoided in Study One. The multi- dimensional topic of monitoring and evaluation community resilience combined with the clear diversity of study participants, meant that opinions needed to be identified along a number of dimensions. This multi-dimensional approach appeared to be more defensible than trying to reduce all analysis to reflect one unitary viewpoint, such as a voting outcome, held by the majority of participants.

According to Robbins and Krueger (2000), Q-methodology "examines the traits of a single person (holistically) rather than matching traits across individuals (atomistically) ... .a method that allows a respondent to assemble a model of her/his own subjectivity, preserving those self-referent factors during statistical analysis" (p. 637). This means that traditional statistical processes for what Stephenson (1935) called *r-methodology* are effectively inverted in Q-methodology. Hence, the term r-methodology has since been used by writers on Q-methodology, such as Brown (1980), to contrast Q-methodology with statistical methods typically used for psychological research.

In Q-methodology, instead of sampling a population of individuals, a statistical sample is drawn from potential components of individuals' subjectivities. Individuals themselves become the statistical variables, while their opinions become a rich, multi-dimensional set of sample data. In contemporary Q-methodology, as detailed by Watts and Stenner (2012), this inversion is achieved through asking each member of a group to sort opinions relating to a particular domain. Members sort the opinions into a standard distribution representing the importance or unimportance of each statement to them as an individual.

Data from participants' standard distributions are then analysed using a combination of factor analysis methods, to identify strong patterns of opinion. These methods, as detailed in 1.3.6, endow Q-methodology with certain advantages over more qualitative approaches to analysing subjectivity. According to Stephenson (1935), one key advantage is that Q-methodology uses statistical analysis to minimise interference from researchers' own subjectivities. For Robbins and Krueger (2000), this meant that: "For those suspicious of qualitative analysis, the lesson of Q-method so far might be that subjectivity and qualitative analysis might avail to certain forms of quantitative rigor" (p. 641).

However, it may be more accurate to soften the original stance taken by Stephenson (1935), especially when considering the relatively permeable division between researcher objectivity and subjectivity ushered in by psychological post-positivism. This post-positivist approach to knowledge assumes that knowledge is imperfect and that it is highly influenced by researchers' subjectivities together with the historical and cultural contexts of their research (Burbules & Linn, 1991). For example, the selection of a subjectivity sample and of participating groups are both dictated by researcher discretion. They are also influenced by historical and cultural influences on the availability and selection of both participants and study material. Furthermore, as outlined in 1.3.6, factor analytical techniques applied in q-methodology also involve at least three stages of subjective judgements on the part of the researcher: choosing the number of factors to be extracted; manually rotating those factors; and labelling those factors based on statistical characteristics combined with interpretations of participant accounts.

Considering post-positivism weakens but does not completely erode the argument by Robbins and Krueger (2000), concerning quantitative rigour. Instead, it can be said that the quantitative rigour of Q-methodology helps structure a more explicit set of subjective decisions made while conducting opinion-related research. As outlined in 1.3.6 below, this is primarily achieved by identifying particularly strong and highly diverse patterns in rich sets of data produced by the sum of participating individuals. These rich sets of data sets, of up to 90 variables per individual, mean that some Q-method studies involve groups as small as three participants. Q-methodology can nonetheless produce in-depth, statistical findings about much larger groupings. The main contemporary criterion for participation is that there should still be more statements than participants (Watts and Stenner, 2012). Therefore, the only limit on participation in Study One was the number of statements which participants could realistically sort by importance.

Q-methodology also offered advantages over a wide range of quantitative research into subjectivity, including but not limited to analyses of opinion survey data. Robbins and Krueger (2000) stated that: “For those distrustful of quantitative analysis, Q method suggests an interesting application of factor analysis to provide novel results on subjectivity” (p. 641). Not only does Q-methodology use word-based qualitative data, multiple stages of Q-method research require researchers to take on a more interpretive, rather than a more descriptive, role. This includes the three stages outlined above. Although the same term is used, interpretation used in Q-methodology nonetheless differs from interpretive processes used in wholly qualitative research methodologies such as thematic analysis. This is because, as specifically highlighted by Watts and Stenner (2012), the interpretive nature of Q-methodology encompasses statistical processes of factor identification and labelling.

Factor identification and labelling begins with factor extraction and rotation to identify and accentuate patterns in a set of Q-sort data. Extraction and rotation is based on parameters such as the number of factors sought which are interpretively set by the researcher. Factor labelling uses the characteristics of identified factors to provide a descriptive label for each one. This forms an inferential process moving from initial assumptions about parameters for exploratory factor analysis to the discovery of certain factor characteristics. Labelling these factors provides the basis for an explanatory narrative. According to Watts and Stenner (2012), this factor identification and labelling process represents a kind of abductive inference, moving from assumptions to discovery to explanation. As outlined in Chapter 1 with reference to Peirce (1935), this process of abductive inference is particularly pragmatic because assumptions will be adjusted and developed into useful insights as Study One progresses.

Data gathered from Q-sorts can include a greater degree of participant involvement than completely quantitative alternatives. This is because participants are typically invited to explain their own reasons for highly and lowly ranked opinions. Given the relevance of these qualitative considerations, qualitative guidelines were applied to the number of Study One participants. According to Smith, Flowers and Larkin (2009), qualitative research into subjectivity often reaches a saturation of themes around the point of ten participants. Study One was cognizant of this guideline, which also came close to the total number of personnel collaborating at the core of the new ICoE:CR (14) during the design of this research.

1.2 Potential Limitations

An article by Kampen and Tamás (2014) sternly criticised many statistical and other assumptions made in Q-methodology research. According to these authors, Q-methodology does not produce valid findings about subjectivity when considering standards for r-methodology analyses. Brown, Danielson and van Exel (2014) responded to this critique by stating that Q-methodology does not attempt to replicate r-methodological findings or pursue related validity criteria. According to Brown et al. (2014), Kampen and Tamás were simply mistaken in thinking that Q-methodology was a traditional attempt to conduct a psychometric analysis of individuals.

Factors produced through Q-methodology reflect patterns in individuals' opinions, as in the plural of *individual's*. This is how Q-methodology reflects a particularly systematic, non-atomistic, approach to subjectivity. It remains important to note that subjectivity does not, in and of itself, substantiate a strictly logical set of propositions (Robbins & Krueger, 2000). The analysis of subjectivities does not transparently reveal some unitary truth of any one research context. Likewise, the analysis of subjectivity does not usually produce a widely descriptive or predictive model for supporting important organisational decisions. For the current thesis, Q-methodology was being used to consider subsequent processes to support research centre and emergency management decisions. Q-method findings therefore represented only one set of considerations in the design of subsequent research-based interventions within the ICoE:CR.

In an effort to define and augment the value of this preliminary analysis, it is necessary to consider and attempt to overcome certain limitations of standard approaches to q-methodology. Comparing Q-methodology with other interpretive approaches to social science, such as interpretive phenomenological analysis, highlights how reports of Q-methodology findings may not always clearly outline how those findings are influenced by a range of subtle, and non-replicable, researcher interpretations. According to Robbins and Krueger (2000), reports of Q-methodology findings have often made researcher interpretations less than transparent, perhaps in order to claim a higher level of statistical objectivity.

Difficulties with articulating researcher reflexivity may relate to the very particular epistemological space in which Q-methodology resides. According to Robbins and Krueger (2000), Q-methodology pursues an effectively positivistic analysis of subjective viewpoints, through highly interpretive means. However, for the purposes of this thesis, concerning a highly specific context, Study One does not pursue universal laws. Instead as introduced in 1.1, Study One is based on a post-positivist epistemology, acknowledging the influence of researchers' subjectivities and the surrounding context (Burbules & Linn, 1991). A more explicit approach to these influences on the research findings is outlined in 1.3 below, in terms of reflexivity.

Kampen and Tamás (2014) also critiqued the coherence of Q-methodology for its selective use of r-methodological statistical analysis. Particular statistical assumptions from r-methodology are used for factor analysis, close to the conclusion of all Q-methodological research. These assumptions are used to qualify all statistically significant Q-methodology findings. It can therefore be argued that assumptions about probabilistic statistics, from r-methodology, should form an important consideration throughout Q-methodology research. These approaches to statistics are based on parametric, normal distributions that usually depend on random sampling. However, this is not usually the case for Q-methodological procedures. Gathering from the guidelines in Watts and Stenner (2012), and their references to a range of Q-method research, nonrandom sampling is typically used to select which set of statements, from a much larger population of statements, will be sorted by participants. Potential solutions to this apparent lack of consistency and coherence are outlined in 1.3.1.

1.2.1 The concept of researcher bias. For the sake of argument with Kampen and Tamás (2014), I will use the concept of researcher bias to discuss the role played by researcher interpretations during Q-methodology research. Although Robbins and Krueger (2000) discussed several aspects of bias which affect Q-methodology findings, the term *bias* is not typically used to describe explicitly interpretive approaches to social science. For example, Smith et al. (2009) outlined how researcher interpretations are an inseparable aspect of qualitative research into embodied experiences. This is the position taken by many other approaches to qualitative research including Discourse Analysis (see Tuffin, 2005) and thematic analysis (see Marks & Yardley, 2004) and by the hermeneutic theory informing approaches such as ethnomethodology (see Lieberman, 2013).

Qualitative dimensions of Q-methodology are also based on the assumption that researcher interpretations are an inseparable part of the research process and subsequent findings. According to Watts and Stenner (2012), researchers must make these kinds of subjective interpretations at many stages of Q-methodology. However, as highlighted by Robbins and Krueger (2000), Q-methodology also appears to use a set of strictly quantitative methods. Quantitative factor analysis methods are used to identify patterns of opinion before using these patterns to characterise viewpoints. The current chapter therefore incorporates the concept of *bias* to highlight aspects of Q-methodology which appear to be quantitative but which are not primarily determined by statistically verifiable procedures. These aspects are primarily influenced by a researcher's subjective judgements, rather than pre-established mathematical protocols for formulating and analysing the same research data.

For the purposes of Study One, this understanding of researcher bias does not reflect in any way the psychological concept of cognitive biases. Kahneman and Tversky (1972) and Tversky and Kahneman (1973) used the latter understanding of biases to describe intuitive assumptions which often lead to mistaken conclusions. However, the current thesis does not include the assumption that researchers' subjective judgements are likely to be mistaken. Instead, researcher bias has been considered using the non-correspondence principle of Rorty's (1980) pragmatism. As outlined in the Initial Literature Review chapter, this principle states that theoretical representations do not have an ideal object to which they correspond. Under this principle, it was not assumed that Q-methodology findings can be validated by correspondence between identified opinion factor patterns and a unitary object existing independently of data collection and analysis. Therefore, even if researcher judgements appear to be false, there is no way of proving that they are categorically so. As detailed in the chapter below, it seems more accurate to say that researcher judgements, or biases in a quantitative sense, have a substantial influence on findings produced using Q-methodology.

This view of researcher bias does not need to jeopardise the relevance of Q-methodological findings to this thesis because, as outlined in Chapter 1, the entire thesis focuses on abductively addressing my own assumptions as a researcher. The critique from Kampen and Tamás (2014) is nonetheless revisited in 1.3.1 below, in terms of discrete concerns about the statistical sample being used for Study One. Methods designed to respond to these concerns and others are then outlined, from 1.3.2 to 1.3.6. Opportunities for taking an explicit approach to reflexivity are then outlined in 1.3.7, as a reflection of the overarching, abductive approach to the thesis.

1.3 Methods

This section outlines methods used for Study One, to reflect the epistemological assumptions of Q-methodology while attempting to avoid potential limitations. Issues concerning the research sample are outlined, before a summary of how these issues were resolved. Methods used for data collection and analysis, which were subject to requirements for the Low Risk Notification to the Massey University Human Ethics Committee shown in Appendix M, are also outlined.

1.3.1 Sampling considerations. Like a range of other research methodologies, researcher interpretations in Q-methodology extend to the construction of a data sample. In Q-methodology, a statistical sample is selected from a wider *concourse* of possible data which represents the population of interest, being an identifiable domain of communicability (Brown, 1980). Q-methodology research often uses a quasi-naturalistic approach to assembling a notional concourse, as opposed to gathering naturalistic interview data (Robbins and Krueger, 2000). As outlined in the following chapter, Study One used this approach to gather an initial set of 653 statements from a variety of written and verbal sources circulating in the ICoE:CR context, concerning indicators of community resilience. For the majority of statements, this involved leveraging the verbatim quality of accessible reports and presentations and other literature within and around the new ICoE:CR.

An initial Q-sample of 120 statements was selected from this Study One concourse. This selection was initially carried out with quota sampling, using a random number generator for 10 statements each within each of the matrix quadrants shown in figure 5. The construction of this matrix is another important consideration, which is discussed in more detail further below. The sample produced through this procedure would not be considered a probability sample for statistical purposes. However, this random approach to selecting statements was still able to reduce researcher bias. This was achieved by using a pre-established protocol instead of quasi-naturalistic sampling, which depends on researchers' semantic interpretation of each statement.

Position: Dimension:	Practitioner Leadership	Researcher Leadership	Combined Leadership	Community Leadership
Background Assumptions				
Planning				
Indicators				

Figure 5. Initial sampling matrix by dimension and position.

An alternative Q-sample was then constructed through stratified sampling, to retain the uneven distribution of original concourse statements across matrix categories. The advantage of stratified sampling for standard r-methodology research was that it "is designed to produce more representative and thus more accurate sample" (p. 74). The randomised nature of this sampling procedure also helped satisfy requirements for a parametric probability sample (de Vaus, 2002). This meant that statistical conclusions, based around the Q-sample as a parametric sample of a concourse would be much more robust. First, the proportion of each category was calculated by dividing category (*n*) by the concourse total (*N*). The resulting fraction was used to calculate proportionate categories within a total Q-sample of 90 statements.

This approach also had certain disadvantages. Standard rounding from integer proportions to whole numbers produced a probability sample of 91 whole statements. This was only a minor inconvenience. More importantly, the continued uneven distribution of statements meant that any biases influencing the selection of the initial concourse would continue influencing the remainder of Study One and possibly, this thesis as a whole. Rigidly pursuing this approach to sampling would also limit the otherwise important step of Q-sample piloting to a very structured amalgamation and re-wording of statements within each category which would be relatively pointless.

In addition to the limitations outlined above, the 90 statements produced through the stratified sampling method appeared inadequate at face value. The lack of community-leadership in the Background Assumptions quadrant was particularly concerning. Although it had been a prevalent theme of many concourse statements, only 2 statements relating to community leadership appeared in the stratified sample of 90 statements. A stratified set of 120 statements was produced in an attempt to remedy this problem by evenly allocating statements to each quadrant and this provided much better coverage of concourse positions. However, piloting still needed to reflect a greater focus on eliminating and amalgamating statements, to produce a final Q-sample of 60 statements. In any case, this piloting process appeared to disrupt the stratified and/or randomised structure of a probability sample. This issue could not be resolved without making radical changes to established Q-sample piloting procedures. The question became whether or not these radical changes are justified.

1.3.2 Comparing the three approaches to statistical sampling. The procedures outlined above produced three types of Q-sample: a randomised quota sample of 120 statements; a stratified sample of 90 statements; and a stratified sample of 120 statements. Each type of sample had its own advantages and disadvantages, as also outlined. However, none of the samples appeared amenable to standard piloting procedures which, according to Watts and Stenner (2012), form a very important part of Q-method research. The randomised quota sample had an even distribution across a number of matrix categories, which could be further enhanced during piloting. The stratified samples did not produce this even distribution across all matrix categories, providing a marked challenge for Q-sample piloting procedures.

During construction of the considerable concourse for this research it had appeared that the concourse statements were not evenly distributed, by (research/ collaboration/ practitioner/ community) group leadership or by (background/ planning/ indicator) dimensions. At this stage it seemed rather arbitrary to force the original distribution, rather than reflecting emergent patterns across the many statements circulating in the context of interest. The truly random, stratified samples of statements may have therefore been more appropriate for minimising some of the researcher biases outlined by Robbins and Krueger (2000).

This strength of random stratified sampling highlighted an important characteristic of random quota sampling: that the sampling matrix had become a major artefact influencing the structure of a Q-sample. By this reasoning, stratified statement sampling did not limit researcher discretion influencing the compilation of the concourse being sampled from. Randomised approaches to sampling would therefore structure either the selection of initial concourse statements or the construction of the sampling grid laid over the top of the apparent concourse. Both of these influences involved substantial researcher interpretations and it did not seem possible to balance, let alone triangulate, between them. This paradox between neatly stratified concourse characteristics and balanced sampling designs is also reflected by a commentary on Q-methodology by Theiss-Morse (1993):

> The analytical categories were used to draw a sample from the statement population, which helps to ensure that the sample is representative of the

> population. It is important to note that the logic of drawing a Q-sample is similar to the logic of drawing a stratified sample of individuals: a population is defined and a sample is drawn from the population using a balanced design based on the analytical categories.
>
> (p. 358)

1.3.3 Selecting the Study One Q-sample. Before using any of the three samples detailed above, it was important to recall one of the crucial ways in which Q-methodology varies from r-methodology: participants' subjectivities, rather than researchers' analytical frames, are central (Watts & Stenner, 2012; Wolf, 2014). The appropriateness of a Q-sample may be improved when participants are given the opportunity to pilot and refine that sample. This helps to represent the concourse which surrounds them, rather than an approximated concourse assembled by researchers. Q-sample piloting therefore augments one crucial pillar of Q-method, as stated by Brown (1980): that all analytical data is centred on the individuals, in terms of relevance to those individuals.

The discretion introduced by inviting participant representatives to select an important sub-sample did not align with the statistically randomised basis of that sub-sample. This potential for inconsistency combined with the inability of those randomised samples to mitigate what is commonly referred to as researcher bias. As a result, I was unable to justify using any of the three randomised samples outlined above for Study One. After several attempts at building a balanced and less biased, random sample from the total concourse sample, I reverted to the established Q-method practice, of analytical matrix sampling for Study One. If the influence of researcher biases could not be systematically reduced, it seemed important to ensure that the researcher interpretations affecting the q-sample of statements were developed and implemented with more attention to detail.

The initial set of statements was now filtered to reflect a new grid, now co-designed with my primary doctoral supervisor. This matrix produced a much more even distribution of statements between categories. The matrix also reflected a closer focus on community resilience indicators, matching the draft condition of instruction for participants: “Rank these statements from those which are most relevant to your work in monitoring community resilience, to those which are least relevant”. Although this instruction was subsequently revised, it reflected the ongoing importance of monitoring community resilience to evaluation and research within the ICoE:CR. As shown in figure 6 in the following chapter, new matrix viewpoints were ‘practical’ and ‘theoretical’. New matrix dimensions were ‘generating knowledge’; ‘management and planning’; and ‘democracy and transparency’.

Further duplicate statements were removed at this stage and statement wording was further refined. Only statements concerning some aspect of community resilience indicators were retained, to enhance the coherence of piloting and Q-sorting activities for participants. It was assumed that these amendments would eventually lead to a more coherent factor analysis, based on a unitary focus on indicators for monitoring and evaluating community resilience. Double-barrelled phrases and qualifiers were also edited out from the initial set of statements, without the loss of core content or any one statement as such. This meant that each statement became much more comprehensible and coherent before piloting, as recommended by Watts & Stenner (2012). The original concourse was consequently reduced from an original 635 statements to the more manageable total of 442. The overall process of refining concourse statements produced matrix quadrants of 75, 70, 88, 88, 63 and 62 distinct statements. This was much more even than the distribution produced by applying the original matrix sampling grid to the original set of statements: 56, 52, 27, 16, 34, 58, 68, and 70.

Sampling was then performed using the standard Q-method procedure recommended by Brown (1980): grouping by the viewpoint and dimension matrix, before selecting statements which were most divergent from other statements within each matrix group. This process was carried out manually, using colour-coded cards on a large table. Each category was clustered by likeness before the most distinct statements were moved into the sampling grid. This manual process was also recorded on a digital copy of the same grid. Many statements were further refined and/or re-categorised during this manual sampling process. In some cases, statements were truncated to reflect their most distinctive aspects. This approach meant that, rather than losing the coherence of categories between the beginning and end of re-categorisation, I was able to improve the way each category was reflected by component statements. This led to a condensed and relatively coherent initial sample of 20 statements per quadrant. This initial sample in shown in table 8 of Appendix D and reflects the final sampling matrix applied to the Study One concourse.

1.3.4 Piloting the Q-sample. Study One involved developing a unique strategy for reducing a Q sample to manageable size using participant expertise. The initial sample contained 20 statements for each matrix category, resulting in a total of 120 statements which would be relatively demanding for participant representatives to pilot. My personal experience of piloting a prior Q-method study summarised in Huggins and Peace (2014) suggested that piloting over 100 statements could be both time-consuming and demanding, even when piloted by experienced social science researchers. The prior piloting workshop outlined in Huggins in Peace (2014) started with little over 140 statements and lasted more than 90 fairly repetitive minutes.

With the need to avoid monotony and overall duration in mind, I decided to assemble one combined pilot group: of researchers and practitioners who were most likely to be interested in the current series research into the new ICoE:CR. Managers of the WREMO Community Resilience Team and their Natural Hazards Research Platform partners were invited to attend a dinner launch for the Study One research. They were advised that this dinner would include discussions to help refine my research topic and were asked to invite two Wellington-based colleagues who would be most interested in these discussions.

I also devised a novel activity, in the form of a card game, to help guide discussions and maintain interest from this pilot group. This card game activity included four A4 sheets of cardboard, which were coloured and titled with each of the new Q-sample matrix categories. The initial sample of 120 statements were converted into a series of playing cards, which were coloured to match the matrix categories. Pilot participants were allocated a random selection of 20 cards each. They were asked to discuss each of the statements and to place them on the A4 sheets of cardboard if they thought the statement was being discussed in their workplace. All participant representatives were advised that they needed to have ten cards remaining in their hands at the end of the 90-minute game.

Despite these challenging questions and my relatively detailed answers, all pilot participants still seemed to be genuinely engaged. The evening was scheduled to finish after 90 minutes but we ran more than 30 minutes over-time, without any complaints from the piloting group. Every statement selected by pilot participants was read out loud and discussed with the whole group and this accounted for most of the two hour session. Other statements were simply withheld by participants who found those statements unfamiliar and did not see the need to read them out loud. All pilot participants seemed happy with this way of selecting statements. They did not opt to double-check each group of statements in retrospect.

Some wordings were refined amongst the final set of 60 statements, as a result of piloting discussions suggesting more straight forward synonyms or a clarification of terms. Care was taken to ensure these changes did not alter the meaning of original statements. This ensured that all statements used within the subsequent Q-sort procedure were still drawn from the original concourse. The final sample of statements resulting from the complete piloting process is displayed in table 9 of Appendix D.

1.3.5 Data collection: Preparing the Q-sort procedure. The final Q-sample provided statements which Study One participants would sort by relevance into a structure resembling a standard distribution (Watts & Steiner, 2012). This Q-sort distribution forces statements to be sorted into an ambivalent category, while only a few statements could be sorted as highly relevant or irrelevant. As outlined in 1.3.6, factor analysis then allows cumulative patterns to be distinguished within the sum of Q-sort data, to show groupings around particular themes (Brown, 1980). This stage of analysis is often paired with participant interviews, to further detail the meaning of identifiable factors, based on particularly high and low ranked statements (Watts & Steiner, 2012). Study One used the majority of these standard features of Q-methodology. However Study One incorporated an online Q-sort procedure, which is usually completed by manually sorting a series of statements printed on paper.

Paper-based Q-sorts may have many advantages over an online equivalent, including larger card sizes with larger, more legible writing, and a highly tangible look and feel for the activity. It is also possible to gather more detailed data through follow-up interviews in person, following a paper-based Q-sort. However in my case, anonymity and accessibility issues meant the paper-based approach was not viable. Anonymity represented a way to minimise risk of harm among a diverse group of participants. The preferred, electronic protocol included ways to anonymise all data so that no one individual participant could be identified and embarrassed, or professionally jeopardised in any way. A high degree of anonymity also had the potential to improve Q-sort data quality, considering that participants would be at liberty to produce an individual sort which represented their own opinions, rather than reflecting the strongest opinions of those around them. The latter situation can occur when participants are aware that their Q-sorts can be observed in retrospect, by peers who may know who produced them. Online anonymity may also help avoid participants responding to perceived demands from the researcher, who is not usually present during an online protocol. An online format also means that participants could access the protocol at any time and place which suited them. In Study One, this meant that many participants had the opportunity to complete the protocol in situ during work time, under working conditions –adding to the contextual relevance, or ecological validity of their Q-sort data.

Q-Assessor (1999) was initially chosen as the online platform for administering Q-sorts in Study One. This decision was made with reference to research by Q-Assessor developers, Reber, Kaufman and Cropp (2000) who conducted a validation of this software for online Q-methodology. They compared results from the Q-Assessor platform with results from the standard, paper-based procedure. This analysis found that their electronic procedure was faster for both participation and data analysis. When 30 participants self-selected paper or Q-Assessor protocols, Reber et al. (2000) found that both formats arrived at the same set of identified factor groupings.

During development and piloting of the Q-sample for Study One, Kaufman (2013) announced that the Q-Assessor (1999) program would only be available for five more weeks. Purchase or licensing options had not yet been developed and this made it much more difficult to use an online procedure. I was nonetheless fortunate to have previously compiled a list of software with interfaces which could be compared to the Q-Assessor interface. Comparability to Q-Assessor was important because the Q-Assessor interface appeared to have easily engaged participants in my prior Q-methodology research (see Huggins & Peace, 2014). Q-Assessor was also the one interface which had been validated for matching results from the standard, paper-based Q-methodology. FlashQ (Version 1.0, Hackert & Braehler, 2007) was a close match which had already been widely used for a range of prior Q-methodology research, including research by Gruber (2011), Anderson, Shulze and Seppel (2012), Pruslow and Red Owl (2012) and Kim (2014) among many other examples. The development of FlashQ software appeared to have stalled around 2007, resulting in a software version with a very small and narrow display. I needed to modify the programming of this interface to more closely resemble the Q-Assessor's capability to expand across a contemporary, wide screen computer display.

Sample piloting with representatives of WREMO and the Natural Hazards Research Platform suggested that they had already spent considerable time discussing indicators for community resilience. Many personnel from each organisation appeared to have been either co-authoring a strategic document with indicator assumptions embedded, or actively researching a related topic. As recommended by van Exel and Graaf (2005), I selected a wide kurtosis for the bell curve distribution statements -to represent the way that this concourse had been well developed in the ICoE:CR context. Participants were likely to produce relatively nuanced sorts, given that their organisations had been involved in such active discussions. It follows that there was less need for a large neutral category, because most statements could be specifically ranked in terms of agreement or disagreement.

A distribution from -5 to +5 was applied, based on a recommendation from van Exel and de Graaf (2005) who state that this is reliably standard practice. For the purposes of Study One, this distribution provided a Q-sort interface with a maximum of ten statements in any one category within FlashQ. All statements were only fully readable by mouse-over within the interface, which was comparable to larger sorts using the Q-Assessor (1999) software. However, the size of sorting cards was re-programmed, to ensure participants could read a greater proportion of each statement without having to hold the mouse cursor over one statement at a time. The resulting set of statements and sorting distribution were informally piloted by research colleagues who tried the Q-sort protocol and provided recommendations for the final version. Piloting showed that the Q-sort procedure could be performed in as little as 25 minutes and this was detailed on the information sheet for all research participants.

1.3.6 Data analysis. A complete set of data resulting from the Study One Q-sort procedure was collected in a format that retained each participants' ranking of each statement. These data sets are shown in their original format in figures 19 and 20 of Appendix E. The Q-sort data sets were then combined to identify an initial set of overall patterns, or factors, using PQMethod (Version 2.33; Schmolck, 2012) factor analysis software. Un-rotated factors were extracted from the combined Q-sort data using centroid extraction, which starts by detecting the strongest pattern of correlations in a correlation matrix (Rummel, 1970). For Study One, this analysis was conducted on the correlation matrix shown in Appendix F. In this instance, centroid extraction detected the strongest pattern of correlations, principally between practitioner sort 2 (r = .80), practitioner sort 3 (r = .86), researcher sort 2 (r = .80) and researcher sort (r = .81).

Centroid extraction then detects the next strongest pattern of correlations, that is least correlated with previously extracted factor(s) (Rummel, 1970). For the purposes of Q-methodology as reflected in Study One, this means that a set strongly trending but distinct "factor exemplars are merged to form a single ideal-typical q-sort for each factor called a factor array" (Stenner, Cooper, Skevington, 2003, p.2164). According to Stenner et al. (2003, p.2165) "Being a merged average, [each] factor array looks like a single complete Q sort".

Seven factors had been described by Brown (1980) as the generic ideal for developing sets of factors within Q-methodology. However, Watts and Stenner (2012) had stated that one factor per 6-8 participants is the most workable ratio, based on their more contemporary experience with Q-methodology. The latter clarification applied to the Study One, where a total of seven distinctive factors appeared excessive for Q-sort data produced by a maximum of 14 participants.

Guidelines from r-methodology also appeared to be relevant to this stage of Q-methodology, because this is where factor analysis originated. A minimum sample of N=10 for each factor had been recommended by Tabachnick and Fidell (1996) as a common standard for factor analysis in r-methodology. According to Tabachnick and Fidell (1996), this common standard helps to ensure that the variance of a sample is well structured. This standard would be easily met by a maximum of six to nine factors for my sample of 60 or 90 statements. Concerning an equivalent for participant variables rather than *N*, MacCallum (1990) recommended three to five variables per factor in standard exploratory factor analysis. According to MacCallum (1990), this enhances probability measures amongst large samples. The current Q-method research would involve up to 14 participants, who were treated as variables for Q-methodology. This meant I could attempt factor analysis for up to four distinct factors, using the ratio of variables to factors established by MacCallum (1990).

The importance of researcher interpretations within Q-methodology reinforced the relevance of the participant-based guideline from Watts and Stenner (2012), of one factor per 6-8 participants. This equated to between one and two factors for the current group of up to 14 participants. However, previous research by Huggins and Peace (2014) had produced three coherent factors using Q-sort data from only three participants. Considering the range of applicable guidelines, combined with my personal experience suggested that Study One could pursue around four factors for a group of around 14 participants and two factors for sub-groups of seven participants. These limits could be adjusted at a later stage, to reflect actual response and completion rates.

Using a combination of the approaches outlined above, Study One factor analysis would attempt to identify up to two factors for researcher and practitioner sub-groups and up to four factors for the combination of these groups' q-sort data. These upper limits reflected standards established for traditional factor analysis and outlined by Tabachnick and Fidell (1996), and MacCallum (1990), for what Stephenson (1935) and Brown (1980) referred to as r-methodology. They also reflected Brown's (1980) Q-methodology guideline of up to seven factors and his caution against excessively complex interpretations involving too many components for any one factor. In practical terms, a balanced ratio of factors to participants appeared to avoid jeopardising factor strength. These balanced ratios also appeared to avoid including too many characteristic statements for any one factor.

Table 10 of Appendix F displays all correlations between sorts, prior to centroid factor extraction. The subsequent set of extracted factors, shown in table 11 of Appendix

F, were manually rotated in order to identify a combination of factors that coherently reflected both differences and commonalities between participant groups. This form of factor rotation effectively changes the reference point from which factor patterns are identified. For example, Brown (1980) moved the central point of his exemplar analysis from focusing on an abstract reference point, to centering at the point where trend lines would pass directly through the majority of the Q-sort data sets. Woods (2004) provides a diagram of how this exemplar was performed, at www.pcqsoft.com/essays.htm. Manual rotation is commonly used in Q-methodology because, as opposed to Varimax rotation, this method of factor rotation further constitutes part of the indeterminate approach used throughout Q-methodology (Watts & Stenner, 2012). Results of the current manual factor rotation and interpretation of the resulting factors are discussed in Chapter Three, as part of an overall summary of Study One.

1.3.7 Considering reflexivity. Q-methodology has a number of potential limitations, as outlined in 1.2. These limitations include how many Q-method research articles do not include a section on reflexivity, or any outline of the role which researcher interpretations have played. Robbins and Krueger (2000) took a particularly critical approach to this lack of reflexivity. Although their views form an invaluable step towards more transparent researcher interpretations, remedies forming part of Study One needed to be drawn from outside of Q-methodology literature. For program evaluation and qualitative research specialist Patton (2002), reflexivity meant “understanding and depicting the world authentically in all its complexity while being self-analytical, politically aware, and reflexive in consciousness” (p. 41). In practice, this means a reflexive researcher will systematically detail their own assumptions and how these assumptions have affected the research (Patton, 2002).

A full section on reflexivity may jeopardise the persuasiveness of Q-method research among some audiences, especially if it is assumed that many readers are accustomed to a more traditionally positivist understanding of psychology. As outlined in 1.2.1, traditional psychology literature often describes researcher bias in terms of bias-limiting procedures and their shortfalls. By contrast, reflexive approaches to research do not consider that researcher bias, also referred to as subjective discretion or interpretations, constitute a limitation as such.

Q-methodology typically involves a high degree of subjective interpretation by researchers (Robbins & Krueger, 2000; Watts & Stenner, 2012; Wolf, 2014). This is especially true during factor identification and labelling but also applies to most other stages of Study One. It cannot be denied that researcher subjectivity played a major part in producing Q-methodology findings in Study One. Ideally, a reflexive discussion of influences from my own subjectivity would be provided by the main set of findings outlined in Chapter 3. However, in the interests of publishing a persuasive and succinct summary of findings for an emergency management audience, this will form a sub-section of Chapter 4. As prompted by Patton (2002), this sub- section will include a discussion of my own assumptions, an analysis of how these assumptions have affected Study One, and an analysis of political factors affecting the production and implementation of findings.

1.4 Conclusion

Study One aimed to identify differences and similarities in stakeholder opinions about building a framework of community resilience indicators shared within a new collaborative research centre called the ICoE:CR. It was assumed that Q-methodology could avoid a pitfall of survey based opinion research, of reducing collective dynamics down to individually based data or arbitrary groupings of such data. This pitfall appears to be avoided by treating participants as the loci on which a domain of communicability varies. Q-methodology offered several other advantages for the purposes of Study One, as outlined in 1 and 1.1 above. This methodology also appeared to have a number of limitations, as outlined in 1.2, including the way that sampling procedures and other adaptations of r-methodology precedents can appear overly arbitrary.

To address some of these limitations and in answer to related critiques from Robbins and Krueger (2000) and Kampen and Tamás (2014), 1.3 compared Q-methodology sampling with more traditional, approaches to statistical sampling from r-methodology. This process has reinforced the value of the standard Q-methodology sampling procedure eventually used in Study One. Six participant representatives then helped to reduce the initial sample produced into a smaller sample representing statements which were actually discussed in their work places. A final sample of 60 statements was produced using a custom designed card-game, played by all representatives at once. This process used to develop a final sample through incorporating participant expertise comprises a novel contribution to the field of Q-methodology.

The final sample was now ready to be transferred to a custom-designed electronic protocol, for reasons of accessibility and anonymity during the Q-sort process. R-methodology and Q-methodology guidelines discussed in 1.3.6 were considered alongside my own prior experience, to plan the factor analysis of resulting data. This necessitated a reflexive account of these and my other subjective influences on Study One which is provided in Chapter 4.

This is preceded by Chapter 3 which has previously been peer reviewed and published as a stand-alone article, re-examining my initial assumption concerning the value of research into opinions about community resilience. A particular case is made for research into opinions about monitoring and evaluating community resilience approaches to emergency management. Study One data collection procedures are outlined, before a summary of procedures used to identify and label three distinct patterns of opinion, or viewpoints. These viewpoints are then outlined with reference to a range of surrounding research literature. Implications of these viewpoints are discussed, concerning the new ICoE:CR and other collaborative research initiatives.

3. Study One: Politics of Practical and Academic Knowledge

Huggins, T.J., R. Peace, S.R. Hill, D.M. Johnston, and A. Cuevas. (2015a). Politics of practical and academic knowledge: A Q-method analysis of gauging community disaster resilience. *Journal of Contingencies and Crisis Management*, *23,* 246-256. doi:10.1111/1468-5973.12092.

Abstract

This research analysed strong opinions, held by emergency management practitioners and researchers, about developing a regional framework of community resilience indicators. A group of practitioners and another group, of researchers, were planning an International Centre of Excellence, focused on community disaster resilience in Wellington, New Zealand. Each of these groups used similar terminology to describe the 'resilience' focus of their collaborative centre. However, we observed that certain concepts and priorities varied widely between group members, who had arrived from very different professional backgrounds. Five participants from each of the researcher and practitioner groups were successfully recruited to better identify opinion factors which either differed or were shared between those groups, using Q-methodology. We identified one strong perspective supporting complicated analysis to inform strategic decisions, which was particular to the researcher group. Practitioners appeared to share a particular opposition to insular, top-down decision making. Both practitioner and researcher groups appeared to perceive a need to evaluate opportunities for improving post-disaster outcomes. At the time of writing, this analysis was helping to facilitate further planning for the upcoming International Centre of Excellence. Our discussion of the perspectives identified also helps to inform comparable approaches to community disaster resilience.

3.1 Introduction

This research analysed strong opinions about gauging community disaster resilience, held by a group of practitioners and a group of researchers. These collaborating professionals aimed to carry out monitoring, evaluation and associated research activities, which focused on improving the resilience of communities, in the face of disaster hazards which included storms, earthquakes and tsunamis. Our analysis aimed to identify differences and similarities in their opinions about building a shared framework of community resilience indicators. This form of analysis was an effort to inform collaborative processes between the two groups.

Our engagement with the research context began through discussions with groups who were planning an international centre of excellence, as approved by IRDR International (2013). This centre of excellence was called the ICoE:CR and was focused on the disaster resilience of urban communities in New Zealand's capital city, Wellington. The professionals involved came from a variety of academic and professional disciplines. They were looking at an accumulation of resilience concepts, where psychological and other individual aspects of resilience were nested within system-orientated understandings of community capacities and wider societal dynamics.

Despite disciplinary and professional differences, the researchers and practitioners involved appeared to use a similar set of key terms, like *resilience* and *collaboration*. However, each speciality appeared to use those words in very different ways. For example, many Wellington-based researchers appeared to have been focused on *resilience* in terms of disaster preparedness. On the other hand, a draft strategy for community resilience practitioners at WREMO had defined resilience as the capacity for a rapid recovery, following a major disaster event.

A very wide range of community resilience literature offered support for each of these perspectives. Existing research literature had encompassed multiple phases of an adaptive cycle: prior to, immediately following, and during recovery from, shock events (see for example: Béné et al., 2012; Birkmann et al., 2012a; Carpenter, Walker, Anderies & Abel, 2001). The multiple ways that resilience had been understood in the literature suggested that researcher and practitioner groups were not necessarily going to be able to work together, under an umbrella term of community resilience which seemed to be rapidly diverging.

The term *community resilience* is neither straight-forwardly agreed nor understood. This term may share as much in common with wider development planning as it does with the specific management of emergencies (Coppola, 2007). A broad summary of community resilience definitions by Béné et al. (2012) concluded that demands of balancing stability, adaptation, and transformation in the face of a range of potential shocks meant that a single definition of community resilience was unlikely. Recent efforts at synthesising a very wide range of resilience indicators, by Birkmann et al. (2012a), suggest that particular definitions of *disaster resilience* are no less diverse. Likewise, community disaster resilience remains very broadly defined by the United Nations as "The ability of a system, community or society exposed to hazards to resist, absorb, accommodate to and recover from the effects of a hazard in a timely and efficient manner, including through the preservation and restoration of its essential basic structures and functions" (UNISDR, 2009).

Perhaps only these very broad definitions can accommodate the range of resilience definitions described by Ungar (2011) as varying widely between very different social ecological settings. A variety of background assumptions appear to be borne out in very different stakeholder viewpoints, even when those stakeholders share very concrete elements of the same physical geography and related hazards (e.g. the potential destruction to coastal areas from a tsunami hazard). For example, the very long timeframes commonly used in geology may be intuitive for many researchers while the same analyses become very abstract for many practitioners. Survey research by Sinclair et al. (2012b) suggested that many New Zealand emergency managers think natural hazard research is either absent from, or irrelevant to, their decision making roles. Seventy one percent of the emergency managers, across 48 different local government areas, indicated a need for further training in the use of research materials (Sinclair et al., 2012b).

Lack of agreement about the most relevant aspects of a hazard is only magnified across the extended lead up to actual, but hard-to-predict disaster events. Many disaster researchers focus on mitigation through transforming existing practices. For example, Saunders, Beban and Kilvington (2013) have promoted the value of detailed hazard information for planning New Zealand's rural and urban development. Many emergency management agencies are unlikely to take such an approach, especially when, according to Béné et al. (2012), government agencies often lack the mandate for such transformational interventions.

3.1.1 A boundary object between groups. A well-developed monitoring and evaluation framework promised to become a *boundary object* for parties to the ICoE:CR. In the terms of Owen et al. (2013), this could promote consistent interpretations and responsive information sharing between emergency management collaborators and their different *activity systems*, or combinations of activities. According to Cole, Engestrom and Vasquez (1997), distinct organisational histories and norms of operating can result in many different viewpoints. To facilitate productive collaborations between the activity systems of diverse teams, boundary objects and associated processes we therefore need to consider the differences and commonalities of each collaborating group. Owen et al. (2013) suggested that "by highlighting the historical and contradictory elements within an activity system… …enables an analysis of those contradictions to be used to trace disruptions and to point to new opportunities for development" (p. 12).

Q-methodology provided an opportunity to analyse contradictory elements, in terms of perspectives that united or divided the research and practice collaborators. Furthermore, this form of analysis could be based on statements about monitoring and evaluating community disaster resilience which were already circulating in the ICoE:CR context. We used Q-methodology to pursue three component objectives of the overall aim: to identify differences and similarities in ICoE:CR members' opinions about building a shared framework of community resilience indicators[3]. Firstly, to[4] identify any prevalent pattern(s) of opinion about monitoring and evaluation indicators, held by ICoE:CR practitioners in particular. Secondly, we wanted to identify any prevalent pattern(s) of opinion amongst ICoE:CR researchers in particular. Thirdly, we wanted to identify any pattern(s) of opinions indicating agreement between both researcher and practitioner groups. Answers to these research questions would guide the construction of effective boundary objects between the two initial ICoE:CR groups, especially in terms of any framework of community disaster resilience indicators.

[3] Edited from original sentence for consistency as part of overall thesis.
[4] Edited from original sentence for consistency as part of overall thesis.

3.2 Method

Q-methodology assumes that the statistical population to be sampled is a domain of communicability, or the sum of communications on a certain topic within a particular context (Brown, 1980). Participants from that domain are then treated as variables for statistical purposes. They are asked to sort a sample of the domain of communicability, by relevance to their own viewpoints. The extent to which opinion components (statements) are relevant to any grouping of participants forms the statistical structure factors, which are commonly referred to as *perspectives*.

The current research involved Q-methodology analysis of one combined case of ICoE:CR researchers and practitioners aiming to collaborate as part of the ICoE:CR. Practitioner and researcher sub-cases were detailed as part of this analysis. This is not a new approach to Q-methodology. Relevant Q-methodology precedents have included a study of environmental assessment sub-cases by Webler and Tuler (2006), and research by Danielson (2007), into perceptions of wildfires amongst United States and Australian sub-cases.

3.2.1 Sample. Our initial *concourse* was drawn from the ICoE:CR domain of communicability and consisted of 653 statements about monitoring and evaluation indicators of community disaster resilience. Most of these statements were drawn from sources including 50 books, 45 edited book chapters, 79 academic articles and 51 other reports circulating in Wellington research and practice communities, involved in the development of the ICoE:CR during 2012. Other statements were drawn from field notes taken during meetings with the participating groups, over the same period. Full sentences were used instead of individual words because this concourse had already been documented in considerable detail. The use of full sentences also meant we could preserve key terminology alongside the surrounding syntax established for that terminology.

The initial 653 statements were placed within the two by three matrix shown in figure 6. Statements within each quadrant were clustered by similarity and the most diverse set of statements was selected from amongst these intra-quadrant clusters, to produce an initial sample of 120 statements. This approach to initial sampling from a concourse is designed to promote an even distribution across dimensions and positions, while maximising the diversity of statement content within each quadrant (Brown, 1980).

	Practical (position)	Theoretical (position)
For Generating Knowledge (dimension)		
For Planning & Management (dimension)		
For Transparency & Democracy (dimension)		

Figure 6. Sampling grid for collating concourse statements.

The initial sampling process also created the opportunity to engage a wider selection panel, who could select a final sample from amongst a more compact, and therefore workable, set of statements. Our initial 120 statement sample was presented to a combined group of three researcher and three practitioner representatives party to ICoe:CR development. Representatives of the researcher participants were selected by the head of the societal resilience strand of New Zealand's Natural Hazards Research Platform (see Natural Hazards Research Platform, 2014). Representatives of the practitioner representatives were selected by the manager of Community Resilience, WREMO. Each of these individuals were the leaders of their aspect of the ICoE:CR at the time. Their nominated representatives were asked to select a total of 60 statements which were being readily talked about in their workplaces. This produced a working sample of statements which was much more manageable for research participants to read and sort by relevance.

Subsequent piloting dictated that some of the statements needed to be simplified for easier reading. Piloting also suggested that participants would agree with most of the statements, so the direction of some statements was reversed. For example, a statement saying a monitoring and evaluation activity is necessary was changed to saying it was unnecessary.

3.2.3 Procedure. ICoE:CR research coordinators invited seven core members of the Wellington-based social science team at Geological and Nuclear Sciences (GNS) to participate. All five members of the WREMO community resilience team were also invited to participate. All participants were presented with our final sample of 60 q statements for online sorting, using our own customised version of FlashQ (Version 1.0, Hackert & Braehler, 2007) software. The electronic, online protocol provided three key advantages: anonymity; convenience; and the opportunity for participation within real working environments.

Participants were presented with all q statements in randomised order after being told that: “This activity involves reading 60 statement cards about community resilience indicators, with your primary working role in mind. You will be asked to sort those statement cards by: “THE EXTENT TO WHICH YOU AGREE OR DISAGREE WITH EACH STATEMENT”. All statements were sorted into the format shown in Figure 7. The next screen asked the participants additional qualitative questions, about why they sorted particular statements into -5 and +5 categories. Five of seven invited researchers and five of five practitioners completed the entire Q-sort process.

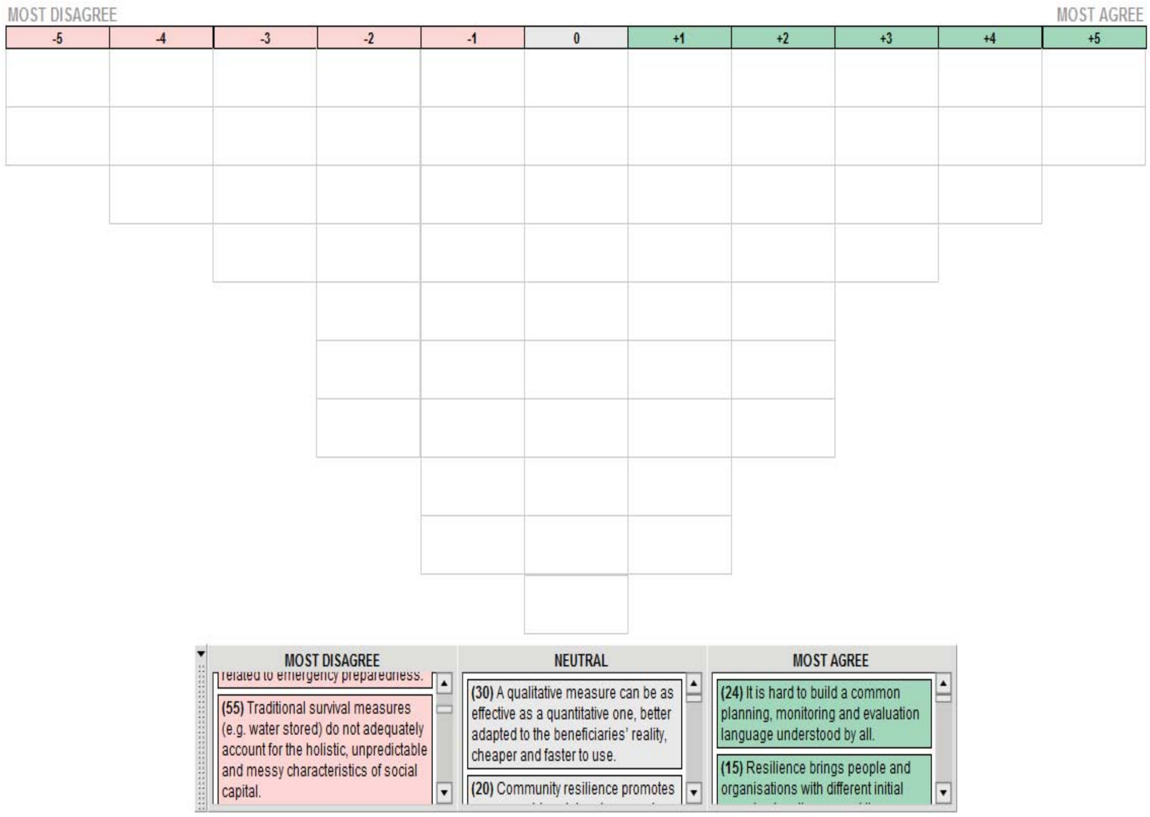

Figure 7. Full sorting activity

3.3 Results

According to Stenner et al. (2003), centroid factor analysis in Q-methodology involves merging "factor exemplars… …to form a single ideal-typical Q-sort for each factor called a factor array." (p. 2164). Three centroid factors were initially extracted from the combination of Q-sort data. We used manual factor rotations to more evenly distribute loadings between the first and second centroid factors and a third factor which was initially statistically insignificant. The three factors produced though this process were many less than the maximum of seven factors, recommended by Brown (1980). As shown in table 1, all factors retained after factor rotation had an eigenvalue greater than 1.0, meeting the Kaiser criterion from Kim and Mueller (1978) and Weiss (1976).

Table 1
Co-variance between Rotated Factors and Participant Q-Sorts

	Co-variance		
	Factor A	Factor B	Factor C
Practitioner Sort 1	-.39*	.23*	.45*
Practitioner Sort 2	-.52*	.29*	.56*
Practitioner Sort 3	-.53*	.33*	.61*
Practitioner Sort 4	-.67*	.09	.32*
Practitioner Sort 5	-.69*	.17	.45*
Researcher Sort 1	-.25*	.31*	.39*
Researcher Sort 2	-.34*	.49*	.55*
Researcher Sort 3	-.29*	.78*	.39*
Researcher Sort 4	-.26*	.69*	.42*
Researcher Sort 5	-.15	.50*	.30*
Eigenvalue	1.97	1.95	2.07
Variance Explained	20%	20%	21%

*Significant at $p < 0.05$ level

Manually rotated factors A and B were fairly highly correlated ($r = 0.52$) with one another for the combined grouping. factor C had much higher correlations with both factors A and B ($r = -0.76$; $r = 0.79$ respectively). Factor C appeared to underlie a lot of the variability in our q sort data, across both practitioner and researcher groups. It explained 21 percent of the variance across all q sort data, compared to 20 percent explained by each of the other two factors.

Table 2 provides an example of the information used to characterise and label each of the three factors. Tables for factor B and C are included as appendices to this paper. Participants' qualitative explanations were listed in a table in order of z-score salience. A criterion of qualitative saturation (see Morse, 1994) was then used to consider explanations relating to each of the statements. This meant we considered qualitative explanations from the sort with the next highest co-variance, until the explanations no longer helped to define a factor label. Only statements with a statistically significant z-score were included in this format.

Table 2
Characteristics of Factor A in Order of Descending Z-Scores[5]

Characteristic Q Statements	Z-Score	Qualitative Explanations
29. A bottom-up approach embraces local and tailored solutions.	-2.10*	"There isn't a silver bullet that will work for everyone due to whatever unique circumstances affect them. Local communities have different profiles of risk and vulnerability to impacts, and different levels of resilience" (practitioner sort 3).

[5] Although they were not published with the original paper, equivalent tables for factors B and C are provided in Appendices G and H of this thesis.

Characteristic Q Statements (*cont.*)	Z-Score (*cont.*)	Qualitative Explanations (*cont.*)
43. Project teams should not waste their time exploring further opportunities across organisational boundaries.	2.08*	"To be resilient our community must be connected across organisations. Particularly traditional agencies must understand each other's plans, and have processes to integrate grassroots organisations and spontaneous community activities" (practitioner sort 4). "Emergency preparedness and resilience applies to all organisations, so we need to learn to work with other organisations to improve that. While we may know our stuff when it comes to emergency management and hazards, the organisations know best what impacts an event will have on themselves" (practitioner sort 3).
60. Individuals are independent from the wider community, organisations, institutions, and so on.	1.88*	"If you were to create tags for an individual for all the different groups they are connected to somehow, it would be a really long list. Family, household, street, a suburb, the shops they visit, the sports team they play for or support, the doctor they visit, the support they receive. No man is an island" (practitioner sort 3); "This is what makes up community" (practitioner sort 2).
23. A resilient community has realistic expectations of the levels of support available during an event.	-1.86*	"Information is everything" (practitioner sort 1).
56. Resilience exists at multiple levels or scales: individual, household, community, system, society, etc.	-1.66*	"Because it is true" (practitioner sort 5); "It is a continuum and a state which is in constant fluctuation for all these groups" (participant sort 2).

*Statements distinguishing factor A from factors B and C at $p < .01$ level.

3.4 Discussion

3.4.1 Factor A: Against informing insular, top-down decision making. Factor A related to our first research objective[6], to identify prevalent pattern(s) of opinion amongst ICoE:CR practitioners in particular. Negative covariance with factor A gradually increased from practitioner one to practitioner five, ranging from -.39 to -.69. Covariance with researcher Q-sorts ranged from positive .15 to -.34. It is important to note that factor A had a negative co-variance with all practitioner sorts. This means that factor A represented a pattern of disagreement, rather than the agreement reflected in factors B and C.

The importance of supporting community-based efforts was reflected in the strong salience (z-score -2.10) of statement 29, about local and tailored solutions. The salience of this statement had been explained by practitioner three: “There isn’t a silver bullet… …Local communities have different profiles of risk and vulnerability to impacts, and different levels of resilience”. Statement 43, about opportunities across organisational boundaries, was another highly salient (z-score 2.08) statement in factor A. Qualitative explanations, from practitioner sorts three and four, highlighted how practitioner participants saw organisations outside of WREMO as important planning, monitoring and evaluation partners.

The relevance of interconnected communities for factor A was marked by the strong salience of statement 60 (z-score 1.88): Individuals are independent from the wider community, organisations, institutions, and so on. The salience of this statement was paired with the following qualitative explanations: “If you were to create tags for an individual for all the different groups they are connected to somehow, it would be a really

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[6] Wording changed from original “aim” to differentiate from overall thesis aims.

long list. …No man is an island" (practitioner sort three); "This is what makes up community" (practitioner sort two).

Practitioners appeared to support interventions which were responsive to the unique characteristics, motivations and knowledge of both communities and organisations therein. Given the scope of our research, it was important to focus on an indicator framework rather than the full span of WREMO activities. This factor appeared to reflect a more detailed, localised approach to gathering monitoring and evaluation data and other information. Considering this, and other aspects outlined above, we arrived at a label of 'Against Informing insular, top-down decision making'.

Clegg and Walsh (2004) described how management processes can either push strategic commands from management to personnel and clients, or can pull decisions and the allocation of resources down towards more operational levels. The centralised push of decisions and commands has also been referred to as a style of *command and control* in emergency management literature (see Waugh & Streib, 2006). The command and control style of decision making appears marked by intolerance for any diversity which could interrupt a top-down flow from centralised decision making to operational execution. Factor A reflected a strong perspective against such a centralised, top-down management style. It also made reference to the apparent lack of a rigid command and control structure to suit all emergency management contingencies.

Factor A provided much more detail than a simple division between practitioner and researcher viewpoints. Rather than simply reflecting some kind of resistance to research activities and findings, it appeared that ICoE:CR practitioners resented the way that research findings are filtered through the higher echelons of their organisation. Practitioners appear to have made a case that the top-down use of monitoring and evaluation produces an isomorphic, one size fits all, approach; an approach that would not meet the needs of working closely, with very diverse communities.

3.4.2 Factor B: Need for complicated analysis to inform strategic decisions. Researchers had completed all but one of six Q-sorts with a loading of more than 0.30 for factor B. This meant factor B addressed our second research objective[7], to identify prevalent pattern(s) of opinion amongst ICoE:CR researchers in particular. Multi-level indicators were a major part of factor B, which included a very strong salience (z-score 2.35) for statement 56: 'Resilience exists at multiple levels or scales: individual, household, community, system society, etc.'

The very strong salience (z-score -2.04) of disagreement with statement 60, regarding independent individuals, further suggested that researchers shared a systems orientated understanding of community resilience. This represented an interest in much more than individual level data, suggesting that researchers were interested in data from various levels of a system of resilience. This perspective on multi-level indicators appeared to align with developmental evaluation theory by Patton (2011), which has outlined how complex social systems include dynamics both within and between levels.

The salience (z-score 1.88) of statement 20, about how resilience promotes a more rapid social and economic recovery, shows how researchers were not just interested in the static properties of an idealised state. For the researchers, community resilience appeared to represent capacities for improving post-disaster outcomes. This perspective had much in common with the resilience theory of adaptive capacity, from Paton (2006) and Paton et al. (2010), concerning factors which predicted improved response to, and recovery from, major disasters. Likewise, the inclusion of non-economic indicators illustrates a

[7] Wording changed from original "aim" to differentiate from overall thesis aims.

broad basis for the researchers' conceptual frame which, in terms of Delorme (2010), is more likely to encompass the complexity of social systems. Researchers' strong emphasis on a rapid recovery also partially aligned researcher participants with WREMO (2012) strategy, which was aiming to support: "an efficient and effective recovery" (p. 7).

A focus on rapid recovery also brings certain limitations. Overly rapid recovery can ignore the opportunities for the adaptive improvements to communities and associated infrastructure outlined by Berke, Kartez and Wenger (1993) and by Smith and Wenger (2007). The crude velocity of disaster recovery can also undermine democratic processes, which are an important part of societal function in the longer term. According to Hayward (2013), the erosion of democratic process has been a major feature of the New Zealand government's approach to recovery in Canterbury, including the devolution of important issues such as housing shortages to market forces. It appears that the drive towards purely rapid recovery can neglect opportunities for broader principles of democracy and social justice to guide future mitigation and current transformation. It therefore seems important for ICoE:CR researchers to temper any apparent tendencies towards this trend.

The strong salience (z-score -2.04) of disagreement with statement 47 about assessing effectiveness without baseline data, matched a straight-forward explanation from researcher sort 2: "Assessment requires data." This stance may also need to be tempered. Monitoring and evaluation for the complexity of applied issues and interventions often does not allow for baseline data (Patton, 2011). It can be difficult to attribute shifts in this baseline data even when it exists (Duignan, 2013). Evaluation often needs to use data which does not attempt to control all variables but which can nonetheless show progress across time, or by contrast with a comparable population who were not affected by an intervention (Duignan, 2013).

This salience of statement 47 suggests a strong drive towards theory-building research rather than applied monitoring and evaluation activities. It may represent a certain *technical rationality*, as outlined by Schön (1995): where scientists plan to produce knowledge which is then used to optimise the work of practitioners in the field. As stated by Schwandt (2005), technical rationality appears to be a fairly intuitive perspective pursued by most academic research institutions. Furthermore, a large degree of technical rationality is required to guide many aspects of risk assessment, especially concerning the initial identification of salient natural hazards. Likewise, many, fairly generic, community resilience indicators have already been developed by researchers with little or no practitioner engagement.

However, practice-based research questions, interpretations and feedback appear to be easily disregarded by this view. A tangential departure from traditional technical rationality was suggested by another highly salient (z-score 1.65) statement, number 40: “As a consequence of monitoring, we may decide to adjust programs, change team patterns, or facilitate social bonds between individuals and groups”. This appeared to reflect a more immediately pragmatic role for community resilience indicators, using more frequent data which is not necessarily gathered by researchers.

Factor B also appeared to value practitioner interpretations, as shown by significant disagreement (z-score -1.88) with statement 27: ‘Risk management is never political…’. A qualitative explanation clarified the salience of this statement, in terms of how indicator data *informs*, rather that dictates decisions: “Assessment of what risk treatments are acceptable will require an assessment of effects and some judgements will need to be made” (researcher sort four).

Disagreement with statement 27, about the political and operational neutrality of community resilience indicators, was shared between four of five researcher participants. The researcher group appeared to almost uniformly agree that indicator data is used to inform rather than dictate WREMO community resilience interventions, amongst the political complexity of associated policy and operational decision making. This focus on data for informing rather than dictating comes supported in terms of: the un-responsive rigidity of purely evidence-based policy (Pawson, 2006); and the futility of generalising pre-existing evidence within the hard-to-predict emergence of complex adaptive systems (Patton, 2011).

Practitioners' perceptions about data for informing rather than dictating interventions also marks some alignment with a strategic principal outlined by WREMO (2012): "Evidence *Informed* – WREMO will draw upon current good practices in Emergency Management and Community Development and incorporate them into the way it operates" (p. 8) [emphasis added]. However, the alignment is only partial, given WREMO's focus on evidence from good practice, rather than evidence from research activities.

Particular q statements distinguished factor B from factors A and C. Factor B had high agreement (z-score 2.35) with statement 56, regarding resilience at multiple scales, which distinguished factor B at the $p < 0.5$ level. Factor B was also characterised by disagreement with statement 47 (z-score -2.04) and agreement with statement 40 (z-score 1.65). Statement 47 was distinguishing for factor B ($p < .05$) and statement 40 was even more distinguishing, ($p < .01$). Both of these statements supported systematic approaches to the applied usefulness of monitoring and evaluation data. This was explained in very concise terms by researcher sort two: "Assessment requires data".

This factor appears relatively unsurprising on the surface. However, it is important to note that multi-level analyses were not yet being carried out by the majority of researchers engaged with the ICoE:CR. Research participants' viewpoint, around the need for analysis at a variety of scales, does not therefore simply suit their own interests. Instead, it highlights researchers' perceived need to engage a wider variety of researchers, extending well beyond initial partners to the ICoE:CR. Researchers' focus on informing high level strategy was much less surprising, given the prestige related to impacting policy rather than operational minutiae. For the ICoE:CR, this focus on prestige and larger scale concepts would be directly opposed to practitioners' operational priorities, reflected in factor A.

3.4.3 Factor C: Need to evaluate opportunities to improve complex post-disaster outcomes at a range of societal levels. This factor addressed the third research objective[8] of the current research, to identify any pattern(s) of opinions indicating agreement between both researcher and practitioner groups. Factor C represented a departure from the largely practitioner-centric factor A and researcher-centric factor B. By contrast, factor C loaded onto both practitioner and researcher sorts, with statistically significant ($p < 0.05$) loadings on every sort for the combined grouping.

Statement 60 had the highest z-score (-2.04) for factor C. Disagreement with this statement, about the independence of individuals from their communities and organisations, suggested an appreciation of contexts and influences therein. The diversity of these contexts was detailed in a statement from practitioner three: "If you were to create tags for all the different groups they are connected to… it would be a really long list… …No man is an island." We interpreted this explanation in the context of

[8] Wording changed from original "aim" to differentiate from overall thesis aims.

researcher and practitioner q sorts, to mean that we could conceivably compile such a list, as evidence that no man really is an island.

Support for the nested diversity of systems was complemented by agreement with statement 29, about diversity at a larger, community scale. This statement was a highly distinguishing statement for factor C ($p < 0.01$) and was accompanied by the explanation: “There isn’t a silver bullet that will work for everyone… …Local communities have different profiles of risk…” (practitioner sort four). Disagreement with statement 60, about independent individuals, also displayed a shared understanding of multi-level dynamics. So did a high level of agreement (z-score 1.82) with statement 12, about the interdependence of community groups immediately following an emergency event. High agreement with statement 12 was also accompanied by a qualitative statement to the same effect: “Communities should be able [to] look after one another with the basic essentials immediately after an emergency event…” (practitioner sort two).

Both practitioners and researchers appeared to value collaborations with each other’s organisations. This was suggested by the highly negative z-score (-1.90) for q statement 43: Project teams should not waste their time exploring further opportunities across organisational boundaries. Likewise, both practitioners and researchers appeared to place some value on evaluative findings, shown by a high level of disagreement (z-score -1.85) for statement 37: Organisations have no use for evaluative findings.

A focus on the pragmatic implications of monitoring and evaluating community resilience was shown by agreement (z-score 1.66) with statement 20, about how community resilience promotes a more rapid social and economic recovery. The pragmatic focus of this statement and some alignment with the outcomes theory of complex evaluations (see Duignan, 2013), was reinforced by the concise qualitative explanation, “This is an outcome of a resilient community” (researcher sort four). The functional nature of resilience in statement 12, about the capacities of resilient communities, appeared to further support a pragmatic focus. This statement had a z-score of 1.82 and was a particularly distinguishing statement ($p < .05$) for factor C.

Factor C was therefore labelled ‘Evaluating opportunities to improve complex post-disaster outcomes at a range of societal levels’. This factor label encompassed the value which all participants had placed on interventions for a diverse range of nested systems. The label also reflected a need for evaluation activities which will improve those interventions, towards improved post-disaster outcomes.

It was surprising to see that this pragmatic viewpoint significantly co-varied with all researcher and practitioner Q-sorts. There are often practitioners who do not see the pragmatic relevance of data collection and analysis. Likewise, most readers will know at least one, if not several, researchers, who fear being labelled *applied*. Although this term suggests that a researcher would like their research findings to make a positive impact, many researchers prefer to focus on a distant and therefore more distant view of their subject matter. Despite the higher conceptual focus suggested by factor B, researchers at the core of the ICoE:CR appeared genuinely motivated to ensure their efforts make a real difference for disaster-affected communities. ICoE:CR practitioners appeared confident that this could occur.

3.5 Conclusion

Five ICoE:CR researchers and five ICoE:CR practitioners were successfully recruited to better identify opinion factors which either differed or were shared between those groups, using Q-methodology. Three main aspects have emerged from this analysis of opinions about monitoring and evaluating community resilience. A factor analysis labelled one pattern of opinions ‘against informing insular, top-down decision making’. This pattern was prevalent amongst practitioners. Other patterns included: a ‘need for complicated analysis to inform strategic decisions’ which was prevalent amongst researchers; and a ‘need to evaluate opportunities to improve complex post-disaster outcomes at a range of societal levels’ which applied to both researcher and practitioner groups. Implications and limitations of these findings are outlined below.

The pattern of opinions ‘against informing insular, top-down decision making’ marked a specific potential for developing ICoE:CR collaborations. There appeared to be a strong drive towards more horizontal collaborations, between individual members and sub-groups, rather than whole organisations. The relatively flat organisational structure at WREMO meant that a range of ICoE:CR initiatives to monitor and evaluate community disaster resilience would be coordinated by front-line personnel. This differed from a more hierarchical approach, which would depend on vertical layers of management to develop new initiatives and filter the resulting information. In a way, this would resemble the dynamics of a distributed system (see Fiksel, 2003), which usually depend on nodes and horizontal linkages, rather than more rigidly top-down organisational structures.

For the ICoE:CR and similar programs, coordinators need to balance this drive towards horizontal networks with the continuing need for overall coherence. It can be granted that many individuals contributing to understandings of a resilience social system do not want to be limited by overly formal hierarchies. However, some form of hierarchy will still be required to exist within what Waugh and Streib (2006) referred to as the command and control paradigm of surrounding emergency management practice.

Likewise, the ICoE:CR will need to retain an identity as one of several centres of excellence within the overarching IRDR structure.

The ‘need for complicated analysis to inform strategic decisions’ amongst researchers was relatively predictable. This pattern of opinions relates to commentary by Schwandt (2005), who outlined a technical rationality of producing and delivering knowledge for uptake. For the ICoE:CR, this drive appeared to conflict with practitioners’ drive towards a much less hierarchical approach to monitoring and evaluating community disaster resilience. Researchers appeared to prefer delivering research findings to the more strategic echelons of emergency management agencies. This has clarified an issue of status within ICoE:CR collaborations, where researchers want to instruct managers while those managers and their personnel are pursuing a much more egalitarian approach. Considering funding and career structures of many contemporary universities, this conflict between status-based technical rationality and a more unassuming approach to horizontal collaborations is likely to affect a range of collaborative research programmes.

The third pattern of opinions suggested a solution for this conflict between practitioners’ egalitarianism and researchers’ technical rationality. The ‘need to evaluate opportunities to improve complex post-disaster outcomes at a range of societal levels’ was strongly shared amongst researchers and practitioners alike. This marks a combined impetus for the ICoE:CR which would not be simple. This impetus could nonetheless prove very useful for bringing the efforts of ICoE:CR researchers and practitioners together. The evaluation theory of pragmatic pluralism is relevant here. This theory has been used to facilitate monitoring and evaluation collaborations between diverse disciplines and focuses on three core questions: “What is to be done?; How shall we decide what to do?; What can guide our actions?” (Taket & White, 1996, p. 574).

Pragmatic approaches are commonly criticised for taking a superficial approach to complex matters, without considering ethical concerns. However, any overly practical drive towards a Machiavellian ethic, where the means justify the end, can be managed by documenting a clear set of ethical principles. Such principles offer a profound response to the question: What can guide our actions? As outlined by Patton (2011) explicit principles create an overarching context beneath which a more socially responsive program can be fostered to full development. This approach has already been taken by at least one monitoring and evaluation initiative for emergency management: Morgan and Begg (2013) outlined the framework developed to monitor and evaluate social dimensions of recovery from the Canterbury Earthquakes. Close to thirty organisations began collaborating amongst the conceptual milieu of social recovery from disasters. This domain of theory and practice was arguably just as complex as pre-disaster community resilience. Considering the relationship between domain complexity and evaluation complications outlined by Rogers (2008), the complexity of recovery concepts made these collaborations particularly complicated to coordinate. Few details are publicly available about this New Zealand Government initiative. However, the current authors are aware that the monitoring and evaluation framework was guided by overarching principles from Sen's (2009) theory of social justice.

As recommended by an abbreviated version of these research findings, the ICoE:CR has since documented an explicit set of guiding principles. These principles have begun to build on a number of general principles outlined in the WREMO community resilience strategy, to guide even the most initial stages of ICoE:CR development. There is still a potential to neglect analyses of vulnerability, a concept which is related but distinct to indicators of resilience (see Manyena, 2006). This potential for neglecting vulnerabilities is one of several ethical issues which remain to be explored as the ICoE:CR and similar community disaster resilience initiatives develop.

The current analysis was limited in two particular ways. No analytical data piloted and included in the final sample for the current research referred to an extended timescale for post-disaster outcomes. More extended timeframes will need to be considered by any person hoping to facilitate an indicator framework, as a boundary object between ICoE:CR partners. Our current findings were also limited by the 2013 Seddon earthquakes, which occurred between Q-sort data collection and full analysis. These earthquakes produced magnitudes of 6.5M and 6.6M (GeoNet, 2013) and caused light to major damage to buildings in Wellington City (Wellington City Council, 2013). Many of the perspectives identified are likely to may have been modified by participants' personal experiences of these events.

We hope that this first phase of our research programme nonetheless provides a worthwhile discussion of relevant theory surrounding practice and research collaborations in the field of emergency management. It appears that both researchers and practitioners can agree on a practical imperative of using complicated analyses towards improving the resilience of geographically situated communities. Inclinations toward technical rationality and overly-simplified concepts remain a workable pair of challenges for Wellington ICoE:CR practitioners and researchers. Ethical considerations will also require more work. Approaches to meeting these challenges, amongst others faced by the Wellington ICoE:CR, will benefit by being documented, shared and discussed between a wide range of national and international community disaster resilience contexts.

The current research forms part of an extended programme of research, funded by the New Zealand Earthquake Commission, GNS Science, and Massey University. This

phase has built a conceptual foundation for the remainder of the research programme, which now involves building and evaluating a working monitoring and evaluation framework for the ICoE:CR.

4. Study One Exposition

Study One identified strong opinions about community resilience, held by researcher and practitioner members of a new collaborative research centre. This study specifically aimed to identify differences and similarities in members' opinions about building a shared framework of community resilience indicators. Three clear patterns of opinion were identified, using an approach to opinion-related research called Q-methodology. The concourse of statements analysed in Study One had been derived from discourse relating to indicators of community resilience, in answer to the research question: What are the strong patterns of opinion that need to be considered when implementing an information display for collaboratively monitoring and evaluating a regional community resilience strategy? Implicit in this research question was a background assumption that patterns of opinions about indicators for monitoring and evaluating community resilience could be coherently identified. This assumption has since been evidenced by the statistical structure, logical clarity, and theoretical relevance of each opinion factor outlined in the previous chapter.

Each of the identified opinion factors are reiterated in 4.1 below, alongside the apparent relevance of each one, for researcher and practitioner participants. Section 4.2 then outlines implications of these results for ICoE:CR development. Study One nonetheless had a number of limitations which could not be outlined within the restrictions of a published academic paper. Limitations surrounding participant fatigue and the online interface are therefore discussed in detail, in 4.3. Recommendations are made to help avoid this limitation in future Q-method research. A commentary on reflexivity is also provided, in 4.3.4. This commentary focuses on subjective influences on the Study One research design, and on the subsequent interpretation of factor labels.

This chapter then concludes by outlining findings and implications which are particularly relevant to Study Two action research.

4.1 Summary of Results

As shown in table 1 of the previous chapter, all three factors retained after factor rotation had an eigenvalue greater than 1.0, meeting the Kaiser criterion from Kim and Mueller (1978) and Weiss (1976). This set of factors was also retained because it highlighted both differences and similarities between ICoE:CR partner groups, addressing the specific focus of Study One outlined above

Factor A explained 20 percent of overall variance in the Q-sort data and was labelled ‘Against informing insular, top-down decision making.’ As shown in table 1, this factor was particularly prevalent among practitioners. As detailed in Chapter 3, the characteristics of factor A included support for: bottom-up solutions; horizontal collaborations between project teams: and for incorporating highly localised knowledge into decisions about community resilience interventions. These characteristics appeared to place factor A in conflict with the subsequent viewpoint identified.

Factor B explained 20 percent of variance and was labelled ‘Need for complicated analysis to inform strategic decisions.’ This factor was most prevalent among researchers, rather than practitioner partners to the ICoE:CR. As detailed in Appendix G, the characteristics of factor B appeared to amount to a focus on the theoretical, rather than practical, use of community resilience indicators.

Factor C explained 22 percent of variance and was labelled ‘Need for complicated analysis to inform strategic decisions’. Tables detailing factor characteristics that were used to formulate this factor label are provided in Appendix H. Factor C was prevalent among both practitioner and researcher members of the ICoE:CR.

4.2 Further Discussion

The relevance of Study One to the thesis as a whole rested on one key assumption: that analysing patterns of opinions amongst two very different groups of professionals would better define the contributions of a monitoring and evaluation framework to ecological rationality. An abductive approach to this key assumption meant further developing this assumption into a more detailed hypothesis, rather than simply seeking to support or contradict the initial assumption. As outlined in Chapter 3, the analysis of strong patterns of opinions amongst collaborating researchers and practitioners did help define useful decisions which could be supported by a monitoring and evaluation framework of community resilience indicators. Factor C provided a valuable contribution to defining how a logic model embedded in the ICoE:CR could constitute a component of heuristic decisions exhibiting ecological rationality. In other words, factor C identified a common purpose which decisions made using that logic model could help address. However, Study One also highlighted very different views among ICoE:CR researchers and practitioners, about how community resilience indicators should be formulated and used among.

4.2.1 Double demotivation. Insights from organisational psychology suggested that the divide between researcher and practitioner opinions, illustrated by differences between factor A and factor B, could have serious implications. The organisational psychology concept of *double demotivation* describes what can occur when groups with different cultural backgrounds work together in a way that turns their different circumstances and cultural differences into a counter-productive double loop of inter-group friction (Carr & McLachlan, 1995; Carr & MacLachlan, 2005; MacLachlan & Carr, 1993). This is because interactions between different cultural groups can be interpreted and reproduced with reference to very different sets of implicit assumptions, especially when each group has relatively little knowledge of the other group's assumptions (Carr & MacLachlan, 2005).

Figure 8 illustrates how this concept could also define the destructive potential of differences between practitioner and researcher opinions within the ICoE:CR identified in Study One. Labels on the lines between each group posit the type of communication which is likely to occur. These labels are based on the relevance of operational issues among ICoE:CR practitioners and on the identified relevance for ICoE:CR researchers, respectively identified as factors A and B in Study One. These cultural differences meant that practitioners and researchers were likely to interpret interactions with each other in a negative light.

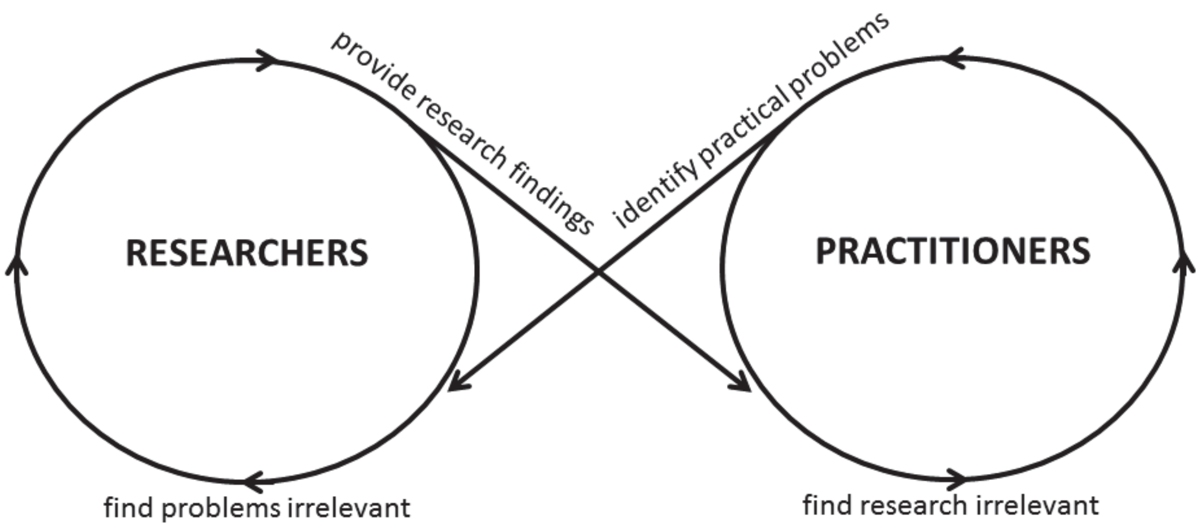

Figure 8. Potential double-demotivation between ICoE:CR researchers and practitioners

The type of dynamics shown in figure 8 appeared to be particularly likely in the absence of an innovative approach to the way that each of these groups operate and interact. This was this importance of factor C, which highlighted a way to mitigate the potential for double demotivation within the ICoE:CR. This viewpoint marked a strong and mutual impetus towards improving community resilience related outcomes across the Wellington region. In effect, both researchers and practitioners appeared to agree that their use of indicators for analysing community resilience should result in a more effective program of community resilience interventions.

These practical implications of identifying factor C resembled a key conclusion from previous organisational Q-method research by Sostrin (2008), that Q-methodology can inform invaluable improvements to workplace learning and performance. According to Sostrin (2008), the benefits of insights from their own Q-methodological research were "potentially immense" (p. 179) for professionals leading organisational development.

4.2.2 A mode 3 approach to ICoE:CR collaborations. Theoretically-focused research, alluded to in factor B, had an important role to play in the new research centre. However, this did not need to limit the pragmatic value of applying and refining that research with reference to practical problem situations alluded to by factor A. The potential for applied organisational research which references and contributes to theoretical foundations was outlined in the *mode three* model of research from Huff and Huff (2001). This model of research extended rigid understandings of *mode one* knowledge generation and *mode two* knowledge application research into an attempt to address the purposes of both of these modes. This mode three approach to organisational research may avoid a major pitfall of *pedantic* research into organisations which, according to Anderson, Herriot and Hodgkinson (2001), is focused on intellectual rigor at the cost of practical relevance. A mode three approach to research may also avoid the pitfalls of what Anderson et al. (2001) call *populistic* research into organisations that is practically relevant while lacking methodological and theoretical rigor.

Huff and Huff (2001) stated that a mode three process of collaborative research is triggered by appreciation and critique. Both researchers and practitioners become active participants in mode 3 research, towards the shared goal of "future good" in society (Huff and Huff, 2001, p. 52). According to Huff and Huff (2001), mode three research focuses on collective experience and conversation as part of a research process which extends from immediate to long term timeframes. Considering the impetus highlighted by factor C, the ICoE:CR approach to community resilience had the potential to assume this kind of research process. Given the mode 3 focus on pragmatic benefits, this potential is of particular interest to the current thesis.

4.3 Limitations

The main methodological limitation identified during the course of Study One was that participants appeared to find the Q-sort procedure particularly demanding. Feedback from participants suggested that this led to considerable fatigue during the online protocol. The way that this Q-sort procedure was performed online, using an electronic interface, represents a second set of limitations. Although the online Q-sort interface enhanced accessibility and anonymity, it may have been inferior to a traditional, paper-based Q-sort procedure. The latter procedure may promote higher quality Q-sort and complementary data. These issues are outlined below.

4.3.1 Participant fatigue. Q-sort procedures may be demanding in general. They require participants to rank the relevance of several statements which they may have never considered in much detail. This difficulty may have been exacerbated by the way that the Study One concourse concerned the highly complex topic of monitoring and evaluating community resilience. Q-sample piloting established that the entire Q-sample would be familiar to most if not all of the Study One participants. However, considering that monitoring and evaluation has not yet become an institutionalised part of WREMO or the surrounding ICoE:CR, many participants were likely to have had a very superficial engagement with the concourse in question. It would have been demanding enough for many of these participants to consider a diverse range of relatively technical concepts concerning community resilience. These demands were probably compounded by the time constraints of performing an online procedure within their busy workplaces. Table 3, overleaf, shows a number of comments from participants concerning the difficulty of completing the online Q-sort procedure. These statements suggested that that both practitioners and researchers became fatigued as a result of specific difficulties.

Q-sort data from the researcher group included an even more specific comment: “Also, card allocation depends in part on order of cards, as columns fill up and then it comes down to how much you can be bothered re-organising.” This statement illustrated an additional impact of fatigue during the q-sort procedure, where several participants may have not have re-ordered their initial sort. This would have detracted from participants’ careful consideration of all statements, and the relevance of resulting variance.

The same researcher participant complained about how an “Inability to readily see the full content of cards while sorting the second time hampers allocation.” This highlighted a difference between paper and electronic Q-sorts. Paper-based Q-sorts keep full statements within view of the participants on the table in front on them. Many statements embedded in either FlashQ (Version 1.0, Hackert & Braehler, 2007) or Q-

Assessor (1999) software platforms are only fully visible when hovering the mouse cursor over them. This capability helps accommodate several statements within the limited dimensions of a computer screen. However, as illustrated by this participants' comment, but may have made it difficult for Study One participants to gain a more holistic perspective of their Q-sort.

Table 3

Participant Feedback Concerning the Difficulty of Completing the Online Q-sort

Statement	Participant Group
"That was one of the hardest things I have ever had to do."	Practitioner
"I have done your thingy (and didn't like it very much, too complex,didn't do a very good job with it, so you may want to bin it."	Researcher
"Sorry I have been too busy to make another attempt to battle the Q-sort dragon."	Researcher
"…due to the language used there were several statements I could not place in either agree disagree or neutral box because their meaning was ambiguous. I simply did not understand what they were trying to express."	Researcher
"This is way too long and complex [to] fill in when you're busy!!!!"	Researcher

4.3.2 Complementary qualitative data. Further limitations posed by the online protocol included the use of online survey questions instead of more detailed follow-up interviews. Survey questions in Study One simply asked participants why they ranked highest and lowest ranked statements so high or low. This meant that participant's commentaries detailed in Study One lacked the depth and scope of in-person interview data. The lack of follow-up interviews may have also detracted from the process of factor labelling. Compared with post Q-sort interviews, brief survey questions could have provided much less opportunity to “discuss or amplify the researcher’s interpretation” (Wolf, 2014, p. 4). Instead, researcher interpretations were only checked through a relatively informal approach to presenting very initial factor labels for discussion with the groups involved.

4.3.3 Data collection. Software customised for the online protocol posed two limitations regarding the physical collection of Q-sort data. Firstly, the custom modification of FlashQ used for Study One did not allow participants to upload their Q-sort responses to the internet. Instead, all participants needed to print a report and place it into a sealed post box in their workplace. This mode of completing the protocol was less anonymous than simply pressing a button at the end of the online protocol because colleagues could observe exactly who was participating in the research. Secondly, participants did not always complete the protocol in their workplaces. Although they were encouraged to make sure they had the ability to at least print to pdf (i.e. create an electronic version to print upon return to the office) from a remote location, complications with submitting Q-sort print-outs resulted in the loss of at least one participant’s data.

4.3.4 Reflexivity. Patton (2002) defined reflexivity in qualitative research as being: “self-analytical”; “politically aware”; and “reflexive in consciousness” (p. 41). The previous chapter outlined some degree of self-analysis. For example, key differences between researcher expectations and factor analysis results have been outlined in terms of personally surprising findings. These surprises include researchers’ interest in multi-level analyses. Likewise, it was surprising to see such strong and universal support for using community resilience indicators to improve post-disaster outcomes. However, as outlined in the methodology chapter for this study, Q-methodology and the abductive processes it entails can benefit from a slightly more in-depth approach to reflexivity. This helps to acknowledge and structure the many interpretations made by the researchers during Q-methodology research. Considering the components of reflexivity outlined by Patton (2002), it seemed important to further discuss how certain understandings of the ICoE:CR and similar initiatives affected the research. As outlined in 4.3.5, it is also important to outline how my own understandings have changed as a result of conducting the research.

As outlined in the preceding chapters, the Q-sample was selected from a large initial set of over 650 statements. These statements were selected and piloted using a sampling matrix which divided all statements into the following purposes: generating knowledge; planning and management; transparency and democracy. As shown in figure 6 in the previous chapter, these groups of statements were also sub-divided by practical and theoretical positions. The structure of this sampling matrix closely resembled the structure of viewpoints subsequently identified. The most obvious resemblance is how two viewpoints assumed the same practical/theoretical division shown in figure 6, both in terms of content and a neat division between practitioner and researcher groups.

It seems important to note how Study One results could have been very different if a different sampling matrix was used to select the Q-sample of 60 statements used for the Q-sort protocol. However, it is also possible that my intuitions regarding the initial sampling matrix represented insights regarding the ICoE:CR. Rorty's (1980) principle of the lack of correspondence between a theoretical statement and any unitary object existing independently of that statement is relevant here. The lack of opinion structures identified independently of Study One meant there was no way to know whether the sampling matrix represented an arbitrary judgement or an insightful contribution to the research findings.

4.3.5 The (ir)relevance of monitoring and evaluation. Parallels between the sampling matrix and viewpoints identified were not necessarily surprising. My surprisingly inaccurate assumption about the relevance of monitoring and evaluation for ICoE:CR stakeholders provided a much better avenue for extending an abductive approach to Study One. While designing Study One, I had assumed that monitoring and evaluating community resilience would be paramount for ICoE:CR coordinators and collaborators. This assumption had been formed after discussing the relevance of the upcoming regional community resilience strategy with the coordinators, in the months leading up to Study One. As a researcher with an ongoing interest in monitoring and evaluating sustainability and disaster recovery initiatives, I had assumed that a research focus on strategy would mean monitoring and evaluating the effectiveness of that strategy. Developments following Study One suggested that an alternative explanation was required.

Within six months of approving the initial set of Study One findings, ICoE:CR coordinators planned a large-scale workshop. This workshop involved participants from several regions of New Zealand and from off-shore emergency agencies and research institutions. All workshop participants were asked to help answer one key question: "How do we ensure that lessons from past disasters and day-to-day good practice in one region are implemented into future pre-disaster recovery plans in others?" (Doyle, Becker, Neely, Johnston & Pepperell, 2015, p. 60). On the surface, the latter half of this question seems highly relevant to monitoring and evaluation. However, not one of the presenters invited to introduce and facilitate the workshop appeared to have a background in monitoring and evaluation as a part of program evaluation. As a result, workshop outcomes were characterised by commentary on: Challenges to collaboration; Ideas to improve collaboration; and Collaboration considerations for a digital space (Doyle et al.

(2015). A summary of workshop outcomes, by Doyle et al. (2015), outlined how participants had discussed the need for trust and transparency. Monitoring and evaluation was not mentioned as a way to meet these needs. Actually, monitoring and evaluation was not mentioned at all, in the documented workshop outcomes and recommendations. The following section explains how this unanticipated discovery changed my approach to Study Two.

4.4 Conclusion

As outlined in 4.3, Study One findings summarised in 4.1 and discussed in 4.2 were affected by a number of limitations. Most of these limitations concerned the online interface which participants used to complete their Q-sorts of statements about monitoring and evaluating community resilience. This interface combined with other software issues and a challenging research topic to mean that some Study One participants became unnecessarily fatigued. Substantial changes to online Q-sort software may have helped reduce this fatigue while integrating a more in-depth approach to post-sort survey questions.

A reflexive approach to interpretations made during Study One concluded that monitoring and evaluation was a much more important topic for the current thesis than it was for coordinators and the wider membership of the ICoE:CR. This is one way that the usefulness of any logic model developed during Study Two needed to be more multi-faceted and nuanced than initially assumed. Other aspects of building a logic model for promoting a genuinely collaborative approach to the ICoE:CR were needed to complement the shared objective of improving post-disaster outcomes throughout Wellington region communities. Considering that Study One had identified a potential for destructive inter-group friction, decisions supported by this logic model also needed to promote a more constructive approach to collaborations within the centre, assuming a mode three approach to collaborative research.

Potential improvements to methods. Paper-based Q-sorts may help overcome many of the limitations outlined earlier in this chapter. Researchers conducting a paper-based Q-sort in person have the advantage of being able to motivate participant engagement, interview participants in detail at the end of the Q-sort process, and provide a more user-friendly sorting interface. However, paper-based Q-sorts may also include disadvantages, such as a perceived lack of anonymity amongst participants. Q-participants are typically observed by researchers while completing a paper-based Q-sort. They are also interviewed personally, regarding that sort.

This method of data collection also means that researchers are not blinded to the identity of the participant completing each sort. This lack of privacy may feel invasive to some participants, especially when the sort concerns personally sensitive topics, or politically sensitive topic such as community resilience against disasters. For Study One, this means paper-based Q-sorts would have probably reflected sorting behaviours in response to perceived demands from the researcher rather than only reflecting participants' beliefs.

Unlike most paper-based Q-sorts, the online Q-sort protocols could be completed at any time which suited the participants. This flexible accessibility may have helped promote a higher rate of participation in Study One. Twelve of a total of fourteen practitioners and researchers clearly involved in the initial development of the ICoE:CR completed the online Q-sort. This level of engagement may not have been achieved if these very busy participants needed to agree to a place, date and time to complete the Q-sort. Instead, these researchers and practitioners were able to complete the Q-sort at a place, date and time which most suited them. Future online Q-sort interfaces could be designed to at least partially avoid limitations observed during Study One. These interfaces could be re-designed for showing whole statements on large widescreen monitors, considering that these monitors are feature of many modern workplaces. They could also use survey questions which more closely resemble a follow up interview, in order to obtain a richer set of explanations about participants' sorting behaviour. Future software should include the opportunity to simply upload the resulting Q-sort data, to improve anonymity and general ease of use.

Some of the changes outlined above may help address the challenge of participant fatigue in a range of Q-methodological research. However, given the complexity and complicatedness of the research topic, fatigue may have been an unavoidable part of Study One. This may not be the case for Q-methodology research concerning more straight-forward domains, among participants facing fewer and more defined demands in their daily working lives. In retrospect, this means that participant fatigue formed an ethical issue for Study One. The Study One design did not include any measures to minimise distress caused by the demanding nature of the Q-sort protocol. This may have represented an unreasonable demand on emergency management professionals in particular, considering their busy working lives and often unpredictable schedules. Future Q-sorts amongst participant groups facing these kinds of demands may need to define a much less complex portion of an overall topic. Conducting this research in person using a paper-based Q-sort may also help minimise potential harm, by enabling the researcher to detect and mitigate any signs of participant distress and/or fatigue.

Relevance to Study Two. The potentials outlined above, for supporting decisions which promote collaborations and decisions which improve post-disaster outcomes, became important considerations for the current thesis. These potentials defined the importance of any logic model framework developed in the ICoE:CR context, to ecological rationality. At this stage of the thesis, a logic model resulting in decisions which facilitate diverse collaborations while improving the effectiveness of WREMO community resilience interventions would therefore represent a component of ecological rationality. In other words, a logic model which constituted an abbreviated but effective representation of the WREMO community resilience strategy would help lead to decisions facilitating improved collaborations and outcomes. This definition of ecological rationality was then used to both guide and assess the logic model being developed during Study Two. To accommodate the plurality of factors A and B identified in Study One, decisions made using this logic model would ideally constitute a mode three approach to research, contributing to theory and more immediately practical knowledge alike.

The following chapter outlines the Study Two methodology adapted to reflect Study One findings. This continuation of the current thesis involved using VMEP to conduct an assessment of how and why the WREMO community resilience strategy could be analysed in an effort to improve that program. This constituted the action research intervention for Study Two, explained in 5.1, 5.2, and 5.3. In addition to this intervention and as a piece of research, the twofold aims of Study Two were to identify how and why the VMEP process changed over time and to test whether the distribution of strong opinions shifted over the same period. Section 5.4 of the following chapter outlines the epistemological assumptions and methodology used to answer these research questions.

5. Methodology for Study Two

Study Two conducted action research to adapt the VMEP process for planning research into community resilience, within the Wellington ICoE:CR. The prinicipal aim of this study was to identify how and why the VMEP process changed over time and to test whether the distribution of strong opinions identified in Study One shifted during this process. A detailed explanation of the action research intervention is provided to illustrate how slight adaptations to VMEP meant that this process could assess the ICoE:CR's readiness for a more structured evaluation and/or further development of their research-based activities. The current chapter focuses on action research methods as a means to promote their collaborative engagement with analysing community resilience interventions. Methodology and methods applied to document this action research as a set of research-based knowledge are also outlined.

Between Study One and Study Two, the ICoE:CR was officially announced as one of the IRDR (2014) International Centres of Research Excellence. Study One established that professionals at the core of the ICoE:CR were divided by strong patterns of opinions, that on the one hand resisted top-down decision making (prevalent among practitioners) and on the other, reinforced a need for complicated analysis to inform strategic decisions (prevalent among researchers). Despite these differences in opinion, these professionals still appeared motivated to work together towards improving more tangible outcomes of the regional community resilience program. This motivation was identified through a viewpoint held by all Study One participants which focused on the need to evaluate opportunities to improve complex post-disaster outcomes at a range of societal levels.

In Study Two, these findings from Study One were used in action research to design and iterate a visual logic model. This logic model was designed to support decisions concerning principal ICoE:CR objectives which, as identified in the previous chapter, were to both: facilitate diverse collaborations; and support the effectiveness of WREMO community resilience activities. In terms of the cognitive theory of ecological rationality, these objectives characterised the decision making usefulness of the VMEP logic model produced and documented during Study Two. It was anticipated that, as a heuristic approach to complexity, a VMEP approach to relevant decisions would mark an improvement on more linear approaches to collaborations within the ICoE:CR, relying on text-based document formats.

The remainder of this chapter outlines how Study Two addressed the second main research question for this thesis: How can a logic model support collaborative efforts to usefully monitor and evaluate a complex community resilience strategy? An overarching process called evaluability assessment is outlined alongside a number of pitfalls which needed to be avoided or mitigated during this process. The following sections outline why and how an evaluability assessment process was facilitated in Study Two, through the use of a VMEP logic model. This process culminated in a combined workshop of ICoE:CR practitioners and researchers which is outlined in specific detail. The chapter concludes with a description of how these action research elements were documented, in an effort to evidence the usefulness of embedding the VMEP logic model as part of ICoE:CR development.

5.1 Study Two as Action Research

According to Reason (2003), action research is an "approach to human inquiry concerned with developing practical knowing through participatory, democratic processes in the pursuit of worthwhile human purposes, drawing on many ways of knowing in an emergent, developmental fashion" (p. 108). As outlined in Chapter 1, this approach to research epitomises Rorty's (1980) pragmatic philosophy, because it avoids trying to produce knowledge from an apparently objective distance. Instead, action research focuses on establishing knowledge that is found to be useful by identifiable groups of people, and produced through the active participation of those groups (Reason, 2003).

As action research, Study Two was primarily focused on preparing and conducting a two hour workshop to foster the development of practical knowledge among WREMO practitioners alongside representatives of various research organisations. As part of the ICoE:CR, each of these workshop participants was a stakeholder in the WREMO (2012) strategy. This workshop therefore focused on further developing an initial VMEP logic model of the WREMO strategy, to make it an integral part of collaborative, inquiry-based activities within the ICoE:CR. As outlined below, this approach to action research constituted a participative approach to developing program-related knowledge, called evaluability assessment.

5.2 The Evaluability Assessment Approach

Evaluability assessment provides a relatively rapid and low-cost way to help "ensure the feasibility and usefulness of further evaluation" (Wholey, 2010, p. 81). This is an exploratory approach to evaluation for addressing complex strategic goals which have been poorly defined and which may be subject to disagreement between important stakeholders (Wholey, 2010). Evaluability assessment was relevant to the ICoE:CR context because, although potential ICoE:CR objectives were identified in Study One, highly divergent objectives were also identified in terms of researcher-centric and practitioner-centric patterns of opinions. Likewise, ICoE:CR stakeholders had not yet agreed on how they would approach any shared objectives collaboratively, to improve the outcomes of community resilience interventions.

Wholey (2010) stated that evaluability assessments are most appropriate when a program does not appear to meet the following criteria: "(1) Program goals are agreed upon and realistic…. (2) Information needs are well defined…. (3) Evaluation data are obtainable…. (4) Intended users are willing and able to use evaluation information" Wholey (2010, p. 83). These criteria had not yet been met by the WREMO (2012) Community Resilience Strategy for the Wellington region. As a very recent initiative which has not yet incorporated key local stakeholders and their respective expertise, the regional community resilience strategy had not yet developed program goals that were widely agreed. Tentative indicator metrics identified by WREMO prior to the workshop were output- rather than objective-based and intended users had not committed to using these data. In order to remedy this kind of situation, the evaluability assessment process outlined by Wholey (2010) entails the following steps:

(1) involve intended users and other stakeholders… .

(2) clarify the program design… .

(3) explore program reality… .

(4) assess the plausibility of the program… .

(5) reach agreement on any needed changes in program design or program implementation… .

(6) reach agreement on the focus and intended use of any further evaluation. (p. 84)

This six step process serves to "assess whether programs are ready for useful evaluation; get agreement on program goals and evaluation criteria; clarify the focus and intended use of further evaluation" (Wholey, 2010, p. 88). According to Wholey (2010), the success of evaluability assessment depends on a range of stakeholder input, concerning a set of agreed objectives which bring those stakeholders together. The need to consider these aspects of evaluability are discussed in the following sub-section. This attention to objective-based stakeholder input is how evaluability assessment constituted action research as part of the current thesis, by what Reason (2003) referred to as the participatory development of diverse and practical knowledge.

5.2.1 Pitfalls to be avoided or mitigated. Wholey (2010) outlined a number of pitfalls which can occur before research and evaluation data collection begins. It appeared that many of these issues could be avoided or mitigated while planning an evaluability assessment as part of Study Two action research. The foremost pitfall outlined by Wholey (2010) was commencing evaluation even through the program in question still has vague objectives with no way to usefully gauge the impacts of those objectives (Wholey, 2010). This also relates to the second pitfall outlined by Wholey (2010) which is a tendency to begin premature data collection. Patton (2011) used a similar critique of premature summative evaluations to justify what he called a *developmental* approach to evaluation. As outlined in Chapter 1, this understanding of evaluation helps to accommodate hard-to-predict characteristics of complex systems by using evaluation to incrementally develop new programs. This developmental approach to evaluation therefore continues to inform many aspects of this thesis, including Study Two action research.

The third and fourth pitfalls outlined by Wholey (2010) were a failure to secure key stakeholder input and the failure to clarify program managers' views on what can be learned through evaluation. The difficulty of engaging busy managers and other stakeholders was illustrated in a case study of evaluability assessment by Thurston, Graham, and Hatfield (2003). It was also important to note that, as highlighted in Chapter 4, a degree of apathy concerning program monitoring and evaluation had been observed among ICoE:CR partners. In an effort to promote their engagement, the Study Two action research engaged core ICoE:CR stakeholders and WREMO management as early as possible in the potential monitoring and evaluation of WREMO community resilience activities. Furthermore, invitations to the current workshop were sent to key stakeholders both repeatedly and well in advance. Many of these stakeholders expressed a specific interest in research activities. To accommodate this interest and avoid apathy concerning program evaluation, the term *collaborative research* was used to describe all monitoring, evaluation and research activities discussed during the Study Two workshop.

5.3 Using VMEP to Facilitate an Evaluability Assessment

The preceding, six step process can be used to improve how a program meets the evaluability criteria of whether: "(1) Program goals are agreed upon and realistic…. (2) Information needs are well defined…. (3) Evaluation data are obtainable…. (4) Intended users are willing and able to use evaluation information" (Wholey, 2010, p. 83). As outlined in table 4 and the following paragraphs, it appeared that many steps in Wholey's (2010) evaluability assessment process could be facilitated by the development of a VMEP logic model.

Table 4
Alignment between Evaluability Assessment and VMEP Processes by Stage

Evaluability Assessment Stage	VMEP Stage
1. Engage stakeholders and other users	No explicit congruence
2. Clarify program design	Develop logic model hierarchy
3. Explore program reality	Show assumed causality and priorities
	Discuss preceding stages
4. Assess program plausibility	Discuss preceding stages
5. Agree on program amendments	Show potential indicators
	Plan monitoring and evaluation projects
	Use results to improve logic model
6. Agree on further evaluation	Show potential indicators
	Plan monitoring and evaluation projects
	Use results to improve logic model

5.3.1 Step one: Involve intended users and other stakeholders. Study One engaged two stakeholder groups for the purpose of monitoring and evaluating the regional community resilience strategy. Representatives of Wellington-based researcher and practitioner stakeholders participated in Q-methodological research, to help identify viewpoints regarding these monitoring and evaluation activities. This initial set of stakeholders was expanded incrementally during Study Two action research, to encompass a wider range of Wellington-based research institutions, including universities such as Victoria University and Crown Research Institutions such as the National

Institute for Water and Atmospheric Research. In Study Two, this represented an opportunity to take a broader approach to community representation, beyond WREMO and its associated research organisations, the Joint Centre for Disaster Research and GNS Science. Details of this engagement are provided as a workshop plan, in 5.4.1.

5.3.2 Step two: Clarify the program design. A workshop focused on evaluability assessment also had the potential to clarify the program design, through further developing the VMEP logic model. According to McLaughlin and Jordan (2010), logic models provide a means to “make explicit … .understandings about programs and how those programs work to achieve their outcomes given their specific operating contexts” (p. 59). Thurston et al. (2003) suggested that logic models help stakeholders detect discrepancies between goals outlined and the activities programmed to meet those goals.

Examples of using logic models to clarify program design have been provided by The Heinz Centre (2009), Hellberg, Davis, Feeney, and Allen (2009), and Margoluis et al. (2009). The potential for clarifying program design was illustrated for VMEP-like models in particular in the case study by Huggins and Jones (2012). This case study detailed how a VMEP-type logic model helped public sector managers to focus on the pragmatic implications of a complex conservation strategy. The use of VMEP logic models for clarifying the design of research-focused programs was illustrated in another case study, by Huggins and Peace (2014). This case study illustrated how VMEP was adapted to help clarify and adjust a large scale program of sustainability research.

This stage of developing the VMEP logic model used in Study Two action research was conducted prior to the workshop, during meetings with the Manager, WREMO Community Resilience. During these meetings, the manager provided components and then directed me to assign them to different sections of the initial hierarchy. This meant that the hierarchy of program components produced during this stage of the VMEP process reflected his interpretation of activity and outcome components described by the WREMO (2012) Community Resilience Strategy. This initial iteration of the logic model helped clarify existing components from the original WREMO (2012) Community Resilience Strategy document. This document had not yet determined clear linkages between WREMO activities and community resilience outcomes. An initial version of these linkages was developed during the next step of evaluability assessment. This marked an effort to explore the pragmatic, action-orientated reality of the WREMO community resilience strategy according to the manager of that program.

5.3.3 Step three: Explore program reality. Study Two took a relatively flexible approach to using logic models to explore program reality. Traditional program logic models discussed by McLaughlin and Jordan (2010) have been largely restricted to one-to-one causal relationships between program components. The VMEP approach to logic models incorporates a slightly different set of drawing rules concerning links between the components of a program hierarchy. Like other types of logic model, these components are linked by arrows to show program intentions between several levels of outputs, objectives and higher level outcomes. Duignan's (2012b) drawing rules for VMEP logic models do not limit the number of links between model components. Practically any logic model component could be linked to any other, regardless of the number of links that a model component already has.

The case study of VMEP for conservation planning, monitoring and evaluation by Huggins and Jones (2012) illustrated how these drawing rules can reflect a more accurate depiction of program pragmatics. For example, multiple linkages were made between multiple aspects of pest control and multiple conservation benefits. This approach to drawing logic model linkages was particularly valuable for exploring program implications within the complex systems of multiple interactions which New Zealand's national conservation strategy aimed to address. As outlined in Chapter 1, community disaster resilience is another complex domain, marked by multiple interactions between multiple sub-systems. This complexity pointed to the particular relevance of VMEP logic models, as introduced in 1.3, for planning monitoring, evaluation and research concerning the WREMO community resilience strategy.

As outlined above, the third step of evaluability assessment focused on exploring the program reality in more depth. This step aligned with a step of the VMEP process that involved building linkages between the hierarchy of logic model activity and outcome components. A highly simplified and generic example of a logic model resulting from these steps is shown in figure 9. This marked a continuation of prior VMEP stages carried out with the WREMO community resilience manager. This initial version of the VMEP logic model, shown in figure 10, represented his current priorities for interventions being carried out by his team of emergency management practitioners.

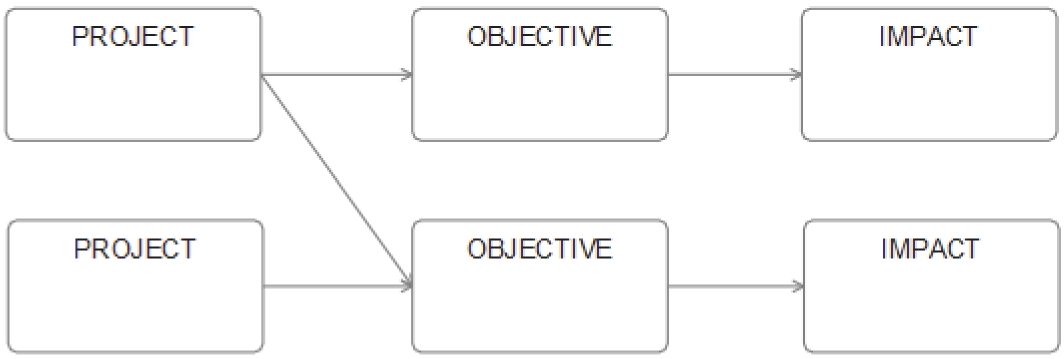

Figure 9. Simplified example of VMEP logic model showing components and line of sight.

Although a number of rules used for drawing a VMEP logic model are immutable, model facilitation could still consider a range of design considerations for maximising the transparency and utility of any particular VMEP model. Informatics design expert, Cairo (2012) highlighted how a range of visual elements help information displays to focus on the way things work, not just the way things are. This suggestion was particularly relevant to Study Two because the dynamism and relatively unpredictable emergence of community resilience made it impossible to create an enduring or exhaustive representation of the way things were throughout the WREMO strategic domain. As detailed in the Initial Literature Review chapter, this focus on actions rather than stasis is also an essential aspect of VMEP logic models. The actions depicted by linkages and component placement means the VMEP process is not trying to exhaustively describe a specific state. Rather, VMEP logic models detail the pragmatic actions surrounding a specific mandate or other set of organisational objectives.

Program reality was explored to some extent prior to the Study Two workshop. This was done by depicting assumed linkages from community resilience activities to components of community disaster resilience identified by the Manager, WREMO Community Resilience. Meetings with this manager established that prioritised activities were assumed to be associated with certain improvements in a sub-set of resilience components. These priorities and linkages were made explicit on the VMEP diagram alongside existing key performance indicators, for further discussion during the Study Two workshop. In an effort to maintain interest and support from WREMO managers, I reduced the complexity usually displayed at this stage of a VMEP logic model. Rather than determining priorities and linkages for every single component, the model was focused on highest level priorities only. This step of an evaluability assessment, exploring program reality, aligned with the need to plot both priorities and indicators onto the

VMEP logic model. The result of these preparations for the Study Two workshop is shown in figure 10.

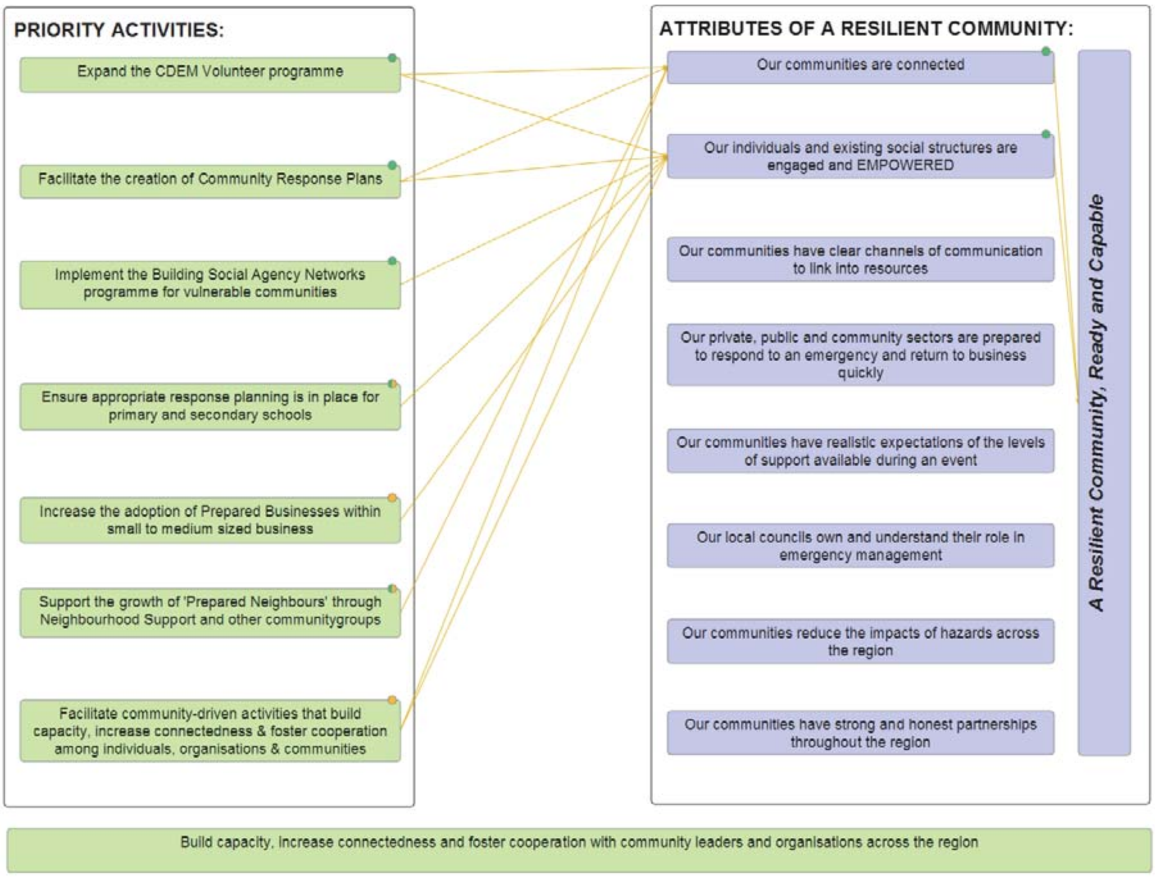

Figure 10. Pre-workshop VMEP logic model showing program components, line of sight, and also priorities using a traffic light at the top right corner of selected components.

5.3.4 Step four: Assess the plausibility of the program. The workshop needed to include an opportunity for stakeholders to critique the plausibility of the WREMO community resilience program shown in figure 10.This need to critique the VMEP logic model aligned with both step four of evaluability assessment, to assess program plausibility. It also aligned with a need outlined by Duignan (2012a), to check program feasibility as part of the VMEP process. Ideally, these checks on both plausibility and feasibility would help to ensure the reliable collection and interpretation of indicator data depicted in figure 11 below.

The Study Two workshop also focused on encouraging critique from researchers and other stakeholders, to help improve these elements of the VMEP logic model with reference to their respective areas of expertise. Priorities selected by the Manager, WREMO Community Resilience were of particular relevance to this stage of the evaluability assessment. There may have been fundamental issues with the overall conceptualisation and selection of priorities within the current community resilience strategy affecting the relevance of indicators used to gauge progress on those priorities. In addition to the prior stage of evaluability assessment, this represented another opportunity to reinforce prior stages of the VMEP process, during the Study Two workshop.

Participants were also asked to critique WREMO's existing indicators of progress towards meeting community resilience objectives. The indicators shown in figure 11 were produced during meetings between WREMO community resilience practitioners and their manager. However, it was not assumed that these indicators were a complete set of metrics for monitoring these practitioners' performance. Workshop participants were likely to notice that the initial VMEP logic model depicted in figure 11 had only defined program performance indicators for project outputs, not systematic outcomes. Outputs generally reflect the amount of work being performed (see Vedung, 1997), such as the number of emergency preparedness pamphlets distributed at a town fair. I assumed that several, research-orientated workshop participants were likely to find this scope too limited because it focused on the quantity, rather than the quality, of WREMO community resilience interventions.

5.3.5 Step five: Changes in program design or program implementation. The collaborative research workshop was designed to facilitate the identification of opportunities to foster elements of the "Evidence Based" practice that WREMO (2012, p. 23) aspired to. It was hoped that the identification of research to inform the WREMO program would promote more in-depth engagements from research stakeholders over the longer term. One workshop was unlikely to achieve detailed amendments to a regional community resilience strategy which took months to develop and gain approval from the Wellington Regional Council. Furthermore, many stakeholder representatives were being invited to the workshop because they held important and demanding roles in their research institutions. As noted by Thurston et al. (2003), competing demands could limit the duration and depth of their engagement with the evaluability assessment process. Any in-depth amendments suggested as a result of critique during the workshop would therefore be recorded as an evaluation or applied research question for further discussions. It was hoped that this approach to suggesting tentative amendments would also avoid unnecessary friction between WREMO practitioners and research stakeholders attending the workshop.

5.3.6 Step six: Agreement on the focus and use of further evaluation. Much of the workshop was focused on this stage. Participants were asked to provide details of current and potential research/evaluation activities which could help examine and improve the community resilience program represented in figure 11. The design of this specific VMEP logic model is outlined in Appendix I. To promote the relevance and utilisation of research/evaluation activities, each actual and potential activity was plotted within the VMEP model, alongside explicitly evaluative questions raised during the session. In terms of the VMEP process, this stage provided an opportunity for identifying and prioritising discrete monitoring and evaluation projects.

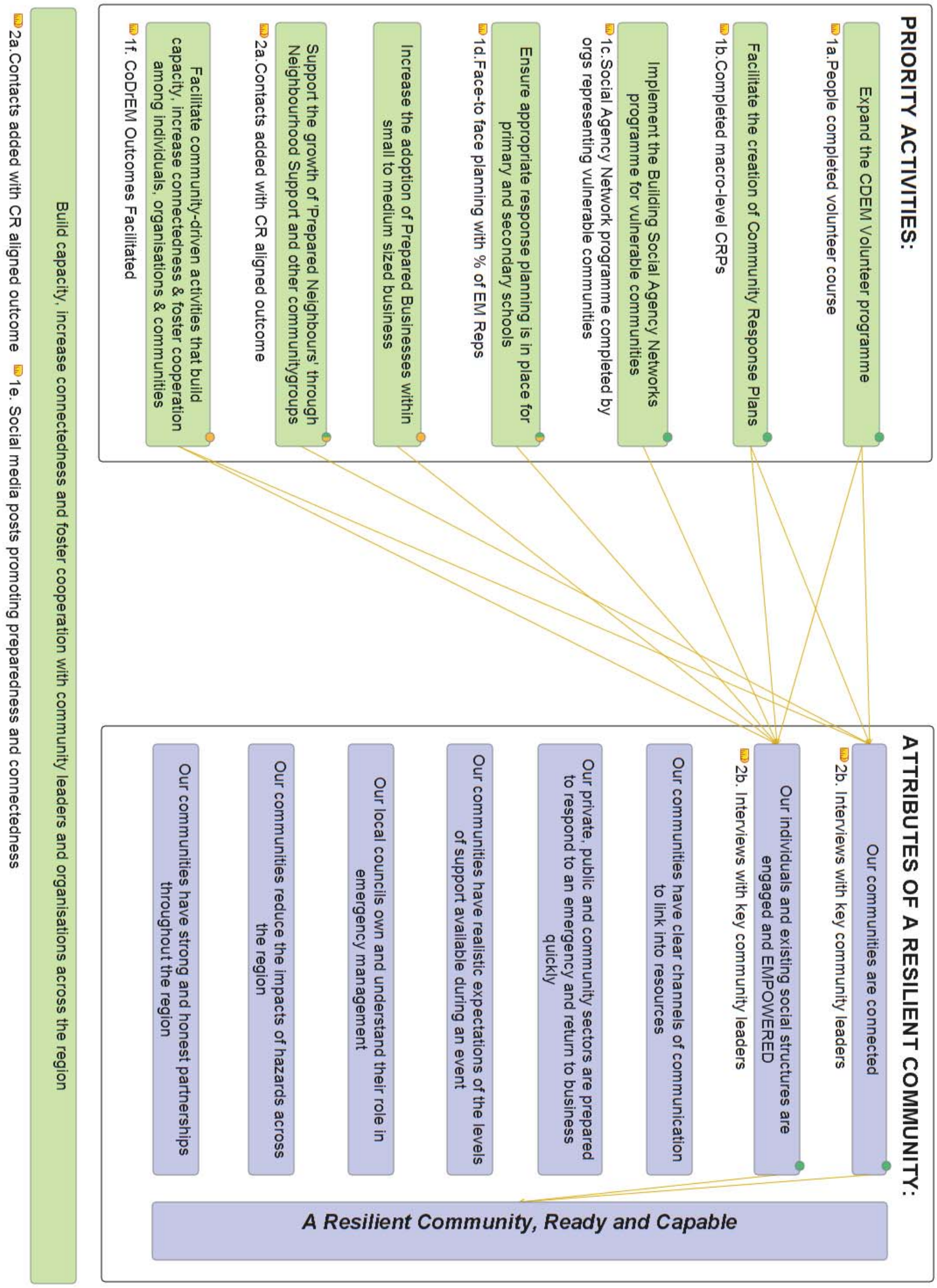

Figure 11. Pre-workshop VMEP logic model showing existing key performance indicators marked by small yellow rectangles.

5.4 Methods

The following section outlines the specific research methods used in Study Two. This includes a single workshop that formed the focal point of my action research intervention. Methods used to document this intervention and analyse the resulting documentation were subject to requirements for the Low Risk Notification to the Massey University Human Ethics Committee shown in Appendix M. These methods are also provided below.

5.4.1 Workshop plan. As outlined above, the action research component of Study Two was focused on a workshop to bring ICoE:CR researchers and practitioners together, to plan research and evaluation activities surrounding the WREMO community resilience strategy. This workshop was designed to further develop a VMEP model which was previously co-designed with the Wellington WREMO Community Resilience Manager. No research or evaluation questions had been added up to this point so adding these details to the logic model comprised the principal workshop activity.

The workshop was scheduled for Thursday the 20th of March 2014, at the WREMO headquarters. Invitees included representatives from a number of Wellington-based research institutions: GNS Science, National Institute of Water and Atmospheric Research, Massey University, Victoria University, the University of Otago, and from Natural Hazard Research Platform management. Given the ICoE:CR focus on the WREMO community resilience strategy, six WREMO practitioners were also invited. Discussions with initial invitees suggested a preference for working alongside community representatives as well. As a result, the WREMO Community Resilience Manager invited a WREMO volunteer from the each of the six emergency management zones, spread across the Wellington region.

The wider, international context for collaborative knowledge-focused approaches to emergency management had been experiencing a major change during the lead up to the Study Two workshop. A new set of knowledge management guidelines had emerged from the Global Platform for Disaster Risk Reduction convened by the UNISDR in June 2013. These Information and Knowledge Management for Disaster Risk Reduction (IKM4DRR) (2013) guidelines promoted knowledge structures, including the monitoring and evaluation of new and existing programs, which are demand-driven, standards-based, collaborative, sustainable, transparent, and monitored (IKM4DRR, 2013). Several other issues relating to knowledge management structures and processes had also been outlined in these guidelines. These new guidelines helped highlight the importance of deliberate knowledge management within the ICoE:CR initiative. Participants were therefore informed that their contributions to VMEP could align with the processes recommended by IKM4DRR (2013). The focus of this alignment was on: establishing user views; objectives and priorities; assessing readiness; communicating with target users; respecting indigenous knowledge; providing training; promoting open data; identifying funding sources; and engaging in co-development agreements.

As outlined below in table 5, this alignment between IKM4DRR (2013) guidelines and the VMEP process was outlined after an initial introduction to the workshop by the Manager, WREMO Community Resilience. The workshop introduction also included a summary of Study One findings and an explanation of how these findings helped to guide the current workshop. The remainder of the workshop incorporated elements of VMEP and evaluability assessment processes outlined earlier in this chapter, using the logic model design outlined in Appendix I.

Table 5
Workshop Agenda

Component	Materials	Facilitator	Time
Introduction to WREMO Community Resilience Strategy, and recent lessons being learned	At WREMO discretion	Dan Neely, Manager, WREMO Community Resilience	15 min
Introduction to visual monitoring and evaluation plan (VMEP), Study One results and new IKM4DRR standards	Animated presentation showing relevant concepts and charts	Thomas Huggins, Researcher	20 min
Brainstorming in small groups, about existing and potential research questions relevant to regional strategy	A3 print-out of pre-workshop VMEP	,, ,,	50 min
Proposals back to the combined group, including mapping back on to and modifying the VMEP diagram	Project live working VMEP onto large screen	,, ,,	20 min
Catered lunch	Full catering	Nil	30 min

5.4.2 Data collection: Documenting the action research. With the Study Two workshop planned and prepared, the remaining methodological issue concerned how the wider evaluability assessment could be documented as a robust piece of action research, aligned with a specified epistemological and methodological framework. A sequence of at least two main documents would be produced during Study Two. At minimum, these documents consisted of logic model versions prior to, and following, the workshop. Together, they formed part of a data set for documenting how VMEP was used to facilitate an evaluability assessment process.

The generation of these documents highlighted one advantage of applying a critical realist epistemological framework. According to Frauley and Pearce (2007), a critical realist theory of social science knowledge differs from other realist epistemologies by not denying that there is a real world underlying the existence of human observers. Instead, critical realism for social science relies on a set of central tenets, to acknowledge *real* dynamics underlying events within human societies. These tenets include an assumption that the analysis of observable phenomena produces relevant, albeit highly fallible, concepts of emergent social objects existing independently of perception (Frauley & Pearce, 2007).

The fallible nature of observations in critical realism is congruent with the philosophical pragmatic foundations of VMEP which, as outlined in Chapter 1, do not assume that there are independent objects directly corresponding to theoretical concepts. Another tenet of critical realist epistemology states that some aspects of social life can nonetheless be systematically inferred, based on their observable effects in the social world. This tenet marks the relevance of critical realism to the current research because VMEP logic models produced during Study Two action research represented observable effects, from which aspects of social life can be inferred.

A summary of critical research precedents provided by Frauley and Pearce (2007) suggested that critical realist research into organisations had been relatively under-developed. Some critical realist studies of organisational dynamics appear to have adopted fairly superficial approaches to methodology. For example Costello (2000) and Coopey, Keegan and Emler (2000) produced critical realist case studies of organisational dynamics with very little detail about the research methods employed. Porter (2000) outlined a more explicit methodology for organisational research which matches the epistemological tenets of critical realism. Methods outlined by Porter (2000) involved building a critical realist hypothesis before making structured observations and reformulating the initial hypotheses. The Study Two research design was built around this existing framework, without being limited to the strictly anthropological procedures used by Porter (2000).

In an attempt to leverage the combination of observable events and unobservable dynamics encompassed by critical realist epistemology, an analysis of interview data was used to fill gaps between observable versions of the VMEP logic model. Transcripts of interviews with workshop participants provided data for *text analysis* which, according to Dey (1993), involves "abstracting from the immense detail and complexity of our data those features which are most salient for our purpose" (p. 94). Study Two incorporated a combination of thematic analysis and content analysis approaches to text analysis. This combination helped to build a longitudinal account of mechanisms and events which occurred before, between and following the two main VMEP logic model versions. Chapter 6 provides further details about the research methods applied. The following section provides outlines methods used for data analysis in particular.

5.4.3 Data analysis. Study Two data analysis used a mixed methods approach, to ensure that quantitative assumptions were founded on a relatively in depth interpretation of interview data. This meant that although quantitative content analysis formed the dominant method (see Bamberger et al., 2006) for analysing Study Two data, this method was supported and refined using qualitative thematic analysis. Further details are provided below, starting with the way that previous research and thematic analysis was used to generate the codes used for subsequent content analysis.

5.4.3.1 Thematic analysis. A framework of initial themes was used to search for instances in the text of participants' interviews. This framework considered themes representing the three viewpoints identified in Study One. The original titles of factors A, B and C were abbreviated to become more flexible abstractions that could be iterated during the thematic analysis process, as recommended by Braun and Clarke (2006). Further themes were added from surrounding research literature relevant to the action research. The use of this literature, as summarised in Chapter 6, means the thematic analysis comprised what Braun and Clarke (2006) called *theory-driven*, a form of thematic analysis that follows a relatively iterative process leading from initial themes to a final set of analytical findings. According to Boyatzis (1998), theory-driven thematic analysis can be used to extend or refute prior researcher discoveries. This is congruent with Porter's (2000) approach to critical realist research into organisations and the abductive approach taken throughout the current thesis, moving from initial assumptions and hypotheses to a more explanatory set of hypotheses. For Study Two, the latter set of explanatory hypotheses would be used to explain what occurred during the action research.

5.4.3.2 Content analysis. According to Stroud and de Macedo Higgins (2009), content analysis "can be used to make inferences about message producers, audiences, or effects when it is used in conjunction with other data" (p. 124), including changes in content "over time" (Stroud & de Macedo Higgins, 2009, p. 124). A focus on inferences about message producers through reference to other data made content analysis particularly relevant for Study Two - considering that the producers of the interview messages were all participants in the VMEP process of interest, accounting for what occurred during that process. In other words, content analysis could be used to identify quantifiable aspects of a narrative about what was occurring among workshop participants, between VMEP logic model versions.

Marks and Yardley (2004) advocated for a good balance of systematization and complexity throughout content analysis. For example, they recommended computerized analysis for effectively balancing analytical systematisation and complexity. These analyses can provide live updates to refine a coding framework during analysis (Marks & Yardley, 2004). Computerised analysis can also help organise very large volumes of text into manageable sections. However, Marks and Yardley (2004) cautioned against an assumption that computerized analysis takes the place of more nuanced human interpretations. This caution helped to highlight the benefits of blending computerised content analysis with more manual aspects of thematic analysis for Study Two, as outlined in more detail in 5.4.3.3 and in Chapters 6 and 7.

Content analysis can provide a number of very concise numerical findings, forming the epitome of Dey's (1993) definition of text analysis: "abstracting from the immense detail and complexity of our data those features which are most salient for our purpose" (p. 94). However, content analysis can also make a fundamental misassumption: that there is always some universal and essential content within a set of text (Krippendorf, 1980). This monist rather than pluralist view of text analysis contrasts with more qualitative approaches, which are often concerned: "…with the natural everyday world of human group life…. views the research process itself as a form of symbolic interaction, wherein the investigator is the 'tool' or 'technique' in both data collection and analysis" (Wilson, 1985, p. 398). It seems that an over-reliance on content analysis could produce overly simplified findings which downplay the interpretive role that researchers play while gathering and analysing the diverse content in question.

5.4.3.3 Combining thematic and content analysis. Huberman and Miles (1994) outlined five overarching steps for analysing transcript data using content or thematic analysis: patterns and themes noted; themes counted to determine commonness or rarity;

plausible narrative constructed to fit preceding literature review; differences in terms of demographic or other groupings looked at; and gathering confirming and disconfirming evidence. Marks and Yardley (2004) supported the use of this process for combining both thematic and content analysis. They stated that anomalies detected while moving from thematic analysis to content analysis are particularly important, because they provoke new insights about quantitatively analysing the context in question. As detailed in Chapter 6, this marked the congruence of blending thematic and content analysis as an adaptation of Porter's (2000) approach to critical realist methodology. As in Study One, researcher subjectivity could not be neglected when providing an account of this analysis and how it is being influenced. Study Two findings therefore included elements of reflexivity which are outlined along with an extended discussion of Study Two findings in Chapter 7.

5.5 Conclusion

Study Two action research involved embedding a visual monitoring and evaluation logic model within the ICoE:CR, to support researcher and practitioner collaborations while improving the community resilience initiatives across the Wellington region. To reflect good evaluation practice, the VMEP process was aligned with an overall process of evaluability assessment, which generally aims to "(1) involve intended users and other stakeholders… .(2) clarify the program design… .(3) explore program reality… .(4) assess the plausibility of the program… .(5) reach agreement on any needed changes in program design or program implementation… .and (6) reach agreement on the focus and intended use of any further evaluation" (Wholey, 2010, p. 84). Although this process is drawn from the field of program evaluation, it formed a participatory approach to developing practical knowledge. This means that evaluability assessment formed a particularly worthwhile structure to guide action research in Study Two.

Pitfalls inherent in any evaluability assessment have been identified and mitigated through the design of Study Two action research. Materials for the Study Two evaluability assessment have been carefully designed as part of these mitigations, with further details provided in Appendix I. The Study Two workshop plan for using these logic model materials has been provided in 5.3. This plan was designed to engage researchers, practitioners and community representatives in the continued development of the VMEP logic model, in the context of new knowledge management standards.

Analysis of logic model versions produced alongside participants' interview accounts of activities using these materials were used to answer the research question: How can a logic model support collaborative efforts to usefully monitor and evaluate a complex community resilience strategy? This analysis adopted a critical realist epistemology which builds a researcher narrative between observable events and other referents. The methodology developed within this epistemology combined thematic and content analyses to create a researcher narrative, from themes identified in participants' interview accounts.

The following chapter summarises key findings resulting from these Study Two research methods, which were peer reviewed and published during the course of this thesis. The ICoE:CR context is briefly reiterated before a summary of how action research was used to help develop the ICoE:CR. An account of dynamics before, during and following the workshop is provided, with reference to the content and thematic analysis of workshop participants' accounts. The chapter concludes with both theoretical and practical implications of this account, including references to recent New Zealand based and international strategies for disaster risk reduction.

6. Study Two: Visually Modelling Collaborative Research into Innovative Community Disaster Resilience Practice, Strategy and Governance

Huggins, T.J., Peace, R., Hill, S.R., Johnston, D.M., & Cuevas, A. (2015b). Visually modelling collaborative research into innovative community disaster resilience practice, strategy and governance. *International Journal of Disaster Risk Science, 6*, 282-294. doi: 10.1007/s13753-015-0061-6

Abstract

In 2013 a new collaborative centre was established in Wellington, New Zealand to focus on integrating resilience research with the region's community disaster resilience strategy. An earlier study with parties to this centre had indicated that researcher and practitioner groups were divided by attention to their own immediate knowledge and skills, but agreed there was a need to maximize community resilience benefits amongst a regional population. An action research workshop of researchers and practitioners used a visual logic model to focus on the pragmatic benefits of improving community resilience. The visual logic model was used to design research activities that would improve the regional community resilience strategy, which was still in an early implementation phase. Ten of 14 workshop participants were interviewed following the workshop. Statistical content analysis of interview data highlighted certain strengths of the action research process: VMEP was a catalyst for complicated conversations between two very different groups of professionals; and researchers became more focused on practical issues as a result. Other findings suggested that in future collaborative research governance would benefit from wider cycles of strategic intelligence, enhanced research contributions, and the use of different information formats for different purposes. Different formats for different purposes should also be considered when developing and implementing large-scale disaster risk reduction policies and strategies.

6.1 Introduction

The word resilience has been anecdotally described as an *espirit d'temps*. The popularity of resilience thinking has been recently demonstrated by a dedicated Erasmus academic network called the Academic Network for Disaster Resilience to Optimise Educational Development; the Rockefeller Foundation's Resilient Cities initiative; and several international centres of excellence for researching disaster resilience. These centres are supported by IRDR International and the UNISDR. Other large-scale attempts to analyse and deploy the often technical (Birkmann et al., 2012a) and increasingly disputed (Béné et al., 2012; Huggins, Peace, Hill, Johnston, & Cuevas, 2015a) concept of resilience have also been initiated. Such initiatives can incorporate[9] a very broad field of knowledge and expertise which, according to Birkmann et al. (2012a), span social-ecological, psychological, critical infrastructure, organisational, and practical perspectives. Interventions have ranged just as widely, across objectives focused on protection to transformation, and on outcomes from stability to flexibility and change (Béné et al. 2012).

Resilience to disasters has become an expansive domain which, according to Béné et al. (2012), has become extremely difficult to summarize under a unitary definition. It can be argued that conceptual complexity, combined with a lack of consensus between different research disciplines, has seen the rise of a particularly practical perspective (Birkmann et al., 2012a). This practice-based perspective of resilience appears to underpin much of the work undertaken by the International Centre of Excellence: Community Resilience (ICoE:CR) in Wellington, New Zealand. However, even within

[9] Edited from original sentence for consistency as part of overall thesis.

this practice-oriented approach, there have been barriers limiting the effective communication of group and discipline specific concepts. Given that much communication between researchers, practitioners, and agencies in the resilience domain is text-based and language dense, it appeared that visual representations of concepts and plans could enhance communicability and enrich individual participants' ability to better understand and work at the research and practice interface. This article reports on research undertaken to explore potentials for using a rich visual interface to help plan, develop, and adjust practical activities within the ICoE:CR.

The Wellington ICoE:CR is one of several IRDR International Centres of Excellence. As extensions of the international IRDR program (McBean, 2012; IRDR, 2013), International Centres of Excellence are located in China, Colombia, the United States, New Zealand, and South Africa (IRDR, 2014). The centres have been tasked with conducting operationally relevant research, providing technical assistance for policy and decision making, sponsoring workshops and other events, and improving member networks (IRDR, 2013).

The Wellington ICoE:CR is the only IRDR International Centre of Excellence that has explicitly avoided a top-down approach to research in which academic findings are pushed down for practitioner uptake. Instead, core ICoE:CR researchers and practitioners are focused on working in partnership with WREMO and in alignment with their Community Resilience Strategy. As outlined in a recent summary of the ICoE:CR, " … 'active' members [of ICoE:CR] are those conducting research or practice under the Community Resilience Strategy" (Joint Centre for Disaster Research, 2014, p. 2). This strategy outlines the equivalent status of WREMO and other practitioners alongside researchers, rather than treating practitioners as passive recipients for the top-down uptake of research findings.

The ICoE:CR approach is supported by a strategic review of contemporary urban emergency management by Kapucu (2012), which concluded that effective emergency management cannot be achieved by organisations acting in isolation. Kapucu (2012) also advocated for a wider geographic approach to community resilience, as reflected in the regional approach of the ICoE:CR. However, many documented emergency management collaborations, including collaborations reviewed by Kapucu (2012), have focused on immediate emergency response. Emergency response works on a much shorter timeframe than the combination of risk reduction, readiness, and recovery collaborations that could systematically enhance community disaster resilience in the Wellington region.

The ICoE:CR has sought its "excellence" through the development of quality interactions between collaborating institutions and wider communities. The determination of that excellence relies on the careful management of commonalities and differences between diverse stakeholders. It was this notion of excellence that motivated antecedent Q-method research (Huggins et al., 2015a) into strong patterns of opinions held by initial practitioner and research partners to the new ICoE:CR. This antecedent research used factor analysis to identify patterns of opinion either shared by collaborating researchers and practitioners or differentiating between them. This factor analysis detected patterns in participants' rating of the relevance of several statements concerning the monitoring and evaluation of community resilience.

There were three key patterns that stood out from this initial research and analysis of participant viewpoints. The first was a pattern of opinions against insular, top-down decision making. This factor was consistently relevant to practitioner representatives but not researchers, with individual factor loadings from -0.39 ($p < .05$) to -0.69 ($p < .05$) amongst practitioners. The second pattern was a 'need for complicated analysis to inform strategic decisions'. This factor was consistently shared among researchers, but not practitioners, with factor loadings from 0.31 ($p < .05$) to 0.50 ($p < .05$) amongst researchers.

Finally, both researchers and practitioners supported a pattern of opinions amounting to a ‘need to evaluate opportunities to improve complex post-disaster outcomes at a range of societal levels’. Consistently significant loadings for this factor ranged between 0.30 ($p < .05$) and 0.61 ($p < .05$) for researchers and practitioners alike. This third factor provided a particularly pragmatic, action-focused impetus for further ICoE:CR development. The first two factors identified clear differences in viewpoint. These differences would need to be acknowledged by ICoE:CR coordinators and other professionals assisting them. A popular practice, simply gathering a range of Wellington-based emergency management collaborators in the same space at the same time, seemed unlikely to overcome such deeply rooted differences.

6.1.1 Visual Monitoring and Evaluation Planning for the ICoE:CR. Owen et al. (2013) outlined a solution for managing this kind of emergency management dilemma, where stakeholders with very different priorities would need to collaborate despite clear differences in viewpoint. It seemed vital to document a range of understandings, without insisting that every single aspect was shared between every single stakeholder. For Owen et al. (2013), documentation that served this purpose would become "boundary objects" (p. 1) for communicating diverse understandings in a way that spanned multiple divides between diverse collaborators.

Case studies by Huggins and Jones (2012) and Huggins and Peace (2014) looked at similarly complicated planning, monitoring, and evaluation contexts where similar communication issues were addressed through the use of visual logic models. Both of these cases involved planning, monitoring, and evaluating complex projects at a national scale. The latter case study focused on integrated project-management—to support implementation that was both well-informed and timely. Both studies highlighted the potential of a specialist software tool, DoView (Version 4.0, 2013), which is used for VMEP developed by Duignan (2012b). The kind of visual logic models produced in Huggins and Jones (2012) and Huggins and Peace (2014) represented a boundary object document in the context of the ICoE:CR. A simplified example of these visual logic models, created for the purposes of VMEP, is provided in figure. 15. This document format was used in the current research to mobilize the third, more pragmatic, pattern of opinions identified in antecedent Q-method research as the 'need to evaluate opportunities to improve complex post-disaster outcomes at a range of societal levels'. Using an action research methodology gave the ICoE:CR researchers and practitioners an opportunity to deepen their collective understanding of the planning, evaluation, and monitoring context for the resilience strategy as they participated in the research.

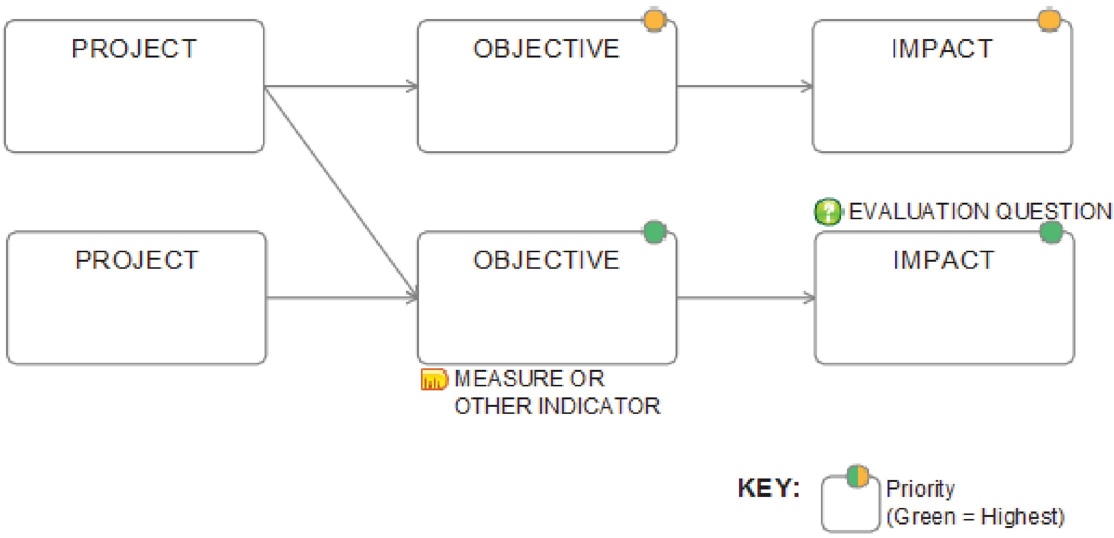

Figure 12. Simplified visual logic model

Observed strengths of the visual logic models used in VMEP were documented by Huggins and Jones (2012) and Huggins and Peace (2014). These strengths include the ability to visually communicate multiple levels of shared activities and objectives across diverse stakeholder groups, and to generate a dialogic approach to the production of indicators and evaluation questions. The outcomes theory background to VMEP outlines the concept of outcome hierarchies: “a cascading set of causes in the real world” (Duignan, 2013, p. 1). This is how VMEP suited the pragmatism shared amongst ICoE:CR researchers and practitioners, by visualizing multiple levels of shared actions and outcomes before connecting them to relevant indicators and evaluation questions.

The deployment of VMEP within the ICoE:CR also came informed by a growing body of cognitive research into how visual imagery complements other forms of communication. For example, a critical review of associated scientific literature by Tversky (2011) concluded that rich visual representations can improve understanding of action in space. Klingner, Tversky and Hanrahan (2011) found that visual representations required fewer internal cognitive resources than a verbal equivalent when measured by pupil dilation during cognitive tasks. Visual representations also appear to help people engage with nonlinear concepts. For example, one experiment by Kessell and Tversky (2009) found that 60 percent of participants habitually drew cycle dynamics, from part A to part B to part C to part A etcetera, along a single line. However, 80 % of participants in the same experiment preferred to see these dynamics on a circular diagram.

6.1.2 Current hypotheses. The main focus of the current research was on detailing[10] how and why the ICoE:CR visual logic model transformed over time. Visual logic models had played particularly pragmatic roles in prior case studies by Huggins and Jones (2012) and Huggins and Peace (2014). We therefore hypothesized that the current

[10] Edited from original sentence for consistency as part of overall thesis.

visual logic model would serve a pragmatically useful purpose for workshop participants, and that this would be evidenced by their accounts of the VMEP process.

We also focused on showing how opinion factors identified through Q-method could endure over time[11]. It is often assumed that social science analyses, such as Q-method factor analyses, are unreliable and represent little more than a moment in time, under very particular conditions. For emphatic examples of this viewpoint, see Faigman (1989) and Kampen and Tamás (2014). The current research assumed that statistically robust factors identified through Q-method research were relatively reliable and of enduring relevance to ICoE:CR development. Our hypothesis was that the distribution of interview content related to these opinion factors would closely resemble the distribution of original Q-method factors amongst ICoE:CR groups.

6.2 Methods

Critical realism provides an important theoretical foundation for organisational research. This epistemology, or set of rules about what can be considered knowledge, states that what occurs between observable events can be even more real than the events themselves (Frauley & Pearce, 2007). Prior critical realist research into organisational dynamics, for example by Porter (2000), has prescribed a series of methodical steps: form hypotheses; test hypotheses against empirical observations; reformulate hypotheses. The current research incorporates these steps, working from the hypotheses outlined in 6.1. Prior critical realist research into organisations, for example by Porter (2000) and Costello (2000), has depended entirely on qualitative analysis. Our current research had the

[11] Edited from original text for consistency as part of overall thesis.

potential to produce much more than a persuasive narrative[12]. Qualitative assumptions made during the current research have been therefore tested and refined through systematic statistical analyses.

6.2.1 Data collection. The data collected, developed, and analysed in the current research were compiled in two phases. The first phase involved the development of the VMEP model, and the second phase involved in-depth interviews with participants about their engagement in the VMEP process. The development of the model is described first, followed by a brief description of data collected from interviews with VMEP participants.

VMEP uses a visual logic model to plan strategically relevant monitoring and evaluation activities. According to Duignan (2012b), this is achieved by: (1) drawing an initial diagram of intended outcomes and the steps required to achieve those outcomes; (2) marking the relative priority of outcomes and steps and drawing causal linkages between them; (3) identifying key performance indicators that can help gauge performance towards intended outcomes; (4) developing evaluation projects; and (5) reporting evaluation results back onto the overall diagram and revising that diagram in response to those results.

Participants in the current action research were generally unfamiliar with evaluation frameworks, so the standard VMEP process outlined above was modified in four minor ways. First, although Duignan (2012c) had advised against defining distinctions between objectives and outcomes, we were unlikely to engage ICoE:CR coordinators without a clear overarching structure. This meant that all strategy components were neatly divided into activities, objectives, and outcomes. Second, although they are not usually highlighted so explicitly during a VMEP process,

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[12] Edited from original sentence for consistency as part of overall thesis.

overarching ethical principles were written in text above the main visual logic model. This reflected a recommendation from Huggins et al. (2015a), that a strong pragmatic impetus within the ICoE:CR needed to be complemented by explicit ethical principles. According to Huggins et al. (2015a), a prominent set of ethical principles would help avoid using a range of disaster-related ends to justify any given means. Third, we chose to use the term "research question" rather than "evaluation question" due to many participants’ lack of familiarity with the latter concept. The former term was more intuitive for non-practitioner representatives in particular, who were all representing research institutions. Finally, VMEP step five was not included in the scope and timeframe of the current research because indicator data would take many more months to collect.

The first three VMEP steps were completed prior to the workshop, with the Manager, WREMO Community Resilience. This involved a series of meetings where, over a period of six months, an evolving visual logic model was used to represent what the WREMO Community Resilience team was doing, show why they were doing it, and demonstrate how they were tracking progress against internally established targets. It is important to note that framework components representing higher level impacts did not survive discussions to establish this initial series of VMEP steps. Engaging a range of stakeholders during these preliminary steps could have led to a different outcome. However, the main focus of pre-workshop activities was to produce a representation of the WREMO community resilience strategy, which WREMO management would then release for wider discussions.

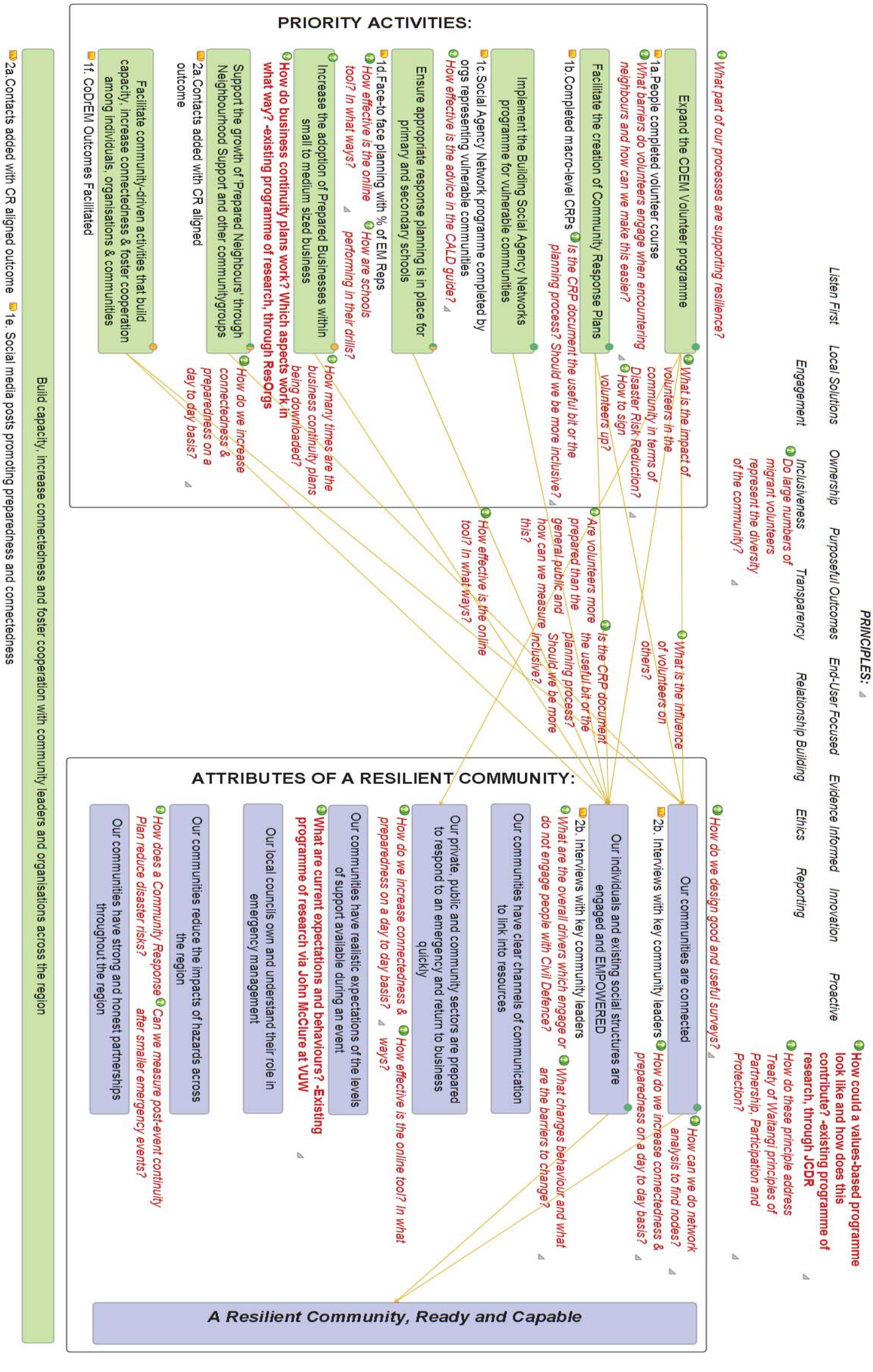

Figure 13. Post-workshop visual logic model

The workshop proper was then attended by a combination of seven representatives of research institutions and seven WREMO practitioners, all of whom were selected and invited by ICoE:CR coordinators. The workshop began with a very brief introduction to the WREMO Community Resilience Strategy, delivered by the Manager, WREMO Community Resilience. To prepare workshop attendees for active VMEP engagement, they were introduced to three preliminary pieces of information: recently developed standards from IKM4DRR (2013); a summary of results from the antecedent Q-method research; and an animated Prezi (Version 5.0.10, 2013) introduction to the VMEP process.

Results from VMEP steps one to three were introduced to workshop participants, who then broke out into subgroups that combined research and practitioner stakeholders. Each subgroup was invited to complete VMEP step four by writing research questions onto relevant sections of their own visual logic model printout. All subgroups then reported back to the main group to outline their research questions. These questions were recorded in real time, and typed in red alongside relevant sections of the VMEP diagram. Each question was finalized after being discussed, and agreed upon by the group as a whole. The resulting visual logic model is shown in figure 13. This is a verbatim copy of the workshop outcome that is usually presented as an A3 minimum printout or on a projector screen.

Although figure 13 is difficult to read in the current format, readers may note that several research questions have been added in red, to a more elaborate version of the example shown in figure 12. Activities are listed in boxes to the left of figure 13. Priority activities are indicated by a traffic light at their top right corner and these boxes are linked to other boxes showing relevant objectives towards the right of the logic model. Existing performance indicators are shown by a small yellow ruler beneath the activity or objective components that they are meant to gauge. Potential research questions are shown in italic red type and questions that were already being addressed by existing research are shown in bold red type. Each of these research questions is displayed next to the section of the logic model to which it refers. A key and a directional arrow were added to the bottom of the original version, to help provide these explanations. The original logic model also included hyperlinks that led to further details for boxes and text with small triangles in their bottom right corner.

Following the production of this model in the workshop, ten out of 14 workshop participants agreed to give semi-structured, 90 minute interviews about what had occurred during the VMEP process. All workshop participants' names were replaced with pseudonyms on interview transcripts, and all minor utterances were deleted unless they were essential for interpretation. Interviewees were offered the opportunity to delete any additional text and clarify any part of their interview before the following analysis.

6.2.2 Data analysis. Interview transcripts were subjected to systematic thematic analysis prior to a more statistically oriented content analysis. Relying on content analysis alone was likely to neglect richer details about "the natural everyday world of human group life" (Wilson, 1985, p. 398). The thematic analysis employed was what Braun and Clarke (2006) called "theory-driven," because our entire analysis was based upon pre-established themes derived from the antecedent Q-method research, in Huggins et al. (2015a), pre-existing case studies of using visual logic models by Huggins and Jones (2012) and Huggins and Peace (2014), and other literature outlined below. Besides being transparent about preconceived ideas, Marks and Yardley (2004) stated that this approach to thematic analysis allows researchers to seek contradictions to many preconceptions. A theory-driven analysis therefore made a good match with the process of reformulating critical realist hypotheses, as outlined by Porter (2000).

Systematic thematic analysis relies on the development of a coding frame in which key themes can be noted and annotated. Our initial coding frame reworked the three opinion factors from antecedent Q-method research. According to Wolf (2014), in-depth interviews extend insights that can be constrained by rushing into full, and relatively arbitrary, factor descriptions. With reference to original elements outlined in Huggins et al. (2015a), the code of a 'Focus on WREMO Activities' was derived from the opinion factor, of being 'against insular, top-down decision making.' A second code, 'Scientist Leadership', reflected the Q factor of a 'need for complicated analysis to inform strategic decisions.' Finally, the opinion factor 'need to evaluate opportunities to improve complex post-disaster outcomes at a range of societal levels' gave rise to a concise code of 'Positive Resilience Outcomes'.

Further initial codes were based on other research literature that has been largely outlined in the introduction to the current article. These codes included: 'Professional Collaborations' with reference to visual modelling case studies by Huggins and Jones (2012) and Huggins and Peace (2014); 'Business Marketing' with reference to the role of financial rationale in the case study by Huggins and Jones (2012); 'Diversity' with reference to diverse engagement in complex domains outlined by Rogers (2008); and 'Documentation' to represent the boundary objects outlined by Owen et al. (2013). Relevant interview excerpts that did not fit the seven initial codes were sorted into an 'Other' category. Like sub-codes sitting beneath the initial theory-based code, codes making up the 'Other' category were linked and spliced as thematic analysis progressed.

For the purposes of content analysis, the action research was divided into three phases: (1) before the WREMO Collaborative Research Design Workshop; (2) during the workshop; and (3) after the workshop. Determining the most salient codes for each particular phase of the action research helped keep the current analysis manageable and coherent. Analysis included as much of the original interview text as possible in order to avoid the dilemma outlined by Dey (1993), of arbitrarily excluding material that could disconfirm researchers' preconceived assumptions. Excerpts used in the current analysis therefore incorporated over 95,000 of a total 130,514 words appearing on interview transcripts. Most of the remaining words made up the interview preamble and other interviewer utterances.

6.3 Results

The final set of main content analysis codes achieved moderate (*kappa* > .41) to good (*kappa* > .61) interrater reliability, using standards from Landis and Koch (1977). A less sophisticated measure of percentage agreement ranged from 64 percent to 93 percent for each final code. These percentages were much greater than 50 percent, which suggested that agreement was due to more than chance alone (Stroud & de Macedo Higgins 2009). Good to moderate interrater reliability was achieved for a final set of three timing codes: 'Before the Workshop' (*kappa* = .77); 'During the Workshop' (*kappa* = 0.69); and 'After the Workshop' (*kappa* = .45).

Construct validity was established by testing codes for convergent and divergent validity. One pair of codes—'Documents' and 'Constructive Focus on WREMO Strategy'—were significantly and positively correlated (*rho* = .16, *p* < .01) by excerpt. This was a logical convergence because the WREMO Community Resilience Strategy was a published formal document. The other main codes were either negatively or non-significantly correlated with each other, suggesting that the other main codes represented distinct constructs. Significant correlations between these main codes and timing codes are shown alongside sub-code details in Table 6.

Table 6
Main Codes Significantly Correlated with Timing Phase Codes

Phase	Main Codes	*rho*	Prevalent Sub-Codes	Description	% of Phase Excerpts
Before the workshop	Constructive Focus on WREMO Activities	.13**	Unique Community Resilience Activities	Belief that WREMO approach has not been applied to disaster resilience by any other organisation.	11%
			Other	Includes a drive towards a community resilience state, but often a focus on WREMO activities in and of themselves.	11%
	Positive Resilience Outcomes	.10**	Improved Coping and Response	Understanding resilience as coping with and response to challenges, emergencies, and/or disasters.	6%
	Considering Diverse Groups and Individuals	.07*	Knowledge, Skills, and Assistance via Network	Belief in distributing skills, knowledge, and assistance through the volunteer network and through networked communities.	3%
			Considering Diverse Individuals	Need to consider unique individuals with diverse preferences, experiences, roles, and contexts.	20%
			Considering Diverse Places	Highlighting unique geographic contexts.	11%

Phase (*cont.*)	Main Codes (*cont.*)	*rho* (*cont.*)	Prevalent Sub-Codes (*cont.*)	Description (*cont.*)	% of Phase Excerpts (*cont.*)
During the Workshop	Positive Resilience Outcomes	.13**	Knowledge, Skills, and Assistance via Network	Belief in distributing skills, knowledge, and assistance through the volunteer network and through networked communities.	4%
			Improved Coping and Response	Understanding resilience as coping with and response to challenges, emergencies, and/or disasters.	4%
After the Workshop	Documents	.12**	Different Formats for Different Purposes	Need for traditional Word, Excel, Pdf etc. formats for formal documents.	12%
			VMEP Framework as a Catalyst	Examples of VMEP diagrams seen as a catalyst for progress, action, or inaction.	11%
	Constructive Focus on WREMO Strategy	.08**	Other	General focus on WREMO Community Resilience Strategy.	4%
			Testing the WREMO Community Resilience Strategy	Need to test the community resilience strategy as a whole.	2%
			Improving the WREMO Community Resilience Strategy	Need to improve the WREMO Community Resilience Strategy.	2%

***** Significant positive correlation at $p < .05$
******Significant positive correlation at $p < .01$

As outlined earlier, three of the content analysis codes were based on patterns of opinion amongst ICoE:CR practitioners and researchers. These opinion factors had been identified in prior research by Huggins et al. (2015a), using a research method called Q-method, which identified statistical patterns in participants' ratings of the relevance of 60 different statements concerning monitoring and evaluating community resilience interventions. A statistical analysis of variance found that the only content analysis code based on these prior Q-method factors that varied significantly between practitioner and researcher groups in the current research was 'Need for Scientist Leadership' ($F(1,8) = 12.46$, $p = .008$). Researcher interviews included significantly more excerpts concerning 'Scientific Leadership' ($M = 38.4$, $SD = 11.55$) than practitioner interviews ($M = 15$, $SD = 9.3$).

The main code, 'Constructive Focus on WREMO Activities' was based on the previous Q-method factor 'against informing insular, top-down decision making'. This original Q-method factor had applied almost exclusively to ICoE:CR practitioners in Huggins et al. (2015a). The current, content analysis version of this factor appeared across both researchers' and practitioners' interview text, and was reflected in 266 out of a total 798 interview excerpts used for the current thematic and content analysis. Variance between researcher ($M = 21$, $SD = 11.64$) and practitioner ($M = 32$, $SD = 14.86$) groups did not significantly exceed within-group variance for this code ($F(1,8) = 1.76$, $p = .22$).

6.4 Discussion

The current research primarily aimed to examine how and why the VMEP process changed over time. This first research aim is primarily addressed by breaking up the content analysis results into VMEP phases. This has enabled us to identify a number of distinct patterns amongst participants' accounts, as outlined in the sections below. This analysis showed how the visual logic model could be a catalyst for actions that would further ICoE:CR objectives. However, participants' interviews also showed how the visual logic model would need to be converted to another format for further use. This call for traditional documentation characterizes the workshop as a transient, facilitated stage for the ICoE:CR. This is a stage that appeared to need further implementation, including the careful construction of a text-based document to represent workshop dialogue and agreements. Participants clearly outlined the way that different documents would serve different purposes. According to many of them, a more traditional format was needed to formalize individual research projects following the VMEP workshop.

The current research also reveals differences between patterns of opinions identified in antecedent research and patterns of opinions raised by the current participants. This was achieved by comparing the distribution of original opinion factors with content from interviews describing the VMEP process—regardless of whether the opinion content related to before, during, or after the workshop. Findings from this overall analysis are discussed at the end of the current section.

6.4.1 What happened before the VMEP workshop. As outlined in section 6.3, a 'Constructive Focus on WREMO Activities' was distinctly related to accounts of what happened before the VMEP workshop (*rho* = .13, $p < .01$). As described above, this code related to an opinion factor from antecedent Q-method research: 'against insular, top-down decision making.' The relevance of this main code to what happened before the workshop suggests that participants had been motivated to constructively engage with operational decisions being made at WREMO before the workshop began. Restricting the VMEP model towards the level of activities and objectives may have helped meet this interest once the workshop began. Content concerning ‘Positive Resilience Outcomes’ (*rho* = .10, $p < .01$) was also used to account for what occurred prior to the workshop. The most prevalent sub-codes for ‘Positive Resilience Outcomes’ were ‘Improved Coping and Response’ (6% of all phase excerpts); and ‘Knowledge, Skills, and Assistance via Network’ (3% of phase excerpts). This content was related to the prevalent opinion factor identified by antecedent opinion Q-method research: ‘need to evaluate opportunities to improve complex post-disaster outcomes at a range of societal levels’. It was not surprising to observe the ongoing relevance of this opinion factor. A strong drive within the ICoE:CR, to analyse and improve the WREMO Community Resilience Strategy, was well documented and announced to many interested parties (Joint Centre for Disaster Research, 2014). Nonetheless, the ongoing relevance of this particularly pragmatic opinion suggests that the VMEP process was well matched with enduring motivations at the core of the ICoE:CR. VMEP was adopted to leverage strong pragmatic motivations, which were shared between two distinct groups of ICoE:CR stakeholders.

‘Considering Diverse Groups and Individuals’ (*rho* = .07, $p < .05$) was the only main code that exclusively related to content about the lead up to the workshop. The other two main codes for this phase were also highly relevant to during and after the workshop, respectively. Participants suggested that there was a need for a more diverse array of participants at the core of ICoE:CR activities. This included suggestions for representatives from a greater number of research institutions, other agencies working with community resilience, and community members from a diverse range of cultural backgrounds. Highlighting the importance of cultural considerations in the lead up to the workshop, one researcher's interview stated: “…the idea of having to look out for people after a disaster, I don’t understand all those details but that cultural perspective…” (Alana, lines 165–167). Several participants also detailed a need to adapt the WREMO strategy for diverse groups and individuals. We assumed that these participants' accounts align with Parkinson (2009), who has described how socially orientated programs need to systematically consider diverse stakeholder needs and viewpoints.

Although diversity was a popular topic overall, researchers and practitioners did not appear to share the same understanding. Practitioners seemed reluctant to discuss culture as such, for example one practitioner's interview stated:

> We're prioritizing partnerships because partnerships happen between everybody…and we're prioritizing participation because everyone needs to participate…and protection because everyone needs to be looked after so it's not, it's not because of race or previous history, it's because people are people and so all of our principles effectively cover all people.
>
> (Bridget, lines 1126–1130)

Other interview content regarding diversity appeared to discount the value of research. An apparent focus on variability and exceptions to theoretical rules could have been constraining researchers and participants and any generalized theoretical models of resilience that they had to offer. In this way, highly prevalent sub-codes, such as 'Considering Diverse Individuals' (20% of phase excerpts) and 'Considering Diverse Places' (11% of phase excerpts), may have represented an obstacle to generalizations from a large body of preexisting community resilience research (see for example, Birkmann et al., 2012b). The sub-code, 'Considering Diverse Individuals' (20% of phase excerpts) can also be considered alongside the sub-code 'Egalitarianism' (3% of phase excerpts). Workshop participants may have focused on reducing the status that researcher views often receive. This egalitarian approach to diminishing researcher views may have also meant down-grading, and eventually eliminating, researchers' focus on predictive models and downstream outcomes.

6.4.2 What happened during the VMEP workshop. There was subsequently very little discussion about downstream resilience impacts identified in surrounding academic research, such as Burton (2012). No workshop participant asked to detail downstream impacts during the workshop, even though they went on to receive an introduction to VMEP that outlined the way these components are usually represented. Likewise, no participant voiced concerns about the way that program benefits appeared unrelated to surrounding research, until this issue was specifically probed during interviews.

Participants' comments about the workshop itself were centred around efforts to work with a visual logic model without any research questions and convert it into the version shown in figure 13. 'Positive Resilience Outcomes' ($rho = 0.13$, $p < 0.01$) was the only main code that was significantly relevant to what happened during the VMEP workshop. The way that participants used content about 'Positive Resilience Outcomes' to explain what happened before and during the workshop suggests that they found the VMEP workshop worthwhile. The VMEP workshop appears to have helped maintain the pragmatic impetus identified in antecedent research, concerning a 'need to evaluate opportunities to improve complex post-disaster outcomes at a range of societal levels.'

Prevalent sub-codes for 'Positive Resilience Outcomes' concerning the actual workshop included 'Improved Coping and Response' (4% of phase excerpts) and 'Knowledge, Skills and Assistance Via a Network' (4% of phase excerpts). Content related to these sub-codes reflected a very optimistic perspective of community disaster resilience in Wellington, which is exemplified by the following quote from a participant interview:

> Yeah so if there's lots of people out there with our *It's Easy* books and stuff and talking to their neighbors …. It's like I can talk to 10 people and say, talk to…the importance of talking to networks and things, and they go to their networks and that's great.
>
> (Kirsty, lines 457–460)

This is also how the relevance of positive resilience outcomes marks a pitfall in using VMEP to support emergency management. The focus on positive, and fairly tautological, outcomes serves as a reminder of how the VMEP process does not explicitly address unintended consequences. The VMEP process itself could be seen as optimistic, because it does not involve searching for negative implications. Many of these consequences fall outside of an initial strategic planning schema, that is, the outcomes specified on a visual logic model could nonetheless be very negative. For example, the popular uptake of preparedness kits may lead to overconfidence, resulting in a lack of interest in other aspects of preparedness and mitigation activities. VMEP for emergency management may therefore need to include a more deliberate and wide-ranging search for changes in a hazard affected environment.

6.4.3 What was going to happen after the VMEP workshop. Workshop participants were also asked about what was going to happen following the VMEP workshop. The analysis of participant accounts highlighted two main codes. The first of these main codes was a focus on 'Documents' (*rho* = .12, $p < .01$), including the prevalent sub-codes 'Different Formats for Different Purposes' (12% of phase excerpts) and 'VMEP Framework as a Catalyst' (11% of phase excerpts). The prevalence of

'VMEP Framework as a Catalyst' shows how the VMEP diagram had represented a catalyst for dialogue, but was not necessarily a document for wider circulation.

Further sub-codes for 'Documents' included a "Need for Written Text' and 'Different Formats for Different Purposes'. These sub-codes highlight a stated need to document workshop outcomes in a more traditional format. One participant's interview made the relevance of both these sub-codes particularly clear: "But I imagine that these will be turned into a document. And then they are more publicly, widely available…" (Alanna, lines 973–974). Here the word *document* refers to a traditional text-based document, like the original WREMO Community Resilience Strategy, which was released as a mainly text-based narrative document. This focus on an established text-based format therefore provides a context for the second most relevant theme: 'Constructive Focus on WREMO Strategy' (*rho* = .08, $p < .01$). Sub-codes detailed in Table 6 show how many participants thought that the strategy included several assumptions, which remained to be tested and improved. This did not mean that participants supported a shift to working from another sort of document altogether—hence the need to edit and redistribute the existing, text-based version of the document.

As discussed in section 6.1, Owen et al. (2013) outlined the need for boundary objects that link multiple organisational systems, beyond members of a single emergency management team. With this in mind, the integration of several preexisting organisations with the ICoE:CR may depend on common and largely text-based narrative documents. Text-based documents represent a strong status quo for formalizing agreements between organisations and other collaborators. Organisational change often fails when trying to eradicate all established norms and impose completely new practices (Clegg & Walsh, 2004). This rationale for organisational development comes supported by blatant requests for a text-based outcome, from workshop participants and ICoE:CR coordinators alike.

The visual logic model was therefore only likely to be formalized when it had been converted to a more traditional document format, such as Microsoft Office Word or Microsoft Excel formats.

This does not mean that narrative documents function well as a catalyst for creative and responsive thinking about complex dynamics. Diagram-based approaches can provide an important avenue to help us think about, and plan for, complex systems (Tversky, 2011; Kessell & Tversky, 2009; Huggins & Jones, 2012). However it is equally important to note how text-based narratives can provide particularly in-depth descriptions. These descriptions clarify details that are relatively opaque in other forms of communication (Tversky, 2011). If we were, for example, to compare the 24 pages of the WREMO (2012) Community Resilience Strategy with the figure 13 diagram, we would note that the diagram is brief and can be read in much less time. It also lacks a great deal of the clarifying detail available in the text document. While it has been important to develop the VMEP visual logic model (figure 13) as a critical engagement and process tool, this approach continues to require a supplementary, narrative explanation—especially for new collaborating parties.

6.4.4 Overall analysis of opinion factor distribution. The current research also aimed to test whether the distribution of Q-method opinion factors shifted during the current action research, where *distribution* refers to distribution between researcher and practitioner groups, and across interview content as a whole. As outlined in section 6.3, the distribution of relevant interview content closely resembled the original distribution of two of the three Q-method opinion factors. However a ‘Constructive Focus on WREMO Activities’ was now observed across both researcher and practitioner groups. This code was equivalent to Q-method opinion factor A, which had not previously been consistently observed amongst ICoE:CR researchers as a group. Implications of this changing pattern of opinions are outlined in the following section.

6.5 Conclusion: How Visual Monitoring and Evaluation Supported ICoE:CR Development

Both original hypotheses for the current research have been revised, in light of equivocal support from our analysis of the interview data. The first hypothesis was that the VMEP process would prove useful to core ICoE:CR stakeholders participating in the VMEP workshop. However, participants perceived that VMEP was more of a catalyst for wider processes than an all-encompassing system for planning ICoE:CR activities. The original hypothesis has therefore been refined, to predict that VMEP processes and outputs will be of value at certain points of developing the ICoE:CR and comparable initiatives.

The second hypothesis—that the distribution of opinions identified by Huggins et al. (2015a) would remain stable—has also been revised. The distribution of one of three factors appears to have changed considerably. ICoE:CR researchers appeared to have assumed more of a focus on WREMO community resilience activities during the VMEP process than they had during the antecedent research. With this in mind, we predict that boundary objects such as visual logic models will not just accommodate different positions from diverse emergency management stakeholders. Instead, boundary objects will facilitate substantial changes to consensus at group and subgroup levels. This revised hypothesis represents an optimistic, inverted interpretation of double demotivation theory (Carr & McLachlan, 1995; Carr & MacLachlan, 2005; MacLachlan & Carr, 1993), which predicts that by bridging between professions boundary objects will transform at least one of the professions involved.

6.5.1 Implications of Current Findings within the ICoE:CR. VMEP outputs were eventually converted to a large 10 page spreadsheet to suit requests from participants and ICoE:CR coordinators. This spreadsheet detailed draft research questions from the visual logic model by different categories: theme; methods; other details; relevant sections of WREMO strategy; existing researchers; and a column for WREMO to show the likelihood of uptake. At the time of writing, this spreadsheet had already been requested and used by researchers wanting to work with WREMO as part of the ICoE:CR. As stated by workshop participants, in terms of 'VMEP as a catalyst', this spreadsheet would not exist if it were not for the VMEP diagram underpinning it. Likewise, the spreadsheet is still being displayed to potential ICoE:CR researchers alongside the original VMEP diagram. This approach to using multiple formats has been directly informed by the current analysis, and by follow up discussions with ICoE:CR coordinators.

A clear limitation of using visual logic models for emergency management has appeared throughout the current VMEP process. As detailed in Sect. 2.1, early stages of the VMEP process at the ICoE:CR dictated that the visual logic model layout would be simplified for sign off by busy WREMO management. Although there had been some convincing reasons to avoid a more richly layered model, the lack of higher level outcomes has now reinforced by participants' overall focus on the operational level of WREMO activities. The resulting visual logic model and surrounding VMEP process have neglected a range of surrounding research into resilience predictions, and require expansion as part of longer term considerations for the WREMO community resilience strategy.

Roorda and Nunns (2009) suggested that logic model diagrams such as visual logic models can struggle to integrate surrounding research in the same way as systems diagrams. It seems reasonable to suggest that other processes, such as researcher-led systems modelling, may help further develop collaborative initiatives such as the Wellington ICoE:CR. For the ICoE:CR, this may substantially improve on the rapid systems model developed by WREMO practitioners and outlined in WREMO (2012).

These issues reflect neglect of research-based considerations and a failure to observe unintended consequences, outlined in Sect. 4.2, which are naturally due to more than document format alone. Process itself has a very important role to play. VMEP for emergency management needs to incorporate information from much further afield than internally established key performance indicators. Relevant changes to the surrounding environment, including unintended consequences, could be just as important to respond to as the success of particular interventions. An appropriately wider search could even reflect a strategic intelligence cycle that incorporates planning and tasking, data collection, processing/exploitation, analysis, production, dissemination, and user requirements and feedback alongside internal evaluation (Krizan, 1999).

6.5.2 Wider Implications. Attempts to integrate planning, monitoring, evaluation, and research may benefit from some form of visual logic model at many points of development. According to Huggins and Jones (2012), systems models and logic models represent a heuristic, abbreviated understanding of the world around us and are best assessed in pragmatic terms. We must ask ourselves whether the boundary object in front of us will really help us achieve what we need it to, while asking what other tools we need to deploy. To do otherwise would distance organisational development from what Huggins and Jones (2012) and Todd and Gigerenzer (2003) have referred to as ecological rationality, where selective and efficient understandings help make genuinely useful decisions, in particular situations. Further research into planning, monitoring, evaluating, and/or researching community disaster resilience programs will benefit from considering this established criterion.

At the time of writing concluding the current research, the new Sendai Framework for Disaster Risk Reduction 2015–2030 (UNISDR, 2015) has been adopted and published as a largely linear, narrative document. Formats such as visual logic models have the potential to complement such an extended narrative document as a catalyst for relevant monitoring, evaluation, and research strategies. For example, visual logic models can use a *drill down* function to break an international scale down into regional, national, and sub-national levels. This kind of rich visual and layered approach could help emergency managers meet contemporary community resilience criteria such as “collaboration and integration” and “issue and place-specific responses” (LGNZ, 2014, p. 1).

In light of the current research, processes such as VMEP and documents such as visual logic models are not simply a replacement for traditional narrative documents. The complementary role of VMEP for complex policy processes is a constructive finding, not a criticism. Experts in constructing extended linear narratives have no need to feel threatened by some new resistance to the clarity of official text-based agreements. It has become difficult to deny that VMEP represents a very different way of facilitating and documenting complicated dialogue between diverse disaster risk reduction stakeholders. But the current research also highlights the relative ease of moving into this mode of richly visual, boundary objects in dialogic, workshop contexts—before moving back to more traditional, text-based formats.

This movement between formats should certainly be considered for documenting many aspects of large-scale policies and strategies such as the Sendai Framework for Disaster Risk Reduction. Given the operational focus observed during the current research, VMEP may be particularly valuable in the implementation of such large-scale policies and strategies. Failure to consider implementation-focused innovations, such as VMEP integrated project-management proposed by Huggins and Peace (2014), could mean doing what we have always done to get what we have always got. As paraphrased from a UNISDR review of their prior disaster risk reduction framework (UNISDR, 2014), the Hyogo Framework for Action 2005–2015, doing what we have always done to monitor and utilize core indicators is simply not good enough. As illustrated by the current research, VMEP represents a constructive challenge to this status quo. This process combines the expertise of practitioners and researchers towards improving the research-informed implementation of contemporary disaster risk reduction initiatives.

7. Study Two Exposition

Study Two involved action research to embed a VMEP logic model within a new group of organisations called the ICoE:CR, to support researcher and practitioner collaborations while improving the community resilience initiatives across the Wellington region. It was assumed that supporting both collaborations and program improvements would constitute the usefulness of a VMEP logic model for decision making in this context. This usefulness would characterise the way that this logic model functioned as part of ecological rationality. Longitudinal data relating to the process of embedding this logic model was gathered by documenting the logic model at different stages of development. Interviews with ICoE:CR stakeholders who helped develop the logic model were then used to build an account of what occurred prior to, between, and after the development of the logic model versions.

Action research in Study Two comprised an evaluability assessment: a process used to assess readiness for evaluation, to clarify program objectives, and to design relevant analyses. As outlined in Chapter 5, VMEP was used to facilitate this process by building a visual logic model to record evaluability assessment progress in a concise and accessible format. Detailed field notes were taken during the entire evaluability assessment process but are not included in full, as part of this thesis. This is because, although the field notes were used to guide the action research, then data collection and analysis, they did not fom part of the data being analysed. A critical realist approach was then used to analyse the combination of interview data and different logic model versions produced during this process - with particular attention to differences before, during and after a dedicated VMEP workshop. Thematic and content analysis of participant accounts were used to create a longitudinal account of the transition between logic model versions.

The first section of this chapter provides a summary of the results outlined in Chapter 6. Section 7.2 of the current chapter then assesses whether or not the VMEP process used in Study Two was able to achieve evaluability assessment objectives outlined by Wholey (2010). This effectively assesses how Study Two formed an action research intervention concerned with what Reason (2003) called the development of "practical knowing through participatory, democratic processes in the pursuit of worthwhile human purposes, drawing on many ways of knowing in an emergent, developmental fashion" (p. 108). Section 7.2 also includes an appraisal of the subsequent, critical realist analysis of action research dynamics. A reflexive discussion of the research findings will then be outlined in 7.3, to consider interpretive elements of both the evaluability assessment and the critical realist analysis. The current chapter concludes with a reflection on how Study Two contributed to the overall thesis.

7.1 Summary of Results

As outlined in 5.4, content analysis was the dominant method used to analyse Study Two interview data. This method was used to document the action research process in terms of statistical patterns. An initial set of content analysis codes achieved moderate (*kappa* > .41) to good (*kappa* > .61) interrater reliability, using standards from Landis and Koch (1977). Moderate to good interrater reliability was achieved for a final set of three timing codes: 'Before the Workshop' (*kappa* = .77); 'During the Workshop' (*kappa* = 0.69); and 'After the Workshop' (*kappa* = .45).

These two sets of codes were then analysed for correlation across the entire set of interview data. Results of this analysis suggested that participants distinctly accounted for the period 'Before the Workshop' in terms of: a constructive focus on WREMO activities (*rho* = .13, $p < .01$); a focus on positive resilience outcomes (*rho* = .10, $p < .01$), and; considering diverse groups and individuals (*rho* = .07, $p < .05$). It seems that they distinctly accounted for the period 'During the Workshop' in terms of a focus on positive resilience outcomes (*rho* = .13, $p < .01$). Participants appeared to distinctly account for the period 'After the Workshop in terms of documents (*rho* = .12, $p < .01$) and a constructive focus on WREMO strategy (*rho* = .08, $p < .01$). Prevalent sub-codes for each of the identified codes are listed by action research phase, in table 6 of Chapter 6.

7.1.1 Additional data analysis. Thematic analysis was in an attempt to augment the analytical depth of Study Two. However, Study Two as a whole may not have achieved the potential balance of detail and depth outlined in Chapter 5. The use of correlational content analysis to summarise all relevant data revealed one very clear limitation in particular. Chapter 6 identified one main code which was significantly correlated with the During the Workshop 'Positive Resilience Outcomes'. The prevalence of this code illustrated how participants perceived that the pursuit of positive resilience outcomes was a distinctive part of building the post-workshop VMEP logic model. However, this code only related to 51 of the 536 excerpts concerning the 'During the Workshop' phase. It appeared that participants also had other ways to explain what occurred. These explanations appeared to be highly salient, even though they were not distinctly correlated with one particular phase of the action research. A broader approach to analysis was required, to better describe what occurred between the first and second versions of the VMEP logic model, during the Study Two workshop.

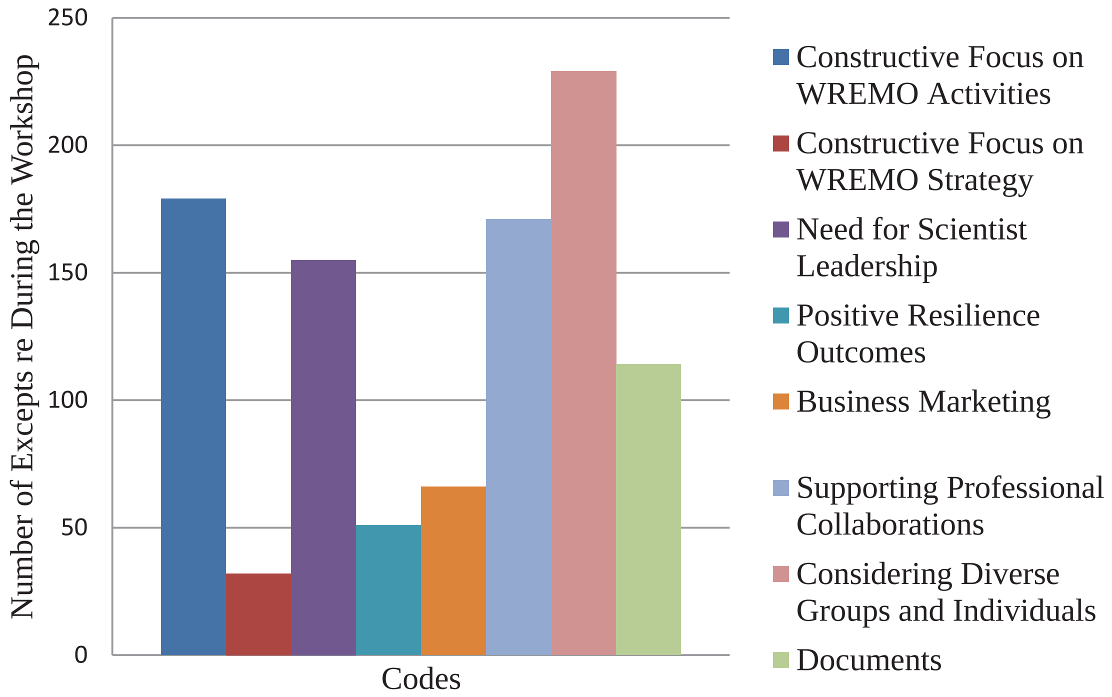

Figure 14. Excerpts concerning what occurred during the workshop by content analysis code.

Figure 14 displays codes applied to all excerpts concerning what occurred during the Study Two workshop. This descriptive analysis shows how additional codes could be used to explain what occurred between version one and two of the VMEP logic model. In particular, this figure suggests that a ‘Constructive Focus on WREMO Activities’, ‘Considering Diverse Groups and Individuals’, ‘Supporting Professional Collaborations’, a ‘Need for Scientific Leadership’, and ‘Documents’ account for what occurred during the actual workshop. The original analysis of Study Two data, outlined in Chapter 6, showed that the ‘Positive Resilience Outcomes’ code was distinctly correlated with the ‘During the Workshop’ timing category. However, in retrospect, this correlation only showed how many other themes used to account for the ‘During the Workshop’ phase were also used to account for what occurred before and after the workshop. Although ‘Positive Resilience Outcomes’ was a distinctive aspect, this code did not represent the sum of how participants accounted for their experiences of the Study Two workshop.

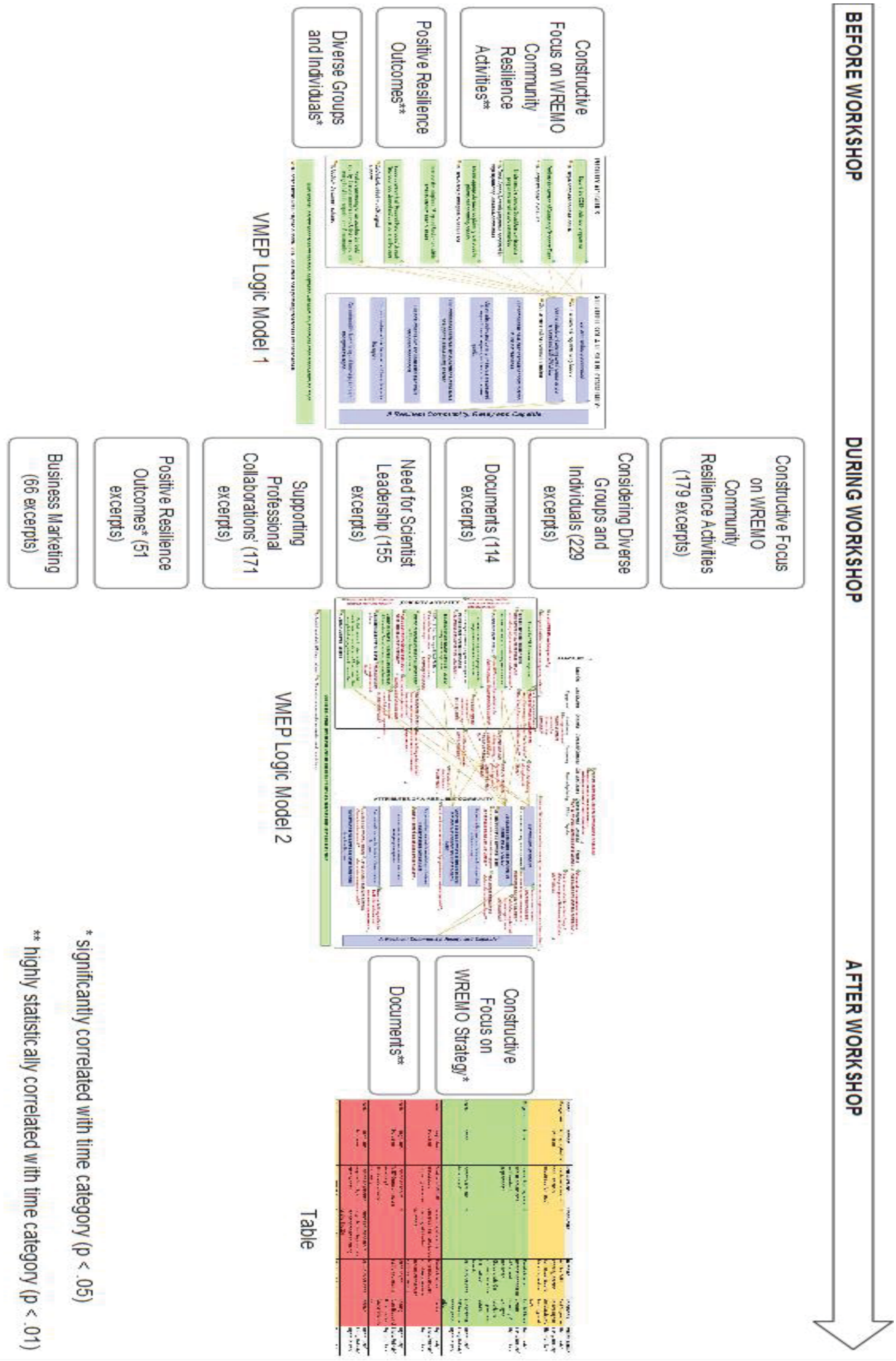

Figure 15. Longitudinal summary of content analysis codes.

A thematic analysis of the additional themes identified alongside their sub-themes would produce an even richer account of how these aspects of the VMEP process led to the post-workshop logic model. However, this more in-depth analysis was not possible within the time constraints of the current thesis. Instead, a more visual approach helped to see how identified codes account for transitions between different iterations of the VMEP logic model. This visual approach to summarising longitudinal features of Study Two findings is shown in Figure 15. Prevalent codes are provided in longitudinal order from right to left, according to their chronological relationship with each of the principal VMEP logic model versions.

7.2 Further Discussion

The following section discusses additional interpretations of the Study Two results, with reference to additional analysis outlined above, in 7.1.1. These interpretations are made to assess the extent to which Study Two action research formed an evaluability assessment, and the extent to which the overall study was aligned with the critical realist epistemology detailed in 5.4.2.

7.2.1 Assessing the action research intervention as an evaluability assessment.

As an evaluability assessment, the Study Two action research intervention focused on checking the readiness of the regional community resilience strategy for useful evaluation. The most recent VMEP logic model, produced during the main Study Two workshop, suggests that many parts of the strategy were now ready to monitor and evaluate, even if these activities were not clearly related to post-disaster resilience outcomes. As an evaluability assessment, the Study Two workshop also focused on forming a consensus about program objectives and the criteria used to monitor and evaluate them. However, as outlined in the previous chapter, workshop participants did not openly discuss the suitability of WREMO objectives. Despite the value of incremental critique and adjustment alongside the need to engage diverse expertise, both outlined in Chapter 1, this is one problem emerging during the evaluability assessment that was unable to be mitigated within the Study Two timeframe and scope. Other unmitigated issues affecting the evaluability assessment as a whole are outlined below while Appendix K provides a more detailed assessment of the Study Two action research intervention.

It was particularly surprising to observe an absence of critique from researcher participants, especially regarding a regional community resilience strategy which appeared largely disconnected from their own research and the research of their peers. During the workshop, researchers appeared to be more interested in the draft key performance indicators rather than objectives underlying them. This focus on indicators rather than outcomes may also be shared by several large scale indicator synthesis programs outlined in the Literature Review chapter.

It is important to ask what kind of reasoning was or was not being applied to the programme of community resilience interventions in question. Gallagher and Aschner (1963) defined the concept of *evaluative reasoning* as dealing "…with matters of judgment, value and choice… .characterized by its judgmental quality" (p. 188). As outlined by King (2007), evaluative thinking has become an important aspect of program evaluation because it reinforces the importance of "systematically and purposefully planning an evaluation activity, doing it and collecting information about it, and then reflecting on what happened as one plans next steps" (p. 53).

The VMEP logic model may have promoted some degree of evaluative reasoning, by providing a summary of program components, priorities, linkages and measures which need to be adjusted as part of evaluating the WREMO community resilience strategy. However, program evaluation may have been an unfamiliar or uncomfortable mode of thinking and interacting for many of the Study Two workshop participants. ICoE:CR coordinators had an ongoing opportunity here, to implement training programmes which enhance evaluative thinking. This may prove even more worthwhile than building frameworks for monitoring and evaluation, because evaluative thinking may help ensure ICoE:CR stakeholders could more effectively build, adjust and leverage those frameworks.

The pace of consensus regarding agreed workshop outcomes, displayed on the post-workshop VMEP logic model, may have further limited the value of evaluability assessment decisions made during the workshop. Although I had intended to note any clear disagreements for further discussion, workshop attendees made a clear attempt to work very closely together. Sub-groups appeared to reach agreement very rapidly while avoiding potentially divisive topics such as cultural diversity, post-disaster outcomes and unintended consequences. The way that these topics appear to have been avoided during the workshop is outlined in more detail in Appendix K.

Another practical purpose of the Study Two workshop as an evaluability assessment was to establish the focus and use of program-related research. The post-workshop version of the VMEP logic model displayed in the previous chapter suggests that this was achieved to some extent. Several research questions were outlined and mapped onto the VMEP logic model, indicating aspects of the WREMO community resilience strategy which would be informed by answering them. However, as outlined in Appendix K, no detailed research designs were developed during the workshop. This may have been due to time constraints combined with inclusive workshop dynamics. The latter factor was evidenced by the content analysis code ‘Considering Diverse Groups and Individuals’ which applied to over 200 excerpts from participant excerpts and which may have excluded arguably researcher-centric discussions about finer-grained research methods.

The VMEP logic model format appeared to help facilitate the overall evaluability assessment. However, as outlined in Appendix K, ICoE:CR coordinators appeared unwilling to continue using this information format without my dedicated facilitation. Their reluctance to facilitate a continuation of VMEP within the ICoE:CR may have been due to an apparent unfamiliarity with evaluative reasoning, outlined above. Informal discussions with ICoE:CR coordinators suggest that they were also struggling to find time for their ICoE:CR roles in among other commitments.

In any case, upon request by ICoE:CR coordinators, the post-workshop logic model was converted into a spreadsheet outlining potential research topics and questions alongside relevant components of the regional strategy. This document was delivered to ICoE:CR coordinators and distributed throughout their network of researchers to promote research that would answer agreed research questions. The broad uptake of this document, which did not require any familiarity with VMEP logic models, appeared promising at first. Two different researchers, who had not been involved in the workshop, requested their own copy of the spreadsheet within a fortnight. However, documents created as a result of Study Two action research have since become an historical artefact. They appear to have become limited to the current thesis timeframe, rather than becoming a facet of longer term ICoE:CR development.

Following the evaluability assessment, ICoE:CR coordinators decided to take a very different approach to planning ICoE:CR activities. This approach was taken on a much larger scale, incorporating the views of international colleagues attending the 2014 Australasian Natural Hazards Management Conference. This wider-ranging approach was outlined in Doyle et al. (2015) and has not reflected a particularly evaluative approach to the WREMO community resilience strategy.

Although this outcome reflects a lack of continuity for my role with the ICoE, I was only ever engaged with these organisations as a PhD student. Ethical considerations outlined in Appendix M dictated that this engagement would not comprise a formal component of ICoE:CR development. Furthermore, this otherwise disappointing outcome has helped build a more reflexive understanding of my own role in facilitating a VMEP process as part of the current thesis, as outlined in 7.3.1.

7.2.2 Assessing the critical realist analysis. Study Two action research was documented using a critical realist approach to generating knowledge as a result of the evaluability assessment. As outlined in Chapter 5, methodologies based on critical realism can take a series of longitudinal observations and build a causal narrative between them. For the purposes of the current thesis, participants' causal narratives formed the source material for interpreting the time periods between longitudinal observations constituted by the VMEP logic model versions. Participant accounts were analysed with qualitative thematic analysis, followed by content analysis which provided a statistical account of the initial themes. A set of main themes was derived from data concerning before, during and after the workshop. These timeframes were positioned during: development of the initial VMEP logic model; the iteration of the VMEP logic model agreed upon at the conclusion of the workshop; and the subsequent spreadsheet summary of research questions alongside relevant details of the community resilience program.

Although Q-method viewpoints were translated into analytical themes for Study Two, this approach was not strictly compatible with Q-methodology theory. Q-method research interprets the viewpoints of a particular group of participants at a particular point in time. Viewpoints identified by Q-methodology are not assumed to represent static or inflexible traits (Watts & Stenner, 2012). Although the post-workshop interviews promised to deepen interpretations of original Q-method factors, the workshop and interviews were conducted almost one year after the initial Q-method research. For this reason, the analysis of Q-method factors in Study Two was limited to discussing the way factor distribution (or perspectives) had changed during the VMEP process and during the development of the ICoE:CR as a whole.

As outlined in the previous chapter, interview content related to localised operational issues was labelled with the code, ‘Constructive Focus on WREMO Community Resilience Activities’. The distribution of interview content labelled with this code was evenly spread across both researcher and practitioner groups. A viewpoint identified in Study One concerning a localised focus on localised operational issues had formerly been relevant among ICoE:CR practitioners, not ICoE:CR researchers. Study Two assumed that this change in the relevance of operational issues was due to researchers’ participation in the VMEP process. However, these changes could have also been due to other factors over the same time period, including the way that viewpoints identified in Study One were presented as part of the workshop introduction.

The initial thematic analysis used to detail this difference and other changes over time involved a high degree of interpretation, starting from the formulation of initial themes. Braun and Clarke (2006) stated that a theory-based approach to thematic analysis is never conducted in an epistemological vacuum. This was the approach taken to the thematic analysis of Study Two data. Considering the assertion from Braun and Clarke

(2006), this approach depended on my own personal experience, which allowed me to identify an initial set of themes relating to using VMEP for helping develop a complicated initiative in the complex domain of community resilience.

Although to a lesser extent, content analysis used to refine these narrative elements was also heavily influenced by my own experience. The selection of statistical tests, as outlined in 7.3, was also dependent on my own experience. Therefore, subjectivity played a major role in research findings produced throughout Study Two, even where the statistical methods applied suggest a greater distance between the data and my own personal experience. Concerning the critical realist epistemology that was used to background Study Two, Mingers, Mutch and Willcocks (2013) suggest that "…we do have perceptual experience of the world and that science is carried out through experimental activity in which scientists bring about particular outcomes" (p. 298). A reflexive discussion of these subjective influences is provided in 7.3.1 below.

7.3 Limitations

The following section outlines limitations of the Study Two intervention in particular. In contrast to the limitations outlined in 6.5, the following section resembles the reflexive approach introduced in 1.3.7 and deployed in 4.3.4. This approach acknowledges subjective researcher decisions made throughout the intervention process.

7.3.1 Reflexivity. The role of subjectivity becomes evident through reflexivity. During Study One, I noted that my personal preference for structured planning, monitoring, evaluation and research design was not expressed by any core member of the new ICoE:CR. While this thesis focuses on the role of structured monitoring and evaluation, that did not mean I could identify the same focus amongst ICoE:CR coordinators and their collaborators. Instead, it became clear during Study Two that extended narrative documents and text-based spreadsheets would continue to be used as a status quo within the ICoE:CR.

This status quo appeared to represent a cultural practice surrounding the incorporation of cognitive media, as outlined by Hutchins (2008, 2014). From a socio-ecological perspective, it could be argued that the persistence of this cultural practice evidenced the adaptive value of using traditional information formats to address complexity. However, this would be the small scale equivalent of suggesting that every human practice continues to exist because it leads to an optimal set of outcomes. The existence of a status quo is simply not a sufficiently good argument for the existence of a status quo. For a much more overtly destructive example, sexism is a status quo in many organisations. This does not mean that prejudice based on assumed gender characteristics is justifiable in and of itself. The use of particular document formats is not overtly unjust and destructive but the insufficiency of a circular argument, that the existence of a status quo justifies the exclusive use of these formats, remains comparable.

The concept of document formats as part of cultural practices nonetheless provides a constructive framework for understanding the incorporation of VMEP processes within the ICoE:CR. This cultural lens suggests that it would take much more than a limited exposure to new processes and mediums to convince emergency management practitioners and researchers to adopt new decision making components. In contrast with the organisational outcomes of Study Two, anecdotal reports have suggested that the logic model outlined in Huggins and Jones (2012) was still being used by the New Zealand Department of Conservation as at the beginning of 2014. This logic model was still accompanied by a facilitator who resides in the same city as the

Department of Conservation headquarters. In contrast, I was mostly located outside of New Zealand ever since the Study Two evaluability assessment. Furthermore, as alluded to in 7.2.1, I was engaging with the ICoE:CR as a doctoral student, rather than on any more formal and enduring terms. Without the continuity of local facilitation, the process outlined in Study Two was likely to represent an isolated phase, rather than an enduring change to institutionalised practices. Relatively novel patterns of decision making appeared to have been temporarily facilitated during the main Study Two workshop. In terms of Hutchins' (2008, 2014) concept of distributed cognition, these momentary changes were unlikely to amount to a shift in cultural norms and practices, concerning the incorporation of information formats as part of emergency management decisions.

7.4 Conclusion

The implications of Study Two, for this thesis, extend further than the summary outlined in 7.2. As outlined in 7.2, Study Two action research took an evaluability assessment approach to embedding a VMEP logic model within the ICoE:CR. It was an attempt to support researcher and practitioner collaborations while improving the community resilience initiatives across the Wellington region. This approach to the main Study Two workshop seemed to have been successful in engaging researcher and participant stakeholders at the core of the ICoE:CR. As outlined in Appendix I, the plotting of 35 distinct questions marked a tangible success of Study Two as an action research intervention. Even more collaborative aspects of the evaluability assessment process may have benefitted from being allocated more time, over more than one workshop.

The Critical Realist approach to documenting action research dynamics appeared to have been a worthwhile option, considering the availability of both document and interview data and the generally abductive approach taken by this thesis. However, the blend of Q-method findings with thematic analysis and content analysis was challenging to carry out, especially considering the transient nature of Q-method viewpoints. This led to an analysis of changes in viewpoints identified during Study One, instead of solely attempting to re-validate those viewpoints and their original distribution between researcher and practitioner groups.

Reflexive material in 7.3.1 discussed the highly interpretive processes of Study Two thematic analysis in particular. A reflexive approach to the experience of conducting Study Two action research and documenting the process also reflected my role as a researcher, rather than an agent for more enduring changes within the ICoE:CR. Content analysis was able to produce a very succinct account of what occurred between each iteration of the VMEP logic model. This chapter took a more descriptive, less analytical approach to a broader set of codes concerning what occurred during the Study Two workshop. This approach has highlighted how several codes helped to account for workshop dynamics, in addition to a shared interest in ‘Positive Resilience Outcomes’.

7.4.1 Relevance to the overall thesis. The descriptive analysis outlined above has some important implications, given that there were several other dynamics affecting the Study Two workshop. The combination of ‘Considering Diverse Groups and Individuals’ with a ‘Constructive Focus on WREMO Activities’ and a ‘Need for Scientific Leadership’ was particularly relevant for considering the value of the VMEP logic model being developed. The salience of these codes also suggested aspects of the way that logic model may have operated as part of ecological rationality.

As outlined in 1.4.3, ecological rationality may occur when certain representations support decisions which are more both more efficient and effective than components of less efficient decisions. Study One defined the potential benefits of a VMEP logic model, as part of a more ecologically rational approach to the ICoE:CR context, as one result of decisions capable of supporting researcher and practitioner collaborations and improvements to the WREMO community resilience strategy. This definition of ecological rationality was interrogated during Study Two and needed to be expanded as a result. The VMEP logic model, as a component of ecological rationality, appeared to comprise three characteristics, as outlined beneath the following sub-headings. It should be noted that these characteristics generally refer to the VMEP process used during Study Two action research. It is assumed that the VMEP logic model was a central and inseparable part of this process.

7.4.2 Characteristic one: Resulting in decisions which support researcher and practitioner collaborations. This aspect of decisions related to the VMEP logic model was highlighted by content analysis codes ‘Constructive Focus on WREMO Activities’, ‘Need for Scientist Leadership’, ‘Supporting Professional Collaborations’, and ‘Considering Groups and Individuals’. These four codes all concerned researcher and practitioner collaborations. They applied to 87.3 percent of interview excerpts concerning what occurred during the main Study Two workshop. It appeared that the VMEP logic model supported a number of decisions leading to these dynamics. The ‘Documents’ code was significantly associated with participants’ accounts of what occurred after the workshop. The sub-code ‘VMEP as a Catalyst’ related to 11.3 percent of all excerpts concerning what occurred during the workshop and 10.7 percent of excerpts concerning what occurred afterwards. This suggested that the VMEP logic model led to agreements concerning further collaborations between ICoE:CR researchers and practitioners, even though those agreements were more widely disseminated using a table format.

7.4.3 Characteristic two: Highlighting the importance of operational matters. During Study One, prior to using the VMEP logic model, ICoE:CR researchers had shown little interest in operational aspects of the WREMO community resilience strategy. A viewpoint relating to operational issues was only consistently related to practitioner Q-sort data. This appears to have changed while using the VMEP logic model during Study Two. As outlined above, a content analysis code concerning operational matters appeared to be highly relevant for both researchers and practitioners at the conclusion of Study Two. This marked an alignment between practitioners' and researchers' priorities which appeared to occur as a result of the VMEP process and surrounding workshop elements.

7.4.4. Characteristic three: Helping WREMO promote characteristics of resilient communities. Study One had identified an interest in resilience outcomes that was shared among practitioners and researchers alike. This viewpoint was used to create a code for Study Two content analysis labelled 'Positive Resilience Outcomes'. However, sub-code characteristics, participants' behaviours observed during the Study Two workshop, and a lack of amendments to the resulting VMEP logic model suggested that ICoE:CR researchers and practitioners were content to focus on more immediate objectives. As detailed in figures 12 and 13, these objectives concern characteristics of a community resilience state, rather than post-disaster outcomes related to those characteristics. The implications of this observation are discussed in more detail in the final conclusions of this thesis, in Chapter 11.

The original Study Two analysis, combined with further analysis in the current chapter, resulted in a highly localised view of the potential value of a VMEP logic model in the ICoE:CR context. New criteria for the use of logic models as an ecologically rational approach to the ICoE:CR context were formulated as a result. These criteria marked a major contribution to the entire thesis, alongside materials produced during Study Two which were to be used as experimental stimulus in Study Three.

The following chapter outlines the design of Study Three in considerable detail. This was achieved by adapting established methods for macrocognitive research, which focuses on how groups think together to face the challenges presented by complex domains. This study marked a movement towards using almost completely empirical data and highly structured statistical analysis, concerning responses to two information formats created over the Study Two timeframe. The chapter finishes by outlining the need for a certain type of simulation procedure, to ensure the relevance of Study Three findings to actual emergency management scenarios.

8. Methodology for Study Three

This chapter outlines the methodology for piloting an experimental design to test differences in emergency managers' responses to either a VMEP or traditional, table-based, display of community resilience indicators. The principal aim of this third study of the thesis was to examine whether an experimental design could detect the influence of a boundary object on macrocognitive performance, in the context of strategic emergency management across a geographic region of New Zealand. A detailed explanation of the experimental design is provided to illustrate how this design assesses the way that community resilience indicators are displayed. The chapter begins by outlining the relevance of key performance indicators for improving community resilience programs. The chapter then works through a number of key methodological considerations. This includes methods piloted to help ensure that the results of display assessments are relevant beyond a tightly controlled experimental protocol.

Study Three used materials produced during Study Two to examine a core assumption of this thesis: that a richly visual logic model supports a demonstrable improvement in ecological rationality among emergency management professionals working with the complexities community resilience. For Study Three, *demonstrable* referred to evidencing the effectiveness of decisions made using this logic model through an experimental protocol, compared with the effectiveness of decisions using a status quo information display. The effectiveness of decisions was defined in terms of a mutual objective held by ICoE:CR researchers and practitioners participating in Study Two: improving characteristics of resilient communities that will lead to improved post-disaster outcomes. Ecological rationality for Study Three continued to be defined in these terms. Logic model contributions to ecological rationality were therefore characterised by decisions which: help emergency management professionals to address a broad range of community resilience outcomes, at household, community, area and regional scales.

The following chapter provides further background details that have not been included in the full research paper reproduced in Chapter 9. These details include a brief background to the rationale of Study Three in 8.1, followed by a summary of mathematical theory in 8.2, relating to what key performance indicators represent. This summary is in turn followed by a brief extrapolation on background theories of group cognition, in addition to material outlined in Chapter 1. This section of the chapter focuses on theories of how visual aids can assist groups working in complex scenarios. The epistemology of psychological post-positivism is outlined as a way to generalise theoretically relevant findings from Study Three to a wider set of similar, emergency management contexts. This is followed by a set of methodological considerations concerning congruence between post-positivistic assumptions about knowledge and the data collection and analysis methods used for Study Three.

8.1 Overarching Rationale

As outlined in Chapter 1, the context for this thesis was framed by an emergency management strategy focused on improving community resilience against disasters across the Wellington region. The rich visual display of interest was the VMEP logic model used to summarise complex implications of this strategy during Study Two. Study Two found mixed support for the assumption that this logic model helped support more useful approaches to researching, monitoring, and evaluating performance on the following, pre-existing objectives:

1. Our communities are connected
2. Our individuals and existing social structures are engaged and empowered
3. Our communities have clear channels of communication to link into resources
4. Our communities have realistic expectations of the levels of support available during an event
5. Our private, public and community sectors are prepared to respond to an emergency and return to business quickly
6. Our local councils own and understand their role in emergency management
7. Our communities reduce the impacts of hazards across the region
8. Our communities have strong and honest partnerships throughout the region

(WREMO, 2012, p. 9)

Rather than addressing the full scope of monitoring, evaluation, and research from Study Two, Study Three took a more selective view, of performance measurement. As outlined by Behn (2003), performance measurement can be used to evaluate, control, budget, motivate, promote, celebrate, learn and improve within an organisation. Discussions with WREMO management and personnel had suggested that they were particularly motivated to assess and improve their community resilience program. According to a range of literature discussed in Behn (2003), the use of performance metrics and other performance information is an important part of evaluating performance. This fit the first motivation for using performance metrics at WREMO. Concerning the second motivation, performance metrics "…contain information that can be used not only to evaluate, but also to learn" (Behn, 2003, p. 592). Behn (2003) stated that the learning function of performance metrics occurs when organisations use them to identify not just what works and what does not, but also why.

The value of learning for organisational development created a need to select metrics which contribute to knowledge about causality within a given program of interventions. Contrary to this need for carefully selected measures, Behn (2003) stated that the ambiguity of many public sector mandates means that “almost any performance measure can and will be used to evaluate a public agency's performance” (p. 589). However, as outlined in Chapter 7, the existence of a status quo does not in itself justify that status quo. Although an ad hoc use of performance metrics appeared to be common practice, it would be both costly and counterproductive to assume that any given data were relevant for evaluating and improving WREMO community resilience activities. The wide scope of the community resilience concept could encompass many characteristics of Wellington communities which WREMO would never be able to directly influence. Household income is only one example that may increase resilience but which probably has nothing to do with WREMO resourcing, mandate or activities. Instead, Study Three focused on metrics that could be attributed to WREMO activities. These attributable metrics have been commonly referred to as key performance indicators, for example, by Clarke (1984), Smith (1990), and Bouckaert, Halligan and Van Dooren (2010).

A working set of key performance indicators for the regional community resilience strategy were produced over the prior, Study Two timeframe. These key performance indicators had been documented in both table and logic model formats, specifically designed to measure the success of WREMO efforts to improve regional community resilience. To further examine the value of the WREMO logic model, Study Three compared this visual map of how key performance indicators apply to the overall strategy with the table-based display of the same key performance indicators. Study Three specifically aimed to examine whether an experimental design could detect the influence of these boundary objects on macrocognitive performance, in the context of strategic emergency management across a geographic region of New Zealand.

As outlined in Chapter 1, this thesis is informed by an extended, rather than brain-bound approach to cognitive psychology. Study Three also reflects what Clark (2011) called a *dynamist* understanding of relevant cognitive components and processes. This dynamist understanding is focused on relationships between cognitive components and cognition related states rather than the precise mechanisms causing those changes. Logic models form one such cognitive component in this approach to examining the dynamics of extended cognition.

8.2 The Logically Ordered Need for Logic Models

Organisations can tend to treat monitoring and evaluation as an inconvenient afterthought which stands in the way of efficient strategic planning and implementation. Further to the instances summarised in 8.1, this relatively ad hoc approach to performance metrics was observed by Margoluis et al. (2009) in conservation initiatives at the complex intersections of human and natural systems and by Annecke (2009) in strategies for energy sector reform. The broad domain of disaster risk reduction is no exception. For example, the UNISDR (2014) identified monitoring and evaluation as a substantial weakness in the implementation of their 2005-2015 international strategy for disaster risk reduction.

Study Three focused on assessing a more deliberate approach to monitoring and evaluation metrics. The importance of this more deliberate approach can be conceptualised in terms of Frege's theory of number: that any number is meaningless unless it is combined with a second-order *predicate* logic (Frege, 1884, 1980; Parsons, 1990). For example, the number five means something very different when it describes five apples in a barrel, rather than one apple with a five centimetre radius. It follows that the statement that "a community resilience team completed 50 visits to local schools" is effectively meaningless without the second-order logic of a community resilience team visiting schools. A first order description of the number itself would simply state, "50 visits".

Study Three concerned particularly complex logical statements surrounding community resilience indicators. As outlined above, statements including a second order predicate are a vast improvement on single numbers without any logical context. However, a simplistic approach to second order predicates does not describe performance metrics which guide improvements to the complex dynamics of community resilience. For example, the WREMO Community Resilience Team could have simply crossed a school's front gate 50 times before returning to their own headquarters. The statement that "a community resilience team completed 50 visits to local schools" remains effectively irrelevant to the community resilience strategy. Team members needed to demonstrate the more complex relevance of their visits to functional aspects of community resilience. This is where this thesis extends beyond the theoretical work of Frege (1884), who appeared to assume that human thought could be condensed to simple sequences of written statements.

The logic model generated during Study Two was used to illustrate a more complex, but nonetheless logical significance of strategic performance metrics, using a number of rich visual cues. These visual cues addressed aspects which are difficult to represent in text alone and included: coloured boxes showing the strategic activities and objectives being gauged by each performance metric; arrows to display how these activities link to pragmatic objectives; and bright yellow markers to note the relative priority of activities and objectives. The pragmatic difference in usefulness becomes obvious when comparing this kind of logic model to a set of *ad hoc* performance metrics added to the last few pages of a narrative strategy document. In a logic model, performance metrics are provided alongside the strategic components and surrounding dynamics those metrics are intended to measure. Adding these metrics to the final few pages of a narrative strategy leaves the metrics much more detached and therefore more difficult to relate to the original strategic intentions. Even when slightly less narrative formats such as tables are used to represent performance indicators, these formats still do not display exactly how a performance indicator metric relates to the surrounding strategy.

8.3 Distributed Cognition and Distributed Situation Awareness

Certain challenges for dealing with these kinds of second-order predicates have been highlighted in literature concerning complex dynamic systems. As outlined in the first two chapters of this thesis, the challenges posed by these systems, including systems characterised by community resilience, are produced by multiple interactions between two or more dynamics. In physics, these issues are illustrated by the example of a double pendulum. When one moving pendulum is attached to the bottom of another moving pendulum, the movement of the second pendulum results in what Christini, Collins, and Linsay (1996) called “high-dimensional chaos” (p. 4824). Outcomes from this type of chaos appear to be extremely hard to predict (Christini et al., 1996). Working with dynamic complexity can become even more challenging when at least one of the dimensions concerned is explicitly social. For example, Diehl and Sterman (1995) found that research participants struggled to make accurate financial predications when considering more than one interacting market dynamic.

There appear to be a range of challenges posed by dynamic complexity and other characteristics of complex adaptive systems which are not easily resolved by individual thinkers working in isolation. Reflecting the need engage the mental processing of multiple thinkers and multiple expertise, cognitive issues addressed in Study Three were issues of macrocognition: of how groups think together, to meet the challenges of complexity (Schraagen et al., 2008). As outlined in Chapter 1, the distributed cognition approach to macrocognition has been used to theorise how computational media help individuals and their collaborators to address complex scenarios. Hutchins (1995) highlighted how cognitive medium tools help a ship's crew, for instance, think together to overcome the challenges of complex scenarios. These tools include charts and instrument panels to help crew members understand complex navigational and mechanical scenarios, and to support multiple interactions with other crew members around them. As outlined in the Initial Literature Review, these kinds of visual displays are called computational media. They are designed to help individuals process complex information and tasks in a way which would not be possible without sharing the wider knowledge and skills distributed through such displays. It follows that particularly effective computational media were required to help emergency management teams consider the complex second-order predicate logic of particular performance metrics.

Distributed cognition is one of several approaches to the research domain of macrocognition. Contemporary macrocognition research generally focuses on shared thinking within groups, with a particular focus on how individuals think together to resolve complex issues (Cooke, Gorman, Myers & Duren, 2013). Recent distributed cognition approaches to this area of research have been criticised for assuming that information displays will be uniformly interpreted by all members of a given group. According to Cooke and Gorman (2010), this assumption had led to an overly simplistic approach to researching macrocognitive processes.

More recent theoretical approaches appeared to make a better fit with the current macrocognitive research. For example, the *distributed situation awareness* approach to emergency management replaces theory surrounding computational media with a more flexible view of display interpretation and use. According to Owen et al. (2013), the distributed situation awareness approach takes a more pluralist view of the ways in which information relevance and interpretation varies among diverse groups and individuals. Owen et al. (2013) used the distributed situation awareness approach to explain the relevance of *boundary objects* in emergency management. Owen et al. (2013) primarily used this concept to describe collaborations between emergency management organisations. However, Bechky (2003) outlined how the concept of boundary objects is used in organisational studies, to describe technologies supporting collaborations between any set of collaborators with different professional backgrounds and organisational roles. Boundary objects therefore function as part of collaborations both within and between organisations. These information displays are used to communicate among diverse emergency management collaborators. For example, a diverse range of named partners to the WREMO (2012) Community Resilience Strategy included emergency response and community development specialists, community-based organisations, researchers, and private sector businesses.

The distributed situation awareness approach may not suit many existing macrocognitive research designs. This is because, as stated by Hoffman (2010), the diverse interpretations of distributed situation awareness were problematic for following macrocognitive research precedents. Common approaches to macrocognition research have instead been exemplified by the use of right/wrong decision accuracy criteria for macrocognitive research and testing by Naval Sea Systems Command (2005). By contrast, boundary objects are used to support understandings of complex domains without assuming that there is one universally correct interpretation of a boundary object display and the complex scenario it represents. This made the rigidity of precedent, right/wrong criteria problematic for applying the concept of distributed situation awareness to Study Three.

This distributed approach to diverse interpretations was nonetheless unavoidable for the purposes of Study Three and this thesis as a whole. According to Kapucu (2012), and as also explained at several points throughout this thesis, diverse collaborations are an essential aspect of contemporary emergency management. For one example of this diversity, the WREMO (2012) strategy was not going to be read, interpreted and implemented in exactly the same way by each of its collaborating partners. Likewise, the implications of this strategy varied within the WREMO organisation itself. WREMO personnel in Emergency Response, Business Development, and Community Resilience Team sections needed to interpret the strategy in different ways, depending on their very different working roles. A distributed situation awareness approach to macrocognition helped to account for such variable interpretations of a complex emergency management strategy. Distributed situation awareness was therefore the most appropriate theoretical approach for studying responses to different displays of the WREMO (2012) strategy in Study Three. Expanding on macrocognitive precedents concerning definitively correct and incorrect criteria appeared to be the only way to research the diverse interpretations implicit to contemporary emergency management strategy, using a macrocognitive approach to this phase of the thesis.

8.4 Post-Positivist Epistemology

Given that Study Three represents a divergence from many contemporary approaches to macrocognitive research, it is important to identify how this research still contributed to knowledge concerning the domain of interest. As outlined in 8.3, Study Three was designed with the assumption that certain information displays improve cognitive aspects of performance, as components of distributed situation awareness concerning complex strategic scenarios. There was also an implicit assumption that responses to different display formats could be reliably measured and compared in terms of different levels of distributed situation awareness. These relatively fundamental assumptions needed to be made within an epistemology that assumed that the analysis of experimental observations contributes to knowledge about psychological phenomena which occurs within certain contexts.

The epistemological stance of psychological post-positivism seemed most appropriate. According to Stead (2004), psychological post-positivism assumes that knowledge about fundamental psychological dynamics is marginally improved by testing observable hypotheses over time. Unlike the antecedent epistemology of positivism, it is not assumed that researcher biases and the social contexts in which they are embedded can simply be removed from research findings (Burbules & Linn, 1991). Instead it is assumed that researcher subjectivities, along with specific social and historical contexts, will always substantially affect the testing of observable hypotheses. For example, researchers' subjectivities can affect research aims, questions, hypotheses, measures, procedures, the interpretation of results, and descriptions of implications from the research findings. Social and historical contexts can also affect many of these aspects of research, especially in the case of community resilience interventions, which have been particularly popular amongst researchers and practitioners during the timeframe of the current thesis.

As a result of explicitly acknowledging influences from researcher subjectivities alongside social and historical context, psychological post-positivism takes a much less ambitious stance than traditional positivism. This means that this form of post-positivism pursues marginal improvements to knowledge which are only partially generalizable, to social and historical contexts which are highly comparable to the research context. For the purposes of Study Three, the relatively modest objectives of post-positivism matched a core assumption outlined at the start of the current chapter: that highly specific results would only be generalizable within emergency management contexts which resemble the organisational context of study participants. In sum, psychological positivism was the epistemology which established how Study Three could produce a delimited set of recognisable knowledge.

8.5 Methods

The following section outlines the rational for using an experimental simulation to collect Study Three data. These details are followed by an explanation of how the resulting data, concerning responses to different information formats, were analysed. Each of these methods was subject to requirements for the Low Risk Notification to the Massey University Human Ethics Committee shown in Appendix M.

8.5.1 Experimental simulations. This form of experimental protocol can provide a set of methods linking post-positivist epistemological assumptions to data collection, data analysis and research findings. Many relatively uncontrolled elements of a social context can be accommodated within an experimental simulation, while the core phenomena of interest remain experimentally controlled. For example, an experimental simulation of the use of information systems for fire-fighting response would simulate many elements of the pressures faced during a real fire incident. Interactions with peers would not simply be eliminated during the experiment. Experimental simulations are designed to stimulate participant responses which are relevant to both the context and phenomena of interest. This provides a higher level of external validity to contexts outside a single experiment, while avoiding overly artificial study conditions.

According to Greenwood (1989), the balance between experimental controls and open-world elements in an experimental simulation could help restore confidence in the relevance of social psychology to life outside highly controlled experimental conditions. The balance between experimental controls and less controlled conditions is also consistent with the post-positivist claim that psychological phenomena can never be objectively separated from social contexts, as outlined by Burbules and Linn (1991). Several elements reflecting social context can be included within an experimental simulation as a whole. This can lead to a range of field experiment designs, depending on where the simulation is situated.

8.5.2 Implementation. Coherent links to actual practical contexts were particularly important for Study Three research into visual representations of organisational documents. Stoll and Bengez (2015) highlighted the challenge of representing detailed lengthy documents in a unitary visual representation. Apparently a range of attempts have been made to represent cyber security, epidemic and antiterrorism policy in unitary visual summaries. However, Stoll and Bengez (2015) found that the visual summaries of these policies were largely ineffective because to date, they have not provided an information synthesis which supports actual policy amendments and other relevant action. It seems that the visual displays in question did not form a useful part of users' everyday working lives. The policy level of these complex areas worked slightly differently from a strategic program of emergency management interventions. However, the conclusion from Stoll and Bengez (2015) remained highly relevant to the current thesis, and to the guiding concept of ecological validity. It was important to assess how external mental short-cuts pragmatically supported useful action in actual workplaces, rather than focusing on purely internal cognitions or abstract aesthetic ideals.

Without using approaches such as experimental simulations, the design and assessment of visual representations may have been irrelevant to users' practical interests. Instead, Study Three displayed a sequence of information to emergency managers in their actual work environments. To avoid excluding salient elements of these environments, an online interface was used to record participants' responses to the information displays in situ. Chapter 9 outlines this experimental simulation protocol in detail, including the randomisation of each participant into groups responding to either a VMEP or table-based display.

8.5.3 Data analysis. As also detailed by Chapter 9, participants' qualitative responses to the information displays were rated by academic and practitioner experts who had been recognised for their work in the community resilience domain. These experts were asked to rate participant responses in terms of both decision accuracy and situational awareness, using the six point Likert scales running from zero to five shown in Appendix L.

According to Shrout and Fleiss (1979), intraclass correlation reflects the degree that two independent raters agree about the application of each scoring category to the same set of data. All rating data was tested for inter-rater reliability using intraclass correlation standards outlined by Shrout and Fleiss (1979) and Donner and Koval (1980). The results of these tests are outlined in Chapter 9.

Ratings found to be reliable were then subjected to statistical tests for differences between the two conditions, using an analysis of variance. According to Iversen and Norpoth (1987), this involves testing whether differences between variable data generated by one participant group and data generated by another group exceed differences in the data generated within each group. In terms of interpretation, this means that differences between groups can be attributed to something other than non-systematic variance within the data set. For Study Three, the analysis of variance tested whether differences in expert ratings reflected differences in the information display formats provided to each group of participants. That is, rather than a continuation of other variance, such as differences between the characteristics of individual participants within each group. Further details and the results of these analyses are also provided in Chapter 9.

8.6 Conclusion

Study Three focused on the usefulness of a VMEP logic model being used to represent key performance indicators and surrounding assumptions concerning community resilience interventions for the Wellington region. The need for this analysis was founded on an extension of Frege's (1884, 1980) theory of number, concerning the importance of the framework in which a key performance indicator is embedded. Assumptions which were just as intrinsic to the Study Three research design were founded on a much more recent theoretical approach, to macrocognition, called distributed situation awareness. This interpretation of situation awareness precedents highlighted how certain displays can generate diverse interpretations within a collaborating group, which help to improve a range of demanding emergency management decisions. It followed that key performance indicator data about complex emergency management scenarios depended on being embedded with a framework which could usefully represent the complexity of those scenarios - without requiring the same interpretation by every single member of a collaborating group.

Study One and Study Two focused on the specific case of the Wellington ICoE:CR. Study Three was based on a post-positivist epistemology, in order to pilot an incrementally more generalizable analysis of documents being used as heuristic components within this centre of emergency management research and practice. A set of epistemological knowledge rules from psychological post-positivism formed a theoretical foundation which supported the production of generalizable findings without attempting to eliminate relatively uncontrolled experimental conditions. An experimental simulation was designed to fit this particular epistemology. This design permitted experimental controls for several dynamics of interest, while preserving important features of emergency managers' day-to-day working lives. It seemed that the ecological validity of Study Three findings would be reinforced as a result, towards a moderate extent of context-sensitive generalisation.

Chapter 9 outlines the full experimental simulation used for Study Three. This chapter specifies how Study Three constituted small-scale pilot research, involving a limited number of participants. The pilot research aimed to examine whether an experimental design could differentiate the influence of boundary objects on macrocognitive performance, in the context of strategic emergency management across a geographic region of New Zealand. Research findings are summarised and a number of largely methodological implications outlined. These implications include potentials for further research, to further improve understandings of how emergency managers respond to information concerning longer-term, strategic implications.

9. Study Three: Assessing Displays for Supporting Strategic Emergency Management

Huggins, T.J., Hill, S.R., Peace, R., & Johnston, D.M. (2015). Assessing displays for supporting strategic emergency management. *Disaster Prevention and Management, 24,* 635-650. doi: 10.1108/DPM-05-2015-0100

Abstract

Purpose: Emergency management groups aiming to address community resilience work with complex systems which consist of multiple interacting dynamics. In a practical sense, this pilot research focused on helping ensure that information is displayed in a way which supports strategic performance, to address longer-term challenges faced by these groups[13].

Method: Ten professional emergency managers completed an online simulation of complex, community resilience related tasks faced in their normal working lives. They responded to either table- or diagram–based information about a relevant emergency management strategy. Responses were rated by academic and practitioner experts using 0 to 5 point Likert scales.

Findings: Analyses of the expert ratings found that certain components of macrocognitive performance reached large degrees of inter-rater reliability ($\rho = .76$, $p = .003$; $\rho = .58$, $p = .03$; $\rho = .53$, $p = .05$). Current situation awareness increased by an average of 29% in the diagram condition. Prospective amendment quality also increased, by an average of 38%. A small sample size meant that these increases are difficult to generalise.

[13] Edited from original sentence for consistency as part of overall thesis.

Research Implications: Future extensions of this pilot research could use larger samples under more generic simulation conditions, to rigorously test the claim that certain displays help improve strategic emergency management planning. It is recommended that further research continues to focus on current and prospective situational awareness, as measures of strategic emergency management performance which can be reliably expert rated.

Originality: This research provides novel methodological considerations for informing a more strategic approach to emergency management, with a focus on longer term implications.

9.1 Introduction

Many humans are living in a world facing the unprecedented challenges of accelerating climate change (Intergovernmental Panel on Climate Change, 2014). This is also a world marked by ongoing natural hazard impacts. Despite substantial efforts led by the United Nations International Strategy for Disaster Risk Reduction, financial losses from natural hazard events in 2013 (140,000 million USD) and 2014 (110,000 million USD) have been roughly equivalent to average losses over the last 30 years (130,000 million USD, inflation adjusted) (MunichRE, 2014). Much of the planet is also affected by complex environmental degradation, implicated in the extinction of 52 percent of the world's species between 1970 and 2014 (World Wildlife Foundation, 2014). These phenomena have been observed from within what Fiksel (2006) and Patterson, Miller, Roth, and Woods (2010) described as increasingly complex and interdependent human systems. Cognitive adaptations for working together and resolving longer term issues within the complex domains of climate change, natural hazard impacts, environmental degradation, and human societies have never been so necessary.

Emergency management organisations operate at the nexus of many of these contemporary challenges and according to (Gunderson, 2010), are tasked with dealing with a range of complex human-environment interactions. Emergency managers facing these challenges need to be supported with information displays which they can use in their normal working lives. The current pilot research assumed that particular information displays can improve cognitive responses to the long-term, complex challenges faced by emergency managers. Pilot research was used to help determine whether experimental methods can be used to assess the influence of richly visual displays on responses to strategic, longer-term emergency management issues.

Diehl and Sterman (1995), Kessell and Tversky (2009), Taleb (2010), and Huggins and Jones (2012) highlighted how habitually linear, sequential understandings can limit human interactions amongst a contemporary range of complex interdependencies. Needs for narrative, story-telling coherence (see Klein, 2003) may drive these tendencies to use linear, rather than more holistic or systematic, concepts in developed Western cultural contexts. Schraagen et al. (2008) proposed a solution. They defined *macrocognition* in terms of adapting overly linear thinking to work with non-linear complexity. According to Cooke et al. (2013), macrocognition concerns *cognitive adaptations* within groups, to improve the way they work with many kinds of complex system. Note that for the study of organisations a *complex system* is assumed to:

1. …consist of a large number of elements.

2. These elements interact dynamically.

3. These interactions are rich; any element in the system can influence or be influenced by any other.

4. Interactions are nonlinear.

5. Interactions are typically short range.

6. There are positive and negative feedback loops of interactions.

7. …are open systems.

8. …operate under conditions far from equilibrium

(Maguire, 2011, p. 82)

As outlined by Hoffman (2010), the cognitive adaptations constituting macrocognition can include many changes to thinking within groups working in complex domains. These adaptations are considered positive, rather than negative or counter-productive (Schraagen et al., 2008). Cognitive adaptations to complexity can include a range of processes, such as meta-cognition and group flow. However, contemporary macrocognitive research focuses on a range of other processes, linked to specific functions: deciding; sense-making; planning; adapting; detecting problems; and coordinating (Klein, 2010). Certain theoretical approaches to macrocognition focus on methods which can be used to analyse a range of macrocognitive functions.

9.1.1 Situation awareness. The current pilot research used a theoretical approach to macrocognition called *situation awareness* which can be broken down into awareness of: causal precedents, current comprehension and future projections concerning a complex situation (Endsley, 1988). According to Endsley (1988), these components of performance in complex scenarios can be influenced by many perceived environmental characteristics such as "colour, speed, size, location" (p. 97). Owen et al. (2013) helped highlight how these kinds of influences on situation awareness mark the importance of information displays for emergency management performance. They stated that *boundary objects* are technologies that are used to share information between diverse emergency management collaborators. It follows that many perceived environmental characteristics are mediated by boundary object representations, meaning that people see boundary object displays and not the actual environmental characteristic. Boundary objects can therefore enhance or impede situation awareness, representing impacts on the cognitive performance of emergency management groups.

Boundary objects are rarely provided in text only. Many include rich visual display elements such as colours, form and spatial distribution. The importance of rich visual displays has been reinforced by a critical review of associated research and theory by Tversky (2011), who concluded that such displays can improve thinking about demanding concepts and scenarios. Particular visual displays may also help people to engage with non-linear concepts, even if they would habitually think in terms of more linear, sequential representations. For example, Kessell and Tversky (2009) found that while 60 percent of their research participants tended to draw cyclical dynamics along a straight line, 80 percent of the same participants preferred a circular diagram of the same dynamics.

Boundary objects are very similar to the computational media considered in the distributed cognition approach to macrocognition. However, as stated by Cooke and Gorman (2010), computational media are typically assumed to be interpreted in exactly the same way by all potential collaborators. For example, a shallow reef on the computational medium of a naval map is a shallow reef. Any different interpretation of this computational medium is effectively a misinterpretation which could have dire consequences. In an emergency management context, there are many boundary objects which are not uniformly interpreted by all collaborators (Owen et al., 2013).

According to Owen et al. (2013), information is not interpreted or used in the same way by all parties to emergency management. Many hazards communicated as part of emergency management information are interpreted in different ways, by different collaborators, for different purposes. For example, geologists may decide that a map showing sandy soils beneath a coastal community illustrates a substantial earthquake risk. The same map of sandy soils can illustrate the ideal conditions for beach-front development, as a primary concern for property developers. Their local government representatives may also agree with this interpretation. Such diverse interpretations extend to the social and economic data informing emergency management decisions, as outlined in the Sendai Framework for Disaster Risk Reduction (UNISDR, 2015). Displays which communicate this more abstract information can be interpreted even more disparately amongst diverse interests. The potentially diverse interpretations of boundary objects in emergency management led Owen et al. (2013) to associate boundary objects with a particular view of situational awareness: *distributed situation awareness.* According to Stanton et al. (2006) this view acknowledges how different situational elements are interpreted in different ways, for different purposes. Situational elements also need to be interpreted over different timeframes, as detailed below.

9.1.2 Strategic versus Tactical Timeframes. Many emergency managers are tasked with dealing with the longer term consequences of climate change, natural hazard impacts, environmental degradation and/or rapid urban development. However, macrocognitive methods for analysing the role of emergency management displays have mostly been developed with short-term, tactical implications in mind. This creates a divide between the demands of making longer-term strategic decisions and the short-term focus of extant cognitive research. Examples of a tactical focus in emergency management research include analyses of: critical fire-fighting decisions, by Klein, Calderwood and Clinton-Cirocco (2010); displays for supporting situation awareness during emergency response, by Prasanna (2010); and situation awareness and decision making during emergency response training, by Sinclair, Doyle, Johnston and Paton (2012a). As exceptions, Bruneau et al. (2003) and McDaniels, Chang, Colec, Mikawozc and Longstaff (2008) have outlined the need for decision support tools which help address much longer term aspects of emergency management such as community resilience in the face of ongoing earthquake risk.

9.1.3 Current Hypotheses. The current pilot primarily aimed to examine whether an experimental design could detect the influence of a boundary object on macrocognitive performance, in the context of strategic emergency management across a geographic region of New Zealand[14]. Criteria from the Naval Sea Systems Command (2005) performance testing battery were tested for inter-rater reliability in this markedly strategic domain. These criteria had been used to assess decisions with grave tactical implications during military conflicts, where the quality of decisions was paramount. With reference to Owen et al. (2013) and Bechky (2003), the influence of boundary objects may be so profound that they affect decisions with tactical and strategic implications alike. Reflecting a distributed situational awareness approach to longer-term emergency management challenges, Naval Sea Systems Command (2005) criteria were adapted to assess each response to a boundary object as a unique interpretation. There were no unitary model answers. It was hypothesized that responses to strategically-focused boundary objects would nonetheless be reliably rated by emergency management experts using this approach.

[14] Edited from original sentence for consistency as part of overall thesis.

As part of the primary research aim, the current pilot attempted to test whether an augmented boundary object could support improvements in strategic macrocognitive performance amongst emergency managers[15]. As outlined earlier, highly sequentially linear, text-based displays may do little to support cognitive performance when working with complex systems. It was therefore hypothesized that an augmented, diagram-based boundary object would support a higher level of macrocognitive performance than the status quo, table-based format. This performance would only be assessed using situation awareness measures found to be reliable while testing the first hypothesis.

9.2 Method

Kozlowski and Chao (2012) outlined the value of cognitive experimentation for macrocognition research. They stated that experiments can take a more open approach to information seeking while controlling other, experimentally structured, conditions. For the current pilot research, the phrase *open information seeking* refers to allowing participants to seek information from the same sources that they would in the field. According to Kozlowski and Chao (2012), allowing participants to seek a range of relevant information incorporates stimuli more closely representing the complex demands which those participants would ordinarily have to deal with.

Experimental simulations provide methods for incorporating open information seeking. According to Greenwood (1989), these research designs allow social psychology to respond to criticisms about the artificiality of highly controlled social psychological experiments and findings. Experimental simulation designs represent a balance of

[15] Edited from original sentence for consistency as part of overall thesis.

structured experimental controls alongside conditions which are less restricted. The second half of this balance is achieved by including elements which are not usually found in laboratory research but which help create immersive realism relevant to specific real-world tasks (Greenwood, 1989). For example, an experimental study of email processing in an office environment would include rather than eliminate conversations and other distractions in the background.

This balance of field and laboratory conditions is how experimental simulations meet the need for open information seeking in macrocognitive research. Unrestricted access to the internet and other information sources can form an important part of experimental simulation realism, especially where these activities are an important aspect of real-life conditions. Relevant research precedents include a range of decision support tool evaluations. According to Adleman (1991) decision support tools which are used to display selected information and recommend relevant courses of action in complex scenarios have often been tested in situ. For example, Eguchi et al. (1997) tested a decision support tool with agencies who were responding to the Northridge earthquake of 1994.

The current pilot research is focused on information displays, rather than systems which produce the information displayed. Detailed piloting is an indispensable part of developing robust experimental simulations to assess these displays. It is essential to ensure that these experiments simulate the important conditions and demands that would be faced by participants dealing with real world equivalents. This match between experiment and normal working life helps to ensure *ecological validity*: congruence between experimental conditions and the contexts to which cognitive researchers aim to generalize their analyses (Chaytor & Schmitter-Edgecombe, 2003). This congruence is most likely to be achieved when participant representatives are given the opportunity to comment on successive versions of an experimental protocol. In this way, the ecological validity of an overall design and specific improvements are both addressed before the actual experimental protocol is deployed.

The current pilot research assumes that experimental simulations can stimulate and observe macrocognition in response to realistic conditions. It is also assumed that realistic conditions include boundary objects being used to communicate and adapt actual emergency management strategies. The current experimental simulation design is outlined below, with reference to research precedents which have focused on information systems and planning scenarios within complex domains. Participants, materials, procedures and measures are also outlined.

9.2.1 Research design. There is a clear need to improve strategic responses to many contemporary complexities, as outlined in the introduction to the current paper. However, longer-term, strategic macrocognition can start to look like a misnomer. It can be much more straightforward to conduct experimental simulations of brief, tactical timeframes, rather than simulating part of an extended series of strategic implications. Strategic equivalents would typically involve more people interacting over longer periods of time, creating extremely complex and resource intensive experiments. Perhaps this is why all studies that Klein (2010) used to illustrate macrocognitive metrics were focused on short-term, tactical conditions. Likewise, the Naval Sea Systems Command (2005) program appears to be focused on tactical naval engagements – rather than the longer term intricacies of an entire military deployment. Furthermore, as outlined by Schraagen et al. (2008), contemporary understandings of macrocognitive processes and functions originated in the study of time-pressured individuals, in highly tactical scenarios.

The tactical focus of prior research precedents poses methodological and theoretical challenges to those wanting to conduct strategically-focused macrocognition research. However, important lessons from tactical research than can still be applied to strategic concerns. Consider three of the macrocognitive functions defined by Klein et al. (2010):

> *Planning*: responding to shifting objectives, opportunities, obstacles, occurrences, or trends, and adapting plans that do not adequately address them.
>
> *Detecting*: detecting events that have changed a situation in unexpected ways and which may now merit new sense making, planning and execution.
>
> *Sensemaking:* collating, cross-referencing, and structuring information towards highlighting new explanations.

These macrocognitive functions can all be analysed within *PlanEx* scenarios which, according to Klein (2010), have become an established approach to macrocognitive research. According to Klein (2010), PlanEx scenarios require "the participant to prepare a plan … .measures are the quality of the plan, the ability of the participant to see the 'sweet spot' for leveraging resources, and so on" (p. 50). These scenarios aim to stimulate planning and re-planning behaviour as a response to problems with an original plan (Klein, 2010). The scenarios can fit within an efficient experimental simulation of strategic issues for the following reasons. First, individual contributions to planning or re-planning in the real world are often time-limited due to other workplace demands and document trajectories. It is therefore possible to simulate a re-planning function without extending the timeframe of a strategic scenario *ad infinitum*. Second, an experimental simulation of strategic contributions can continue to focus on macrocognition amongst embedded individuals, without being limited to the purely tactical implications of participants' responses.

9.2.2 Participants. The particularly complex and long term, community resilience approach is commonly concerned with capacities to resist, recover from, adapt to, and mitigate disaster impacts (see Huggins et al. 2015a). All six emergency management offices in New Zealand with a named community resilience strategy were therefore invited to participate. These emergency management offices had a total of 20 community resilience personnel and managers. Four of these offices were contacted through a site visit to their headquarters in the months leading up to formal recruitment. One office was contacted by video conference and another by email. Section managers from the offices helped to improve a dummy version of the experimental simulation outlined below. They provided feedback on the pilot research procedure without viewing the actual experimental conditions, to ensure that data collection and analysis would be relevant to their own interests and the working lives of their personnel. Several changes were made to the experimental procedure as a result.

9.2.3 Materials. As outlined by Kapucu (2012), the complexity of many emergency management scenarios creates challenges that cannot be met by agencies and personnel acting in isolation. This is particularly true for emergency management approaches to community resilience which, according to Cutter et al. (2010), involve a combination of social, economic, institutional, infrastructural, and environmental considerations. Many relevant dynamics need to be measured and then acted upon (Cutter et al., 2010), requiring collaborations both within and between collaborating groups. Actions within these collaborations are often reported in terms of key performance indicators, which help gauge an organisation's progress towards key strategic goals.

For the current pilot research, digital displays showing key performance indicators as part of a regional community resilience strategy were the boundary objects of interest. One of these displays was a diagram used to improve monitoring, evaluation and research surrounding the regional community resilience strategy, as shown in figure 16. This diagram was constructed using the visual monitoring and evaluation (VMEP) process (Duignan, 2012b). For more information about this collaborative process see Huggins, Peace, Hill, Johnston, and Cuevas (2015b). The current pilot research compared this rich visual diagram with a text-based table of key performance indicators based on the table being used by the collaborating practitioners, shown in figure 16.

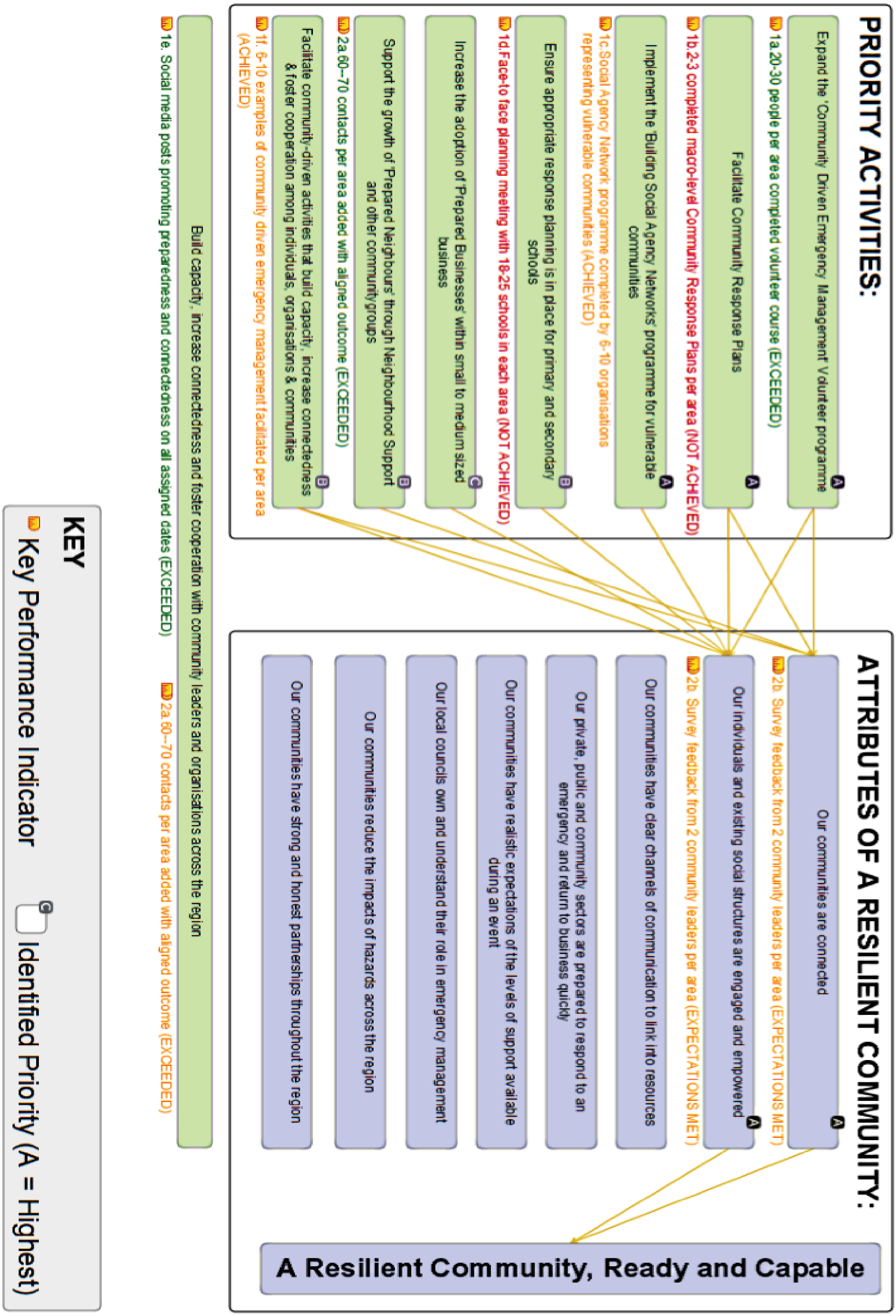

Figure 16. Rich visual, diagram display of key performance indicators

1. Increase resilience across the region		
a.People completed volunteer course	Achieved: 20/area	Exceeded: 30/area
b.Completed macro-level community response plans	Achieved: 2/area	Exceeded: 3/area
c. Social Agency Network programme completed by organisations representing vulnerable communities	Achieved: 6	Exceeded: 10
d. Face-to face planning meetings with schools	Achieved: 18/area	Exceeded: 25/area
e. Social media posts promoting preparedness and connectedness	Achieved: All assigned dates	Exceeded: Additional dates
f. Examples of community driven emergency management facilitated per area	Achieved: 6/area	Exceeded: 10/area

2. Build capacity, increase connectedness and foster cooperation with community leaders and organisations across the region		
a.Contacts added with aligned outcome	Achieved: 60/area	Exceeded: 70/area
b.Interviews with 2 community leaders per area	Achieved: Expectations met	Exceeded: Expectations exceeded

Figure 17. Status quo, table display of key performance indicators

9.2.4 Procedure. All participants were asked to access the online simulation from their workplace where possible, to simulate working conditions. Upon accessing the simulation, participants were shown a brief summary of the pilot research. The summary did not outline visual display benefits, to avoid influencing responses. Participants were then asked to proceed through the following screens:

1. Introduction to the scenario, being an email request for advice about key performance indicator results;
2. A basic introduction to either the diagram or text-based table format, as randomly assigned to each participant;
3. General advice for interpreting the key performance indicator format;
4. An introduction to the actual program key performance indicators, without performance results;
5. The same display, with the addition of actual program results obtained over a six month period, as shown in figures 19 and 20.

Each screen was accompanied by a relatively informal explanation of each image, simulating the extended email request for advice. Participants were then asked to compose a reply to their colleague, as prompted by the following request: “This is what the [diagram/table] looks like with group data from the last six months. Please tell me what you think is going wrong.” The prompts for responses were:

1. “Please start a brief email to your colleague about what you think is going wrong.”
2. “Continue the email to your colleague, detailing anything else you want to know. Include details of how you could get this information.”

3. "Assume that you cannot get more information right now. Acting in your current emergency management role, what would you do about what you have noticed?"

Participants were asked to provide their responses in scrolling text entry boxes which did not have a word limit. Either figure 16 or figure 17 remained on screen below, while participants entered their responses. At the conclusion of the simulation protocol, participants were asked to identify anything about the key performance indicator display that helped them produce their responses. They were then asked to provide demographic details concerning their age and years of relevant experience. These details represented potential moderating influences, which we controlled[16] for by random assignment to experimental conditions. To complete the simulation protocol, all participants then proceeded to a screen which thanked them for their time before giving them the opportunity to enter a draw for a USD 100 Amazon gift voucher.

9.2.5 Performance measures. The current experimental simulation measured differences in macrocognitive performance in response to figure 16 and figure 17, within a PlanEx scenario. As outlined in the research design, the macrocognitive functions of interest were: detecting problems, sensemaking and re-planning. Each of these functions were respectively measured using situation awareness components based on the Naval Sea Systems Command (2005) performance testing battery, as follows:

-*Antecedent situation awareness*: Detecting problems with the regional community resilience strategy shown by the key performance indicator display.

-*Current situation awareness*: Sensemaking about the way those problems affect the regional community resilience strategy.

[16] Edited from original text for consistency as part of overall thesis.

-*Prospective situation awareness*: Re-Planning the regional community resilience strategy to reflect a renewed understanding

Two experts who had been involved in piloting the experimental simulation agreed to complete expert rating scales for each of the simulation responses. One was an internationally renowned expert in community disaster resilience practice, who had recently delivered an online course on the topic to over 1,500 students from a wide variety of international backgrounds. The other expert had an extensive academic background in measuring adaptive capacity components of community resilience. This expert had recently been appointed to head a national science platform for promoting social science research into natural hazards. Both experts were given Likert scales from zero to five. Zero indicated “not at all” or “nil” and five indicated “perfectly” or “complete”. These scales were used to rate the situational awareness of participant responses in terms of:

1. Participant’s awareness of what has happened with the program. (Antecedent)
2. Participant’s awareness of the implications of what has happened. (Current)
3. Have they translated awareness into a feasible course of action?
    a. Seeking further information? (Prospective information seeking)
    b. Amending the original strategy and/or indicator framework? (Prospective re-planning)

9.3 Results

Despite a generally high level of engagement with section managers and several reminders, only 10 emergency managers completed the experimental simulation. This represented a response rate of 50 percent. List-wise missing value analysis was used to determine the most probable age of one participant and years of key performance indicator experience for another participant. Using these figures, participants appeared to range from 34 to 57 years old (*SD* = 6.99). They appeared to have between 0 and 10 years of experience using key performance indicators (*SD* = 3.91)[17]. Outcomes diagram experience ranged from 0 to .5 years (*SD* = .16). The emergency management experience of participants is outlined in detail further below.

All simulation responses were analysed by experts, as outlined in 9.2. Analyses of expert ratings found that one component of situation awareness and two sub-components reached an acceptable level of inter-rater reliability. Ratings for current situation awareness had a large intraclass correlation (ρ = .76, *p* = .003), using standards established by Shrout and Fleiss (1979) and Donner and Koval (1980). Ratings of prospective information seeking quality (ρ = .58, *p* = *.03*) and prospective amendment quality (ρ = .53, *p* = .05) also had large intraclass correlations. Expert-rated antecedent situation awareness did not achieve inter-rater reliability (*rho* = .47, *ns*).

Table 7 shows mean expert-ratings for each of the reliable situation awareness variables: current situation awareness (CSA); prospective information seeking quality (PISQ); and prospective amendment quality (PAQ). There was a substantial difference between current situation awareness and prospective amendment quality between the two conditions. However, these differences, of 29 percent (95% CI 2.74, -.83) and 38 percent

[17] This sentence edited from the original paper, for coherence as part of the overall thesis.

(95% CI 3.20, -.95), were not statistically significant. Participants' comments on the display formats were not revealed to expert raters and did not form part of their ratings. The original comment from each set of responses is displayed in the last column of table 7.

Table 7
Expert Ratings and Participant Comments on Display Format by Experimental Response

Condition	CSA	PISQ	PAQ	Un-Rated Comment on Format
Diagram	2.5	0	2	Nil
Diagram	2.5	2.5	3.5	"The red colour stood out :-)"
Diagram	3	3.5	4	"Yes, understanding the linkages helps"
Diagram	3.5	.5	3	"?"
Diagram	0	.5	.5	Nil
Diagram	2	3	3.5	"I think this format is clear and linked. A PS point - I would also ask if the priority order was correct. Maybe increasing the priority of Facilitating Community Driven Activities would then create the right environment to move onto Community Response Plans."
Table	2	.5	2.5	"Quite liked the fact that if things were met or exceeded they got highlighted; this made it quite easy to read quickly what was working and what wasn't, and where more or different effort may need to be made."
Table	0	0	0	"No"
Table	2	3.5	3	"I could tell where a key performance indicator had not been meet, but not by what margin, and could also not see how close to exceeding they were - eg, did they visit 17 schools, or get 50 through a volunteer course?"
Table	3	3	2.5	"Highlighted areas help read the key performance indicator format"

	CSA *(Cont.)*	PISQ *(Cont.)*	PAQ *(Cont.)*
Diagram Mean	2.25	1.66	2.75
Table Mean	1.75	1.75	2

An analysis of variance between groups suggested that age and key performance indicator experience had been controlled for by random assignment ($F < 1$). Outcome diagram experience amounted to one participant with six months experience, making this moderator negligible. Random assignment did not appear to have controlled for emergency management experience ($F(1, 8) = 1.08$, *ns*). An average 7.08 years of experience in the diagram group was almost double the average 3.88 years of experience amongst participants responding to the table display. This factor appeared to have a generally negative influence on implication awareness ($R^2 = .431$, *ns*) and strategic change quality ($R^2 = .278$, *ns*), which may have attenuated improvements due to display format. However, a small sample size meant multivariate analyses were not feasible. This meant the potentially moderating effect of emergency management experience and other demographic variables could not be accurately determined or statistically controlled.

9.4 Conclusion

Emergency management groups deal with complex interactions among many dynamic human and environmental systems. The current pilot research examined an assumption that certain information displays can improve strategic performance when dealing with related demands[18]. Ten professional emergency managers completed an online simulation of complex, strategic tasks faced in their normal working lives. They responded to either a table- or diagram-based set of information about contributions to a complex emergency management strategy. Responses were rated by emergency management experts using Likert scales from 0 to 5, reflecting components of situation awareness. Results from analyses of these ratings provide fair to tentative support for the two research hypotheses. These results have implications for rating the influence of information displays on strategic emergency management performance. There are certain potentials for further research in this area, as outlined below.

9.4.1 Rating Strategic Emergency Management Performance. Hypothesis one, that situation awareness ratings would achieve inter-rater reliability concerning a strategic scenario, was partially supported. This hypothesis was an important part of the current pilot research aim because the efficacy of strategic boundary objects are very difficult to test without robust rating scales. Three of four situation awareness components achieved inter-rater reliability, with large intraclass correlations from .76 (p = .003) to .58 (p = .03). Inter-rater reliability is not usually considered to be an integral hypothesis for experimental findings. However, it was important that the majority of items in the current set of macrocognitive performance measures were found to be reliable, despite the shift to a more strategic research context.

This finding is particularly important for the field of emergency management, where research has often examined cognitive responses to tactical conditions, involving much shorter-term implications. The current finding, that established tactical metrics can be used to gauge a more strategic approach to macrocognition, is therefore more

[18] Edited from original sentence for consistency as part of overall thesis.

important than it appears at face value. This finding provides an avenue to interrogate and start improving a self-perpetuating focus on researching short-term, rather than longer-term emergency management objectives.

9.4.2 Rich Visual Displays May Improve Strategic Emergency Management. Hypothesis two, that a diagram-based boundary object could support a higher level of macrocognitive performance than the status quo table format, was only very tentatively supported by the current results. A substantial improvement (29%) in current situation awareness was observed amongst responses to the diagram condition. An even more substantial improvement (38%) in prospective amendment quality was observed. Even amongst such a small sample, these differences tentatively suggest that the diagram provided more macrocognitive support than the table equivalent.

Participants' comments about the displays themselves suggest that the diagram was more useful due to additional colours, graphic linkages between components, and markers for the priority level of many components. These are rich visual elements which, according to research by Kessell and Tversky (2009) and Huggins and Jones (2012), help avoid limitations of a more sequentially linear, text-based display. As noted by two participants, the table display also included a limited number of rich visual elements. Two participants commented on the ease of interpreting highlighted sections of the table. One participant's comment, that these made the table "easy to read quickly," appears related to the speed rather than the quality of responses. This particular response received a fairly mediocre set of expert ratings. It is nonetheless possible that differences in macrocognitive performance would be more marked between the current diagram and a fully text-based equivalent.

9.4.3 Limitations and Considerations for Further Research. A highly specific population of interest and a mediocre response rate appear to have limited the inferential power of the current results. A very small sample of participants meant that observed differences between responses to the diagram and table conditions became equivocal at a 95 percent confidence level. Likewise, the notable effect of emergency management experience was not able to be specified or controlled for. The current research therefore remains a pilot for further research into how boundary objects can support strategic emergency management.

Future research in this area will benefit from larger samples. These samples can be achieved through using more generic simulation conditions, which apply to much larger groups of potential participants. Repeated measures amongst the same sample participants can be also used to improve on the size of a data sample, even amongst highly specific groups. Likewise, a higher response rate is likely to be achieved by contacting all participating groups in person, to establish a higher level of trust and interest in the research. These improvements are likely to support more robust statistical analyses of potential changes in strategic performance due to different display formats. Considering inter-rater reliabilities achieved in the current pilot research, it is recommended that further research into strategic macrocognition continues to focus on expert-rated current situation awareness, prospective information seeking quality and prospective amendment quality.

10. Study Three Exposition

Study Three focused on analytically addressing an assumption made throughout this thesis: that rich visual displays improve strategic thinking about complex scenarios. In theoretical terms, visual logic models were assumed to support a higher level of ecological rationality than decisions made using status quo information displays. In the emergency management domain of interest to the current thesis, this would be characterised by decisions that are more likely to improve community resilience characteristics. To address this assumption, the main research question asked was: How can experimental methods help define the advantages of using a visual logic model for addressing strategic aspects of a complex emergency management scenario? An experimental simulation was designed in order to test two hypotheses related to this question. Firstly, Study Three tested a hypothesis that situation awareness variables could be reliably rated under strategic conditions, concerning the ongoing development of a regionals strategy for community disaster resilience. This hypothesis was tested by assessing the inter-rater reliability of expert rated situation awareness variables. Secondly, Study Three tested a hypothesis that a rich visual display would improve reliable ratings of these variables, compared to a status quo display of comparable information. This hypothesis was tested by analysing differences in a reliable sub-set of expert ratings, to see how responses to a rich visual diagram and a relatively plain, text-based equivalent varied.

The following chapter provides a summary of results from Study Three, in 10.1. 10.2 proceeds to outline how these results were in partial support of the hypotheses outlined above. Several limitations are noted in 10.3 before 10.4 outlines how these limitations could be avoided in future research. The chapter concludes by outlining how the sum of Study Three findings, limitations and methodological implications contribute as part of the overall thesis.

10.1 Summary of Results

The responses of ten emergency managers, to either a VMEP or table-based key performance indicator display, were rated by both an academic and a practitioner expert. Three of four expert rating variables had a large intraclass correlations, indicating a consensus between experts: current situation awareness ($\rho = .76$, $p = .003$); prospective information seeking quality ($\rho = .58$, $p = .03$), and; prospective amendment quality ($\rho = .53$, $p = .05$).

Responses to the VMEP display achieved higher levels of expert rated current situation awareness, with an average rating of 2.25 out of 5 ($SD = 1.35$), compared to responses to the table-based display ($m = 1.75$, $SD = 1.39$). Responses to the VMEP display also achieved higher levels of expert rated prospective amendment quality ($m = 2.75$, $SD = 1.10$), compared to responses to the table-based display ($m = 2.00$, $SD = 1.35$). As outlined in the previous chapter, these differences between conditions were not statistically significant.

10.2 Further Discussion

Although each of the study's research hypotheses was only partially supported, results concerning the first hypothesis, that participants' responses would be reliably rated by emergency management experts, were stronger. This hypothesis concerned the reliability of research methods, rather than surrounding assumptions about rich visual displays. In sum, Study Three was documented as a piece of pilot research. An executive summary of this commentary was fairly well received, attracting over 70 views on academia.edu within the first two weeks of publication. This was a notable achievement, considering just how specific the Study Three findings had become.

Study Three nonetheless had a number of major limitations overall. As outlined in 10.3 below, these are also limitations on the contribution made by Study Three to the overall aim of this thesis: to develop a more specific body of evidence to inform the use of distinctly visual, diagram-based information displays, for developing a suite of strategic community resilience interventions. The main implications of Study Three are therefore methodological in nature, as also outlined in the following section.

10.3 Limitations

Study Three was marked by two major limitations. The first concerned how the research design was not entirely consistent with the concept of ecological rationality. This limitation is outlined in 10.3.1 below. The second limitation concerns a limited sample size and the way this affected statistical analysis. This limitation is outlined in 10.3.2.

10.3.1 Operationalising ecological rationality. Study Three was limited by a lack of consistency surrounding the definition of ecological rationality. A consistent definition of ecological rationality had been used to design and interpret Studies One and Two. However, the interpretation of ecological rationality used to design Study Three was not as straight-forward or coherent. This interpretation was used to compare the quality of decisions made using one simplification of the WREMO (2012) strategy with decisions made using another simplification of the strategy. However, neither of these heuristic components clearly represented a component of non-heuristic processes outlined in Chapter 1 of this thesis.

Todd and Gigerenzer (2003) stated that ecological rationality occurs when simplified heuristic approaches lead to decisions which are more useful than decisions made using un-simplified, algorithmic understandings of the same information context. However Study Three did not make any explicit comparison between processes incorporating each of the display stimuli. It was assumed that decisions made using the richer, VMEP display would be associated with a faster and more frugal decision making process compared with decisions made using the status quo, indicator table. This assumption was made using findings from Study Two but was not actually tested by the Study Two protocol. This assumption marks one oversight in the current, experimental approach to the thesis topic.

10.3.1 Sample size. The failure to produce a more decisive test of the second hypothesis was largely due to a mediocre response rate from members of a very small target population. This small target population of interest comprised 20 emergency managers working in a named community resilience program at the time of sampling. There were both logistical and technical difficulties with promoting a better response rate amongst this population. Logistically, I was located outside of New Zealand for the majority of the study timeframe and only spent one month in New Zealand while making specific preparations. This meant that, although a substantial effort was made to visit all applicable emergency management offices, there was not enough time to schedule face-to-face meetings with all potential participants. Furthermore, at least two participants did not complete the online protocol due to technical difficulties. Their emergency management office network did not permit full access to the experimental protocol website. This is another issue that could have been resolved through more time engaging with participating organisations.

The subsequent, and very small, sample affected both sets of statistical analysis, leading to analyses of differences in situation awareness which were generally inconclusive. This situation would have normally been avoided through a test for statistical power, to determine a minimum number of participants before an experiment is carried out. However, the lack of directly applicable prior research meant there was no expected difference in means for Study Three. This figure was an essential requirement for the statistical power test, meaning that it could not be carried out before the research was completed.

Subsequent Study Three results included responses from ten participants, four of whom were in one condition, and six in the other. This very small statistical sample (N = 4) helped explain why the experimental results were so inconclusive, even though participants in the diagram condition achieved much higher levels of current situation awareness and prospective amendment quality. A retrospective power test using the Statistical Solutions (2015) tool recommended a minimum sample of N = 40, using the statistical power of d = .80. This calculation was based on notable increases in the current situation awareness component observed during Study Three. The same test recommended a minimum sample of N = 21 based on notable increases in another component of situation awareness, prospective amendment quality. These retrospective power analyses suggested that even the entire sample population, of 20 emergency managers, was insufficient for a generalizable statistical analysis of differences in mean expert ratings. Even in the unlikely event of a 100 percent response rate, the population of interest appeared to have been too small for the Study Two research design.

The very small sample size also limited the importance of the current experimental results at face value. Such a small group of individual responses were not representative of all potential responses to the same experimental conditions, from all emergency managers working with relevant strategies. This severely limited the interpretation of results, towards helping meet real world challenges of community resilience complexity. In retrospect, it may have been better to provide a more generic scenario to a wider, international group of participants. Repeated measures could have also been used to produce a larger set of data from the same group of participants. Both of these improvements to data collection methods are elaborated as an implication of Study Three, in 10.4 below.

10.4 Conclusion

Study Three was an attempt to test a core assumption of this thesis, concerning the way that VMEP logic models function as part of ecological rationality. An experimental simulation was designed and piloted to test working strategic displays among New Zealand emergency managers who were conducting comparable community resilience programs. This had the potential to closely match experimental results with the everyday working experiences of emergency managers in New Zealand.

Some of the methodological approaches already tested in Study Three may help expand an apparent status quo concerning rapid, short-term scenarios, amongst a growing body of macrocognitive research. As outlined in 10.3, Study Three was severely limited by a very small statistical sample. Inter-rater reliability for two situation awareness measures applied to the Study Three strategic scenario nonetheless suggested that these existing constructs may suit research into tactical situation awareness and strategic, distributed situated awareness alike. As a set of pilot research, Study Three therefore highlights wider potentials for further research into how certain display formats may improve the speed, frugality and overall effectiveness of certain decisions in certain decision making contexts. These potentials are outlined alongside other contributions to the overall thesis below.

10.4.1 Relevance to the overall thesis. Despite being unable to determine a statistically significant ($p < .05$) relationship between display formats and expert rated situation awareness, Study Three managed to clarify a number of challenges for extending research. Identifying these challenges mark an, albeit indirect, contribution to the overall thesis aim: to develop a more specific body of evidence to inform the use of distinctly visual, diagram-based information displays, for developing a suite of strategic community resilience interventions.

One particular challenge was introduced in Chapters 8 and 9, concerning the timeframe for decisions made during macrocognitive research. As outlined in Study Three, decisions being made during macrocognitive research have typically focused on short-term implications –despite many longer-term complexities faced within contemporary human societies. This issue was addressed in Study Three by using experimental stimulus with an explicitly strategic and long-term, rather than tactical and short-term, focus.

Sets of situation awareness and decision accuracy variables were adapted from tactically focused Naval Sea Systems Command precedents and used to rate responses to the Study Three simulation. As outlined in the previous chapter, certain situation awareness variables were found to have acceptable levels of inter-rater reliability between expert raters. These results suggested that established situation awareness variables could be applied to a more strategic approach to macrocognitive decisions. Publishing Study Three results concerning the reliability of these established macrocognitive criteria in a longer-term scenario may help expand the almost exclusively tactical focus of macrocognitive research. Chapter 11 will further discuss how, despite limitations outlined in 10.3, the Study Three approach to macrocognition could support a longer-term, more collaborative approach to complex climate change, environmental degradation and related, disaster mitigation challenges.

Although they may appear relatively unimportant in isolation, results regarding the information seeking component of situation awareness resembled particular findings from Study Two. Observations during and following Study Two action research marked the absence of wider information seeking during the VMEP process. As outlined in 6.5, action research participants did not appear to value information about long-term objectives or unintended consequences. For Study Two, this led to conclusions concerning the need for an intelligence cycle of wider information seeking, in addition to VMEP processes.

During the Study Three experimental simulation, a VMEP diagram display was associated with notable improvements in current situation awareness and prospective amendment quality. However, there was no such difference in information seeking quality between the VMEP diagram and table-based display conditions. A lack of gains in information seeking quality suggests that, as observed in Study Two, the VMEP diagram did not promote wider intelligence gathering. This further highlighted how the intelligence cycle processes outlined by Krizan (1999), can be used to complement VMEP processes.

10.4.2 Implications for further research. As outlined in 10.3, Study Three used a set of data collection methods which resulted in a very small sample of statistical data. A more robust set of statistical data could be collected by providing a more generic scenario to a wider, international group of participants. This approach to data collection was applied to recent New Zealand -based research by Prasanna and Huggins (2016), into the uptake of emergency management software amongst 480 different emergency managers. A generic view of overarching issues resulted in a large data set suitable for structural equation modelling, even though participants had been using a diverse range of emergency management software which varied from workplace to workplace. Contact with survey participants was effectively achieved by Prasanna and Huggins (2016) through email intermediaries.

Studies One and Two illustrated alternatives for generating more substantial data sets while focusing on small, highly specific groups of participants. Study One used a group level analysis of opinion patterns, rather than taking a more individually based approach. A sampling population concourse was constructed from 653 different statements about monitoring and evaluating community resilience which had been documented in the ICoE:CR context. Study One used a roughly representative sample of 60 of these statements. At the time, there were little more than 10 active individuals at the core of this new centre. However, using statistical assumptions from Q-methodology, representatives of these individuals became the loci on which each of the 60 sampled statements varied. The philosophical and statistical assumptions which formed the background to this analysis are further outlined in Chapter One. They effectively led to a statistical sample of 60, rather than a sample of 10 individual loci.

A comparable approach was taken to Study Two. Statistical analysis for this study used a sample of excerpts taken from more than nine hours of interview data. Although there were only ten interview participants, the quantity of data combined with statistical assumptions from content analysis permitted a relatively robust statistical analysis. Several quantitative findings were produced, through both longitudinal and single time point approaches to several hundred pieces of interview data. Relevant statistical assumptions and background philosophical assumptions are outlined in Chapter 5.

In sum, although Study One and Study Two research contexts were highly specific and involved few participants, these characteristics of the research context did not limit the size of the statistical sample. One particular statistical assumption was shared by both of these studies: that communicative data represented substantial and systematic variations which could be analysed on numerical terms. For the current thesis, this means that the most valuable statistical insights were based on variations in data, rather than variations between individuals.

Study Three could have been re-designed to look at cognitive dynamics in a similar way, considering data samples of more than one *n* for each participant. This did not need to depend on the relatively novel statistical methods used in Study One and Study Two. Fairly standard, analyses of variance, statistical tests could be applied to samples of text, a series of stimuli, or to multiple responses to those stimuli. The latter type of sample may be particularly promising for macrocognitive research. Decades of single participant studies have produced rich statistical data sets by repeating experimental procedures several times with each individual (see for example, Morgan & Morgan, 2001). Scruggs and Mastropieri (2001) applied this kind of approach to longitudinal, single participant research. When using this type of data collection, each repeated measure adds to the statistical sample. These approaches to sampling do not need to be limited to single participant studies. They could be applied to greater numbers of participants, groups or other case configurations, for even richer sets of statistical data.

A wider discussion of potentials to overcome a status quo focus on rapid, tactically focused macrocognition is outlined in Chapter 11. This chapter builds a broad case by drawing on answers to the three principal research questions asked by this thesis. Practical and theoretical implications of answers to these questions are discussed. Certain strengths of the way this thesis has addressed the three main research questions are also outlined, alongside a number of overall limitations. Chapter 11 concludes the thesis with a commentary on potentials for further research, to help overcome many of the limitations outlined while capitalising on the current set of research findings.

11. Conclusion

This thesis aimed to develop a more specific body of evidence to inform the use of distinctly visual, diagram-based information displays, for developing a suite of strategic community resilience interventions. I began this thesis with an interest in how resilience at a community level had become an aspirational goal for a broad range of emergency management practice both in New Zealand and internationally. I specifically focused on understanding how information displays could help facilitate the development of a new research centre called the ICoE:CR, that aimed to bring researchers and practitioners together to improve a strategic program of community resilience interventions across the Wellington region of New Zealand. This program of interventions was called the WREMO (2012) Community Resilience Strategy. The ICoE:CR had the potential to use more technical, research-informed concepts of community resilience to improve this program, rather than relying on popular narratives concerning the ability of communities to simply bounce back after a disaster event.

As outlined in 1.1, an extended programme of research by Cutter et al. (2010) had demonstrated how community resilience is a characteristic of multiple and extended interactions between social, economic, institutional, infrastructural and ecological dynamics. According to Paton (2006), multiple community resilience dynamics also interact between multiple scales of society. Perhaps this is why a European commission review by Birkmann et al. (2012b) concluded that understandings of the multiple dynamics characterised by community resilience are informed by a broad range of academic disciplines. These multi-dimensional understandings of community resilience also reflect a characteristic of what program evaluation literature by Patton (2011) has described as co-evolutionary, complex adaptive systems.

The Initial Literature Review chapter outlined how my approach to the complexity of this research context was based extensively on theoretical materials, including literature from program evaluation, cognitive psychology, organisational psychology and pragmatic philosophy. This literature was used to explain how visual displays form part of a macrocognitive understanding of cognitively demanding scenarios. Macrocognition is an aspect of cognitive psychology concerning how human cognition can adapt to meet the challenges of complexity (Schraagen et al., 2008). Distributed cognition forms one approach to macrocognition. It highlights how collaborative approaches to facing these challenges can be facilitated by computational media that help individuals to think and function together as part of a group. It was assumed that visual information displays are one type of computational medium that facilitates distributed cognition as part of macrocognition.

This assumption was specifically motivated by a case study by Huggins and Jones (2012), of building a framework for planning, monitoring, and evaluating New Zealand's environmental conservation strategy. Like Thurston et al. (2003), Sehlke and Jacobsen (2005), Margoluis et al. (2009), and Stoll and Bengaz (2015), this case study concluded that information displays with a variety of visual cues in addition to text could help diverse collaborators develop a useful understanding of complex domains. However, Huggins and Jones (2012) extended this conclusion to suggest that visual logic models may form an important part of ecological rationality. Todd and Gigerenzer (2003) had previously defined ecological rationality as occurring when decisions made using abbreviated cognitive processes, or heuristics, outperform decisions made using less efficient, algorithmic approaches to the same incomplete or uncertain information context. For example, a baseball player is much more likely to catch a baseball by simply adjusting their running speed to reflect the ball’s developing trajectory, rather than trying to calculate exactly where the ball will land before they start running.

Huggins and Jones (2012) tentatively extended this original concept of ecological rationality to highlight how effective and efficient heuristic processes can incorporate components such as logic models, from outside the physical brain. As outlined in the Initial Literature Review chapter, this understanding of heuristic components is particularly applicable to working with complex adaptive systems that, according to Patton (2011), can only be understood in terms of incomplete and uncertain information. It follows that simplifications concerning complex adaptive systems are not only useful. They are also necessary, in the absence of more complete information.

Sections 11.1, 11.2 and 11.3 of the current chapter outline how three principal research questions, concerning how logic models form heuristic components in ecological rationality, were answered by Studies One, Two and Three of this thesis. The chapter then outlines implications of answers to these questions for practice and for surrounding theory. Practical implications, outlined in 11.4, are particularly relevant to the overall aim of this thesis: to develop a more specific body of evidence to inform the use of distinctly visual, diagram-based information displays, for developing a suite of strategic community resilience interventions. Surrounding theoretical implications are outlined in 11.6. Strengths and limitations of the thesis as a case study of ICoE:CR development are then discussed in 11.6 before the chapter concludes with a summary of opportunities for further research.

11.1 Research Question One

The first principal research question asked was: What are the strong patterns of opinions that need to be considered when implementing an information display for collaboratively monitoring and evaluating a regional community resilience strategy? As outlined in Chapter 4, this question was initially answered in Study One, by identifying three viewpoints, or strong patterns of opinions, among ICoE:CR researchers and practitioners, namely: 'against informing insular, top-down decision making'; 'need for complicated analysis to inform strategic decisions'; and 'need to evaluate opportunities to improve complex post-disaster outcomes at a range of societal levels'. The latter viewpoint suggested that the VMEP process and resulting logic models had a distinctly pragmatic potential to highlight the practical value of very different, research- and practice-based, approaches to the ICoE:CR. It was anticipated that a VMEP logic model could be used to highlight these pragmatic potentials, rather than allowing clear differences in viewpoint to create unnecessary friction between researcher and practitioner groups.

Another implication of this particularly pragmatic viewpoint included the need to highlight ethical issues surrounding planning, monitoring, evaluation and associated research within the ICoE:CR and similar initiatives. A focus on the impacts of community resilience initiatives may have otherwise neglected the importance of how those impacts are achieved. This would have represented a superficial interpretation of act-utilitarianism critiqued in 1.3, where the ends are used to justify any given means. A set of ethical principles were displayed at the top above the Study Two VMEP logic model. This was an attempt to ensure a more well-rounded manifestation of pragmatic philosophy which, according to Rorty (1980), includes explicit attention to surrounding ethical values. As outlined in Chapter 6, participants in Study Two went on to plot research questions onto the ethical principles displayed, as well as onto the remainder of the VMEP logic model. This suggested that core ICoE:CR stakeholders appreciated the inclusion of explicit ethical principles as part of the VMEP process.

Study Two also reinforced the value of identifying patterns of opinions, for promoting constructive interactions between ICoE:CR researchers and practitioners. An observed shift in researchers' perceptions was also outlined in Chapter 6. This shift aligned researchers' interests much more closely with operational rather than more technical concerns, and illustrated the overall value of considering Study One viewpoints while adapting and implementing the VMEP process. Several themes in Study Two participants' accounts concerned how the resulting VMEP process became catalysts for constructive dialogue between researchers and practitioners. Themes in participants' accounts concerning diversity and facilitated collaborations were summarised in Chapters 6 and 7. The prevalence of these themes suggest that relevant dialogue may also have been supported by presenting Study One findings at the start of the main Study Two workshop. These advantages of conducting Q-methodology research as part of organisational development illustrate an important implication for practice. This implication will be expanded on in section 11.4 below.

11.2 Research Question Two

The second principal research question asked: How can a logic model support collaborative efforts to usefully monitor and evaluate a complex community resilience strategy? As outlined in Chapters 6 and 7, the main Study Two workshop seemed to have successfully engaged researcher and participant stakeholders at the core of the ICoE:CR. As a result of this workshop, ICoE:CR stakeholders plotted thirty five evaluative questions onto distinct sections of a VMEP logic model representing the WREMO community resilience strategy. Workshop participants referred to the VMEP process as a catalyst for the generation of these program-focused questions and for other discussions between collaborating researcher and practitioner stakeholders. The Study Two workshop may have also improved less tangible aspects of collaborations within the ICoE:CR. The shift in opinions outlined in 11.1 suggests that researchers were taking more interest in operational matters, compared with the patterns of opinion identified prior to the workshop.

Chapter 7 discussed how participants' accounts of VMEP as a catalyst appeared to concern the overall VMEP process. Although the VMEP logic model was an essential part of this process, participants attributed the generation of evaluative questions and associated dialogue to the VMEP process as a whole, rather than associating these advances with the use of a particular document format. Study Two therefore made an observation which had also been made by Huggins and Jones (2012) and Huggins and Peace (2014), that facilitation formed an important part of logic model usefulness within a surrounding process of program development.

The confluence of these observations helps explain how a logic model can support collaborative efforts to usefully plan, monitor and evaluate interventions in the complex domain of community resilience. As part of a heuristic approach to addressing the complex ICoE:CR domain, it seems that the VMEP logic model formed an efficient cognitive medium incorporated within a network of cognitive agents. As an agent facilitating the useful incorporation of this logic model, I became an important part of a heuristic approach to addressing complexity. It can therefore be assumed that facilitation can form one more component of ecological rationality within a network of cognitive agents. This assumption is supported by the way that ICoE:CR requested that I convert the VMEP logic model to a table format equivalent, for use within the ICoE:CR in my absence. No other VMEP facilitator had come forward, despite raising this possibility with WREMO management. This conversion from a VMEP logic model to a table format medium marked the limited incorporation of the VMEP logic model in the absence of facilitation. This also marks how use of the VMEP model had not yet become a cultural practice affecting ongoing decision making within the ICoE:CR. As outlined in Chapter 7, this kind of more deeply embedded change was not likely to be achieved within the time and role restrictions on my interactions with ICoE:CR members.

11.3 Research Question Three

This thesis also addressed a research question that asked: How can experimental methods help define the advantages of using a visual logic model for addressing strategic aspects of a complex emergency management scenario? Chapter 8 outlined how Study Three piloted a new approach to macrocognitive research in order to answer this question. This experimental design was used to test the effect of using a VMEP logic model on decision making quality among emergency managers facing a complex strategic scenario. It was initially assumed that results from this study could be used to generalise certain findings and assumptions from Study Two to strategic contexts beyond the ICoE:CR.

The Study Three experiment managed to clarify one aspect of how experimental methods can define advantages of using a visual logic model for addressing strategic emergency management scenarios. Expert ratings of three components of situation awareness appeared to be reliable indicators of participants' macrocognitive performance. The three components were current situation awareness, prospective information seeking quality, and prospective amendment quality. This finding, outlined in Chapter 9, identified the potential to use these, apparently robust, measures for further macrocognitive research into similar emergency management scenarios, concerning longer term implications.

Responses to the VMEP logic model reflected increases in two of the reliable measures of situation awareness: current situation awareness (29%) and prospective amendment quality (38%). However, as outlined in Chapter 9 and further discussed in Chapter 10, Study Three was unable to determine a statistically significant ($p < .05$) relationship between the use of VMEP logic models and these shifts in macrocognitive performance. This lack of statistically significant results has been attributed to a very small sample, of only 10 participants in total. As outlined in Chapter 10, the current study design would have required a much larger population of interest to produce a statistically robust finding concerning current situation awareness and prospective amendment quality.

This lack of statistically significant findings concerning advantages of using the VMEP logic model marks dual pitfalls for conducting relatively innovative research into highly specific domains. A new set of situation awareness measures had been developed before being applied to a very specific kind of macrocognitive scenario. This innovative approach to the Study Three research question and design meant there was no clear statistical precedent to follow. It was therefore difficult to calculate the number of participants required except in hindsight, once an effect size had been established. Conducting research into the highly specific domain of community resilience programs forming part of New Zealand Civil Defence and Emergency Management also meant there were only 20 eligible participants who were working in the area of interest. As outlined in Chapter 10, this meant that even a 100 percent response rate would not have been enough to produce statistically generalizable results.

A very small sample of responses, together with results addressing methods rather than experimental hypotheses, meant that research question three was answered in terms of pilot research rather than a full experimental protocol. This is how the pilot status of Study Three marks a limitation for all findings outlined in this thesis. In the absence of an experimental basis for generalising Study Two findings, the current thesis mainly forms a case study of using a VMEP logic model within the ICoE:CR. The remainder of this chapter will therefore treat this thesis as a specific but nonetheless theoretically relevant case study, using the definition of a theoretical case study from Yin (2009). This approach to case studies defines the relevance of a case by the way a case reflects particular bodies of theory, in this case, theory concerning the role of external cognitive components in an expansive view of ecological rationality. As a theoretically defined case study, the current thesis is primarily characterised by insights gained through the methodologies applied while using Studies One and Two to answer the first two principal research questions.

11.4 Implications for Practice

This thesis aimed to develop a more specific body of evidence to inform the use of distinctly visual, diagram-based information displays, for developing a suite of strategic community resilience interventions. Considering the answers to research questions, outlined in 11.1, 11.2 and 11.3 above, the most relevant, practical implications of this thesis are drawn from considering how it forms a case study of researcher-practitioner interactions within the ICoE:CR. Even in the absence of a robust answer to research question three, answers to the first two questions have addressed the overall research question asked by this thesis: How can a logic model display, which uses boxes and arrows to display linkages between activities and downstream objectives, be used to help research and practitioner groups pragmatically address the complexities of community resilience?

It follows that practical implications of this thesis can be exemplified through informing and deploying VMEP to facilitate these interactions. These implications mainly concern efforts required to improve status quo approaches to planning, monitoring, evaluating, and associated research into complicated emergency management initiatives. It is important to start by asking what the VMEP process represented for ICoE:CR development, with a focus on research question two: How can a logic model support collaborative efforts to usefully monitor and evaluate a complex community resilience strategy?

Study One findings, concerning relevant patterns of opinion, concluded that a VMEP logic model could mitigate potential friction between researchers and practitioners collaborating to develop the ICoE:CR. As outlined in 3.4, a strong pattern of opinions identified through Q-methodology showed that practitioners were particularly resistant to hierarchical, top down approaches to their community resilience program. They appeared to prefer a highly localised, bottom-up approach to particular community resilience interventions. ICoE:CR researchers however, appeared to be initially more concerned with producing complicated analyses and delivering their findings to a more centralised level of emergency management. As discussed in 3.4 in relation to a contrasting pattern of opinions, it seemed that researchers assumed that these analyses would be focused on improving an overall community resilience strategy, rather than improving more localised activities. Considering these disparate viewpoints, as outlined in 4.4, Study One concluded that a VMEP logic model could focus on a broadly pragmatic viewpoint which was shared by both parties. This viewpoint was the third strong pattern of opinions which had been discussed in 3.4. It was assumed that focusing on this shared motive to improve post-disaster outcomes would help these groups develop new and better modes of interaction.

This optimistic conclusion from Study One was later supported by answers to research question two, concerning how a logic model could support collaborative efforts to usefully monitor and evaluate the WREMO complex community resilience strategy. Chapter 6 included a comparison of Study Two content analysis with previous viewpoints from Study One and found that operational matters had become much more evenly spread among researchers and practitioners while implementing VMEP within the ICoE:CR. As outlined in 6.4, this shift in focus suggested that ICoE:CR researchers and practitioners were able to put certain differences aside during this element of Study Two action research.

All Study Two participants had received a summary of results from Study One as part of the introduction to the main Study Two workshop outlined in 5.4. This included a summary of viewpoints which had been identified and an explanation of why these viewpoints justified holding a workshop as part of action research. Study Two participants proceeded to co-author a VMEP logic model showing a number of potential research questions. They mapped these questions onto the VMEP logic model displayed in figure 11 of 5.3.6, to connect each research question with at least one aspect of the WREMO community resilience strategy. These additions to the VMEP logic model and more or less simultaneous changes in the relevance of operational issues suggest that the VMEP process facilitated during the workshop attracted researchers' attention to localised issues being faced by WREMO practitioners, rather than promoting research activities with no direct application.

This use of findings from Study One shows how Q-methodology can form an important preparatory component of organisational development. As outlined in Chapter 4, Sostrin (2008) arrived at a similar conclusion concerning their use of Q-methodology for informing organisational development. The most important aspect of using Q-methodology findings for organisational development may be reassuring organisational personnel that their thoughts and preferences are being incorporated from the outset. This helps meet the need for a more personnel-informed approach to organisational change outlined by Clegg and Walsh (2004). As illustrated and discussed in Chapters 5, 6 and 7, this approach can promote active and constructive involvement in processes concerning organisational change.

Other answers to the second principal research question led to more specific recommendations concerning the use of VMEP logic models in emergency management settings. Recommendations outlined at the end of Chapter 6 included that logic models can be used at specific stages of developing a range of research, monitoring and evaluation concerning emergency management. This recommendation was provided in 6.5 alongside indications that VMEP can be used to build consensus between otherwise disparate emergency management collaborators, during specific periods of organisational development.

Answering research question two also led to a recommendation that VMEP is used for a more layered approach to monitoring the implementation of the new Sendai Framework for Disaster Risk Reduction published by UNISDR (2015). This could be achieved when simplified but nonetheless useful representations of complicated disaster risk reduction programs are layered to reflect national and sub-national geographic scales, using the hyperlinks provided in proprietary DoView (Version 4.0, 2013) software. As outlined in Chapter 6, this approach to layered logic models may help avoid repeating pitfalls experienced while monitoring and evaluating the prior UNISDR (2005) framework for disaster risk reduction. These pitfalls included the inability to coherently monitor, evaluate and improve interventions at the sub-national geographic scales which are commonly affected by disasters (e.g. province, state, and city scales) (UNISDR, 2014). The layered approach available through taking the VMEP approach to monitoring and evaluation can incorporate sub-national scales of monitoring and evaluation without jeopardising the coherence of national scale summaries.

In addition to answers to the second research question provided by Studies One and Two, Study Three provided tentative evidence of how VMEP logic models may enhance situation awareness concerning a particularly strategic emergency management scenario, with multiple longer term implications. As summarised in 10.1, emergency managers responding to a VMEP, rather than table-based, information format achieved substantial increases in two aspects of situational awareness. These results added a further degree of support to prior recommendations for using VMEP in emergency management and disaster risk reduction, made at several stages of this thesis.

Chapter 9 concluded with a hypothetical critique of how predominantly tactical approaches to emergency management decision making are unlikely to address complex hazard-related dynamics over the longer term. Related recommendations for using the VMEP process were predominantly based on answers to research question two, concerning how VMEP can be used in conjunction with actual emergency management interventions. These recommendations were based on a combination of the rationale outlined in Chapter 8 and findings from both Studies One and Two. The combination of these findings also highlighted a distinct limitation of using VMEP to address emergency management: the VMEP process does not appear to promote a search for unintended consequences or additional information. As outlined in 6.5, this limitation may be mitigated by implementing VMEP as part of a wider ranging process of strategic intelligence. Further modifications may also need to be made within the VMEP process.

A further limitation of VMEP was outlined in 6.4 and concerns how text-based documents provide detailed clarifications which are not easily incorporated into more visual representations. This strength of text-based documents was also outlined by Tversky (2011) and provides a more detailed background to a conclusion made by Huggins and Jones (2012), that alternative formats may be required at different stages of planning, monitoring and evaluating a complex domain. As an action research intervention, Study Two illustrated the fluid movement between a table format, which WREMO used to develop their initial set of performance metrics, to the VMEP logic model and back to a table of research questions for wider dissemination. It was therefore recommended that planning, monitoring, and evaluation for disaster risk reduction is documented in logic model, table or narrative text formats, according to the audiences involved and their preferences for engaging with each stage.

As outlined in Chapter 6, the movement back to a more traditional, text-based table was made on request from ICoE:CR coordinators. This helped meet the need for continuity in the absence of further VMEP facilitation, following the end of Study Two action research. The request for a table format also appears to have been made due to the persistence of status quo approaches to documenting planning, monitoring, evaluation and associated research outcomes. Study Two participants' accounts concerning the period after the workshop clearly outlined a need for traditional document formats, in interview content concerning 'Documents'. Interview content suggested that formats such as narrative documents and electronic spreadsheets had commonly been used to formalise agreements between emergency management stakeholders. This mode of documenting agreements may be very difficult to change, especially when it reflects common communication skills and habits acquired during years of schooling, tertiary education and professional development. Efforts to document agreements using logic models and other less text-based formats may need to be taught as part of initial emergency management courses, rather than trying to reverse status quo learning during implementation. Capacitation concerning evaluative thinking, as outlined in Chapter 7, would also be very worthwhile.

11.5 Theoretical Implications

Findings outlined in this thesis also have a number of theoretical implications which, although they have emerged while answering a set of generally applied research questions, are not directly linked to emergency management or wider disaster risk reduction practice. These implications include a relatively novel understanding of ecological rationality, which links this concept of cognitive heuristics to an extended theory of mind. This understanding has the potential to inform large bodies of related macrocognition theory and research. In these terms, the principal theoretical problem which the current thesis attempted to address was how decisions concerning the complexity of community resilience need to be simplified in a way that promotes a range of systematic benefits among communities affected by disaster risk. This problem is revisited below, with a commentary on the importance of incorporating research-based community resilience indicators as part of strategic emergency management decisions.

11.5.1 Defining an extended concept of ecological rationality. The concept of ecological rationality formed an important part of the theoretical background to this thesis. This concept was drawn from cognitive psychology and was originally used by Todd and Gigerenzer (2003) to describe how internal mental short-cuts may lead to more effective decisions than an unabbreviated, algorithmic alternative when deployed in relatively complex real-world environments. Huggins and Jones (2012) very tentatively suggested that it may be possible to apply this concept of ecological rationality to processes including representations external of the brain. The current thesis has further developed this interpretation of ecological rationality, with reference to the concept of external representations from Tversky (2011). This has been achieved by examining aspects of using a VMEP logic model which appeared to be ecologically rational, in that they were explicitly abbreviated but nonetheless appeared to be effective for organisational development.

As outlined in Chapter 1, the thesis started by assuming that logic models and other computational media and boundary objects form part of heuristic approaches to complex scenarios. These external representations exist beyond the brain of any one individual but nonetheless appear to support an abbreviated and highly selective interpretation of complexity. As stated by Patton (2011) and Stacey (2007), the highly dynamic and hard-to-predict nature of complex systems makes it impractical to definitively describe the characteristics of those systems. This is the ecologically rational advantage of a heuristic approach to complex scenarios. Rather than taking an excessively detailed approach to analysing complex system characteristics, external representations such as VMEP logic models help people to focus on a prioritised set of interventions and the objectives and outcomes related to those interventions. This may function as a catalyst for a philosophically pragmatic approach to complicated program-related decisions, which incorporates diverse stakeholder input despite marked differences in relevant opinions. Useful decisions, such as agreeing on research that relates to program improvements rather than less relevant vested interests appear to result from this selective use of program-related information. Considering Study Two participants' descriptions of VMEP as a catalyst, these decisions may be more useful than decisions made in processes depending on status quo, text-based information formats.

Study Two illustrated how the VMEP process may help ensure that the selective use of logic model content leads to decisions improving the interventions in question. The relative effectiveness of non-abbreviated and abbreviated, heuristic processes of brain-bound cognition appear to mirror comparisons made by Study Two participants, between the abbreviated logic model representation used to facilitate development of the ICoE:CR and extended text-based documents such as the official WREMO (2012) strategy. An analysis of interviews with Study Two participants indicated that progress made during the Study Two workshop may not have come about through continuing to use more detailed, text-based representations of the same scenario. This comparison was illustrated by the prevalence of the sub-code, 'VMEP Framework as a Catalyst' that appeared in 11.3% of all excerpts concerning what occurred during the workshop and 10.7% of all excerpts concerning what was occurring following the workshop.

Participants appeared to primarily refer to VMEP as a catalyst for constructive dialogue which may not have otherwise occurred within the ICoE:CR. As outlined earlier in this chapter, this feature of Study Two participants' accounts concerns the overall VMEP process. Although the VMEP logic model formed an essential part of this process, the Study Two workshop involved other important elements such as VMEP facilitation. The importance of this particular element was highlighted by the theme, 'Supporting Professional Collaborations'. As detailed in Chapter 7, this theme related to almost one third of all interview excerpts used to explain what occurred during the Study Two workshop.

Considering the way that computational media functions as part of distributed cognition, it appears that VMEP facilitation formed a component of ecological rationality among a network of cognitive agents constituted by diverse ICoE:CR stakeholders. As outlined in 6.4 and 7.2, the VMEP model appeared to become part of each collaborating agents' extended cognitive processes due to facilitator contributions. As also observed by Huggins and Jones (2012), this was in addition to input from other members of a pre-existing decision making network. In this way, the VMEP process demonstrates how distributed cognition can include computational media which are facilitated by third parties, external to pre-existing members of a decision making group. The same explanation could be applied to any iterative media used to support decisions during meetings facilitated by an external provider.

11.5.2 Community resilience indicators. As outlined in 11.5.1, the principal theoretical problem actually addressed by the current thesis was: how decisions concerning the complexity of community resilience need to be simplified in a way that promotes a range of systematic benefits among communities affected by disaster risk. This problem was addressed in a research context that was characterised by a place-based approach to improving community resilience outlined in 1.2. This approach reflected a focus on specific characteristics of the Wellington region, rather than focusing on practice and knowledge produced in other parts of the world. In the course of facilitating a VMEP process in this context, it was observed that ICoE:CR stakeholders were content to focus on objectives related to actual and potential community resilience interventions, rather than the potential downstream, post-disaster impacts of those interventions.

As outlined in 1.1, technical definitions of disaster-related community resilience typically focus on the relationship between community characteristics and certain post-disaster outcomes. However, as outlined in 7.2, there was no clear demand among

ICoE:CR stakeholders for adding VMEP logic model components to represent post-disaster outcomes. The absence of specified post-disaster outcomes on the Study Two VMEP logic model could be interpreted in a similar way to the persistent use of text-based documents, as a cultural limitation shared by researchers and practitioners at the core of the ICoE:CR.

However, these collaborating professionals may have actually been taking a much more effective approach to further developing the new WREMO community resilience strategy. It is worth noting how a focus on longer term impacts is likely to complicate the whole ICoE:CR endeavour. Amongst other activities, ICoE:CR stakeholders have been tasked with collaborative research to improve the WREMO community resilience strategy. A focus on downstream outcomes would largely require longitudinal research to examine whether present day activities and objectives are actually related to longer term impacts. In the case of community resilience, these longer term impacts refer to the state of a community following a major disaster. It follows that longitudinal research within the ICoE:CR would need to wait for a disaster, being a serious disruption in functioning that exceeds the capacity of their communities to respond (UNISDR, 2009), to complete an assessment of program impacts within the Wellington region area of interest. The documented success of the ICoE:CR would therefore be placed in major jeopardy if that success was framed by the analysis of long term impacts. Not only would the required research be very resource intensive. Given the unpredictability and relatively low frequency of many intensive disaster events for individual locations (see Masys et al., 2014), a solely place-based approach to this research within the Wellington ICoE:CR may not be concluded for years or even decades.

In a very pragmatic sense, the questionable viability of a longitudinal approach within the ICoE:CR marks the importance of pre-established indicator sets used to describe the characteristics of a resilient community. Some of these indicator sets are drawn from longitudinal research in a range of settings. These indicator sets can help emergency management agencies and their collaborators avoid the pitfalls of localised longitudinal approaches outlined above, by informing longitudinal predictions in advance of a local disaster. Useful indicator sets ideally detail the process used to include and test each of the component indicators, so that emergency management organisations and collaborating researchers can select and adapt the indicators that are most relevant to their local demographics and hazard context. This potential to incorporate more coherent and transparent, research-based sets of community resilience indicators may already have been provided for by ongoing programs of research within the Building Resilience Amongst Communities in Europe initiative (see Birkmann et al., 2012b), the Horizon 2020 programme (see European Commission, 2015), IRDR (2013) and a dedicated Erasmus network focused on resilience (Academic Network for Disaster Resilience to Optimise Educational Development, 2015).

The importance of using research-based indicator sets to determine relevant community characteristics can be illustrated by returning to the baseball metaphor introduced in the first chapter of this thesis. Todd and Gigerenzer (2003) used this metaphor as an example of ecological rationality, concerning how a baseball player runs to catch a high ball. Rather than calculating the trajectory of a baseball trajectory and running to stand exactly where the ball is most likely to fall, a baseball player is likely to take a much more efficient approach. As outlined by Todd and Gigerenzer (2003), a successful baseball player simply maintains a line of sight with the baseball and adjusts their running speed to match. This heuristic approach to catching the baseball is repeatedly used because it is a very effective and efficient approach to catching the ball. It is, therefore, an ecologically rational heuristic.

This example can also be used as a metaphor for explaining the value of research-based community resilience criteria predicting improved post-disaster outcomes. The baseball player can be used to represent an emergency manager who is monitoring, evaluating and adapting a program of interventions in the complex domain of disaster-related community resilience. The high flying baseball represents the disaster-related trajectory of a community resilience intervention. A baseball player can attempt to apply the look and run heuristic to balls flying out of the ball park. However the physical boundaries of the ball park delimit the ecological rationality of this heuristic. Once the ball leaves the ball park, the baseball player is no longer likely to catch it –regardless of the heuristic being applied. As outlined above, an emergency manager would also be ill advised to wait for post-disaster outcomes to monitor, evaluate and adjust community resilience interventions. This is not a high ball that they can catch in order to make a series of timely adjustments within a relatively iterative approach to innovative emergency management.

In an ideal world, the baseball player would leap several stories in the air, to catch the baseball flying high over the ball park stands. Likewise, the emergency manager would make all adjustments to their community resilience interventions based on information concerning a direct relationship between that intervention and certain post-disaster outcomes. However this is not an ideal world. Gravity prevents the baseball player from leaping so high. The unpredictability and relative infrequency of disaster events precludes using place-based, post-disaster data to incrementally develop community resilience interventions. The look and run heuristic forms part of ecological rationality when applied to balls being hit to locations inside the playing area. An efficient and effective heuristic approach to monitoring, evaluating and adjusting community resilience interventions applies to information about the effects those interventions have on more immediate community resilience outcomes.

This is how logic models focused on research-based community resilience indicators can make a substantial contribution to ecological rationality within the monitoring, evaluation and ongoing development of community resilience programs. This theoretical implication leads back to a particularly practical potential. Emergency managers' uptake of relevant research-based community resilience indicators could form part of a collaborative cycle of strategic intelligence, as outlined with reference to Krizan (1999) in Chapter 6. This would involve stepping back from immediate operational concerns, to incorporate new community resilience indicators as they become available for helping gauge and adjust the effectiveness of relevant community resilience interventions.

11.6 Strengths and Limitations of the Thesis as a Case Study

This thesis is characterised by two features that at once represent both strengths and limitations. One of these features concerns the advantages and disadvantages of taking an explicitly abductive approach to research. The second feature concerns advantages and disadvantages of using small samples of around ten participants for each of the three studies. An additional limitation of the current thesis is also outlined below and concerns the assumption that VMEP logic models are components of ecological rationality in a strategic emergency management context.

11.6.1 An explicitly abductive approach. Although inductive and deductive approaches to research were also used to develop this thesis at different stages, many of the overall findings were produced through an abductive approach. This means that initial assumptions have been followed by the analysis of observations to further develop explanatory hypotheses. Chapter 1 outlined certain pragmatic advantages of taking this abductive approach to the current thesis. Foremost was the focus on providing more usable hypotheses to guide practical action. As outlined by Peirce (1935), an abductive approach to research can focus on providing these useful hypotheses while building on prior assumptions concerning an otherwise poorly defined domain. This advantage of taking an abductive approach to research has been highlighted by several implications for practice outlined above and in the main chapters for Studies One, Two and Three. These implications resulted from advancing initial assumptions concerning the otherwise poorly defined domain of how information displays support decisions about community disaster resilience. Summaries of these implications have simultaneously been disseminated as guidance for ICoE:CR coordinators and others working in a similar context. These practical benefits of taking this largely abductive approach to research suggest that if research arbitrarily pursues the certainty and generalisability demanded by hypothetico-deductive methods, many opportunities may be missed to take a iterative, abductive approaches to less certain, less defined, but no less pressing concerns.

The value of abductive hypothesis generation for informing useful action in ill-defined domains appears exemplified by the third stage of this thesis. Further information and definition required to improve a hypothetico-deductive approach to the research topic have been developed as a result of Study Three. However, besides piloting and refining several aspects of an experimental approach, Study Three has made a relatively minor contribution to the current thesis. However Study Three may have been even more limited in the absence of prior, abductive explanations generated during the prior two studies.

11.6.2 Sample size. This thesis has relied on close contact with limited groups of research participants. In-depth consultation with these participants during the lead up to each study ensured that the research was more relevant to participants' practical needs. This approach also helped establish a high level of trust from participating organisations, which became an important requirement for conducting the research. Trust from both participants and organisations helped produce the large body of interview data analysed in Study Two. Participants seemed to speak freely about their experiences and trusted me to remove any sensitive data during transcription and transcript release processes. The trust placed in me by WREMO management and personnel was particularly important because this helped ensure the incorporation of the initial draft of the WREMO Community Resilience Strategy, a draft of key performance indicators developed by their community resilience team, and a series of VMEP logic models representing a combination of the prior two documents. WREMO managers also helped pilot the Q-sample required for Study One and provided the venue for the main Study Two workshop. These managers went on to approve every document used to disseminate Study One and Study Two research findings without requesting any amendments.

Close contact was also pursued with every agency participating in Study Three. However, this concerned a very small population of interest which, as outlined above, led to a very small sample of Study Three participants. As outlined in Chapter 10, a wider scope of engagement with New Zealand and Australian emergency managers may have helped attract a larger sample of participants. This may have led to a much more statistically robust set of findings. This potential is discussed in terms of further research in 11.7.

11.6.3 Assuming ecological rationality. A case for the way VMEP logic models function as part of ecological rationality has been developed at various stages of the current thesis. Practical implications outlined in the current chapter therefore rely on an assumption that VMEP logic models lead to more useful decisions than an extended, text-based equivalent. Although this assumption appears to be relatively robust and informed by relevant literature, I was unable to develop a full set of research methods that would authoritatively test this assumption as part of the current thesis. Thus, there remains a need for further research to systematically compare decisions made using a VMEP logic model with decisions made in reference to an extended text-based representation of the same complex scenario. The need for this type of research is discussed below, alongside other potentials for further research.

11.7 Opportunities for Further Research

According to Alvesson and Sköldberg (2009), a reflexive approach to research can "…develop and add something, bringing in issues of alternative paradigms, root metaphors, perspectives, vocabularies, lines of interpretation, political values and representations; rebalancing and reframing voices in order to interrogate and vary data in a more fundamental way" (p. 313). The following section takes this constructive approach to alternative paradigms and lines of interpretation in particular. This approach further develops the suggestion that research is still required to substantiate an assumption made throughout the current thesis, concerning the use of logic models as part of a heuristic approach to complexity that exhibits ecological rationality. Efforts to substantiate this assumption would mark a substantial contribution to theory concerning the use of logic models as part of cognitive approaches to complexity.

As outlined further below, future research could also better address cultural diversity. Studies One, Two and Three were all conducted with participants who all spoke

English and who appeared to come from predominantly Western European cultural backgrounds. This highlights the potential for further research with participants from a wider range of cultural backgrounds and national settings. This could involve adapting my explanations of how VMEP logic models help address complexity for a much wider range of emergency management contexts and stakeholders. These potentials for further research, to assess ecological rationality and to involve a wider range of participants, are outlined in more detail below.

11.7.1 Substantiating ecological rationality. The previous section, 11.6, highlighted how the current thesis is based on the assumption that VMEP logic models form a heuristic component of ecological rationality in complex scenarios. This assumption has not yet been examined by testing the difference between decisions made using a VMEP logic model and decisions made using a less efficient, text-based representation of the same complex scenario. It should be noted that this applies to many, but not all, text-based equivalents of a VMEP logic model. There is, therefore, a need to compare the functionality of logic model displays to the functionality of non-abbreviated text-based equivalents. This will require a more deductive approach than Studies One and Two, in order to predict and then test how experimental results conform to hypotheses concerning the way logic models contribute to decisions exhibiting ecological rationality.

It is important to dedicate more deliberation, time and collaboration when deductively researching this research topic. Dedicating more time and other resources would also be a more congruent approach to researching the current research topic because it would exemplify the strategic thinking of interest. More deliberation concerning Study Three in particular would have probably helped foresee sampling limitations well in advance. More time may have afforded an expansion of the initial pilot sample, to cover comparable national contexts such as Australia and the United

Kingdom. A more widely collaborative approach to the Study Three experiment would have incorporated expertise from researchers who were more accustomed to designing and conducting relatively controlled experiments.

This need to incorporate more appropriate expertise highlights another potential foregone during Study Three. Certain experts could have recommended repeated measures, to increase the volume of experimental data being analysed. As outlined in Chapter 10, analyses of the larger data sets resulting will increase the statistical power of further research into the current topic. Subsequent findings would therefore be more generalizable to a range of populations and to a range of complex scenarios. An extension of the Study Three experimental design that would help achieve such ends could follow these steps:

1. Invite participation from postgraduate emergency management students who are already working in emergency management roles.
2. Ask participants to construct either a logic model or text-based strategy to address one, hazard specific dimension of community resilience for example, community-based earthquake hazard mitigation.
3. Ask each student to describe how they would address a series of scenarios related to that one dimension of community resilience, with reference to the logic model or text-based document which they constructed.
4. Use expert rating to assess students’ responses using current situation awareness, prospective information seeking quality, and prospective amendment quality criteria tested found to be reliable during Study Three.

5. Compare expert ratings to determine whether the logic model has led to responses with a higher degree of situation awareness than the text-based strategy.

Step two of each experimental condition would need to be facilitated by experts in the document format being created. This would help balance the influence of facilitation quality identified during Study Two of the current thesis on each experimental condition being compared. The selection of one, hazard-specific, dimension of community resilience would avoid the lengthy participation that would be required to develop an entire community resilience strategy for multiple hazards. The active authoring of either a VMEP logic model or text-based equivalent means that these documents would form more genuine, external representations of participants' distributed cognition, rather than somebody else's cognitive process. As outlined above, repeated measures used as part of this research design would also produce a robust statistical sample, even when researching a very small population of interest.

As outlined in Chapter 8, Study Three largely depended on what Clark (2011) called a dynamist understanding of cognition, concerned with changes in system states rather than the particular mechanisms causing those changes. Research into how logic models function as part of ecological rationality may benefit from more complex measures, to provide more thickly described data concerning cognitive mechanisms. Rather than solely tracking one or two outcome measures, this approach to cognitive research would track the way that participants arrive at those outcomes. Eye tracking may provide particularly valuable data here, to help describe apparently continuous processes which flow between using the logic model or narrative equivalent and recommending amendments. This may include timing data, to identify any differences in the speed of transitions between different parts of the display and writing the components of a response. Similar approaches could be developed to monitor brain activity through electroencephalography, and methods to monitor other physiological responses such as heart rate, blood pressure, pupil dilation and skin conductivity produced by nervous sweating. These latter methods may indicate the relative demands posed by certain stimuli conditions. Evidence of relatively less strain could be used to indicate the use of a more frugal, heuristic process to making relevant decisions.

11.7.2 Cultural variations. All participants in the current thesis were recruited from within New Zealand, which is a predominantly English speaking context. Furthermore, most participants in the current thesis were from a variety of Western European cultural backgrounds. This may not seem so important on the surface. Emergency management organisations in New Zealand generally appear to be staffed by people from Western European backgrounds and the current thesis was focused on these organisations. However, the limited cultural inclusivity of the current thesis creates issues for generalising answers to research questions one, two and three to other cultural contexts. It creates a particular issue for generalising these answers to other cultural groups engaged with emergency management in New Zealand, such as New Zealand Māori.

As outlined in Chapter 1, Kessell and Tversky (2009) observed that their research participants tended to draw cycle dynamics along a straight line. This chapter also outlined how Spera et al. (1994) reached a similar conclusion about using linear narratives to understand a cognitively and emotionally challenging scenario. These research findings informed an assumption that the many-to-many linkages used by VMEP logic models would be a relatively novel experience for participants. However, the findings from Kessell and Tversky (2009) were produced in the USA. Spera et al.

(1994) conducted their research in South Africa. Neither study explicitly included participants from non-European cultural backgrounds.

This may seem like a relatively insignificant detail. However it is important to consider how many non-European cultural groups do not appear inclined to think in terms of linear sequences. One can take the symbolism of cycles in eastern traditions such as Buddhism as one example. Buddhist symbols such as the wheel of life focus on a profound belief in reincarnation, rather than a linear path from birth to death. The use of the spiral-shaped koru and circular symbols among New Zealand Māori provides another example of how certain cultural groups may see little novelty in moving from text-based formats to a VMEP logic model format or other, relatively non-linear representations.

Expanding the current thesis to include members of a broader range of cultural groups could help to detect relevant, universal cognitive dynamics which appear consistent across a range of cultural contexts. Perhaps even more importantly and considering the importance of cultural practices in distributed cognition (see Hutchins, 2008, 2014), applying research questions from this thesis to other cultural groups will help develop more specific sets of recommendations for using VMEP in certain emergency management contexts. This may help to actively engage an even wider range of stakeholders in planning, monitoring, and evaluating strategic approaches to emergency management. Engaging with these diverse groups may also help adapt and share benefits of using abbreviated, visual representations for complex decision making outlined in this thesis. This seems especially relevant where strategic approaches to long term disaster risk appear to form a uniquely challenging but also increasingly important part of national and community existence, not just throughout New Zealand but also around the world.

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13. Appendices

Appendix A: Statement of Contribution to Doctoral Thesis Containing Publications

DRC 16

MASSEY UNIVERSITY
GRADUATE RESEARCH SCHOOL

STATEMENT OF CONTRIBUTION TO DOCTORAL THESIS CONTAINING PUBLICATIONS

(To appear at the end of each thesis chapter/section/appendix submitted as an article/paper or collected as an appendix at the end of the thesis)

We, the candidate and the candidate's Principal Supervisor, certify that all co-authors have consented to their work being included in the thesis and they have accepted the candidate's contribution as indicated below in the *Statement of Originality*.

Name of Candidate: Thomas Huggins

Name/Title of Principal Supervisor: Associate Professor Robin Peace

Name of Published Research Output and full reference:

Politics of Practical and Academic Knowledge: A Q-method Analysis of Gauging Community Disaster Resilience.

Huggins, T.J., R. Peace, S.R. Hill, D.M. Johnston, and A. Cuevas. (2015a). Politics of practical and academic knowledge: A Q-method analysis of gauging community disaster resilience. Journal of Contingencies and Crisis Management, 23, 246-256. doi:10.1111/1468-5973.12092.

In which Chapter is the Published Work: Study One: Politics of Practical and Academic Knowledge

Please indicate either:

- The percentage of the Published Work that was contributed by the candidate: 95 percent

  and / or

- Describe the contribution that the candidate has made to the Published Work:

The supervisory role has been of a consultative & editorial nature only. The substantive work is that of the candidate.

Thomas Huggins Digitally signed by Thomas Huggins Date: 2015.11.11 09:59:17 +13'00'

Candidate's Signature

11/11/2015

Date

Principal Supervisor's signature

11/11/15

Date

Appendix B: Statement of Contribution to Doctoral Thesis Containing Publications

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STATEMENT OF CONTRIBUTION
TO DOCTORAL THESIS CONTAINING PUBLICATIONS

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We, the candidate and the candidate's Principal Supervisor, certify that all co-authors have consented to their work being included in the thesis and they have accepted the candidate's contribution as indicated below in the *Statement of Originality*.

Name of Candidate: Thomas Huggins

Name/Title of Principal Supervisor: Associate Professor Robin Peace

Name of Published Research Output and full reference:

Visually Modelling Collaborative Research into Innovative Community Disaster Resilience Practice, Strategy and Governance

Huggins, T.J., Peace, R., Hill, S.R., Johnston, D.M., & Cuevas, A. (2015b). Visually modelling collaborative research into innovative community disaster resilience practice, strategy and governance. International Journal of Disaster Risk Science, 6, 282-294. doi: 10.1007/s13753-015-0061-6

In which Chapter is the Published Work: Study Two: Visually Modelling Collaborative Research [...]

Please indicate either:

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Appendix C: Statement of Contribution to Doctoral Thesis Containing Publications

DRC 16

MASSEY UNIVERSITY
GRADUATE RESEARCH SCHOOL

STATEMENT OF CONTRIBUTION
TO DOCTORAL THESIS CONTAINING PUBLICATIONS

(To appear at the end of each thesis chapter/section/appendix submitted as an article/paper or collected as an appendix at the end of the thesis)

We, the candidate and the candidate's Principal Supervisor, certify that all co-authors have consented to their work being included in the thesis and they have accepted the candidate's contribution as indicated below in the *Statement of Originality*.

Name of Candidate: Thomas Huggins

Name/Title of Principal Supervisor: Associate Professor Robin Peace

Name of Published Research Output and full reference:

Assessing Displays for Supporting Strategic Emergency Management

Huggins, T.J., Hill, S.R., Peace, R., & Johnston, D.M. (2015). Assessing displays for supporting strategic emergency management. Disaster Prevention and Management, 24, 635-650. doi: 10.1108/DPM-05-2015-0100

In which Chapter is the Published Work: Study Three: Assessing Displays for Supporting Strategic Emergency Management

Please indicate either:

- The percentage of the Published Work that was contributed by the candidate: 95 percent

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- Describe the contribution that the candidate has made to the Published Work:

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Appendix D: Study One Statement Samples[19]

Table 8

Initial Statement Sample

Dimension	Practical Position	Theoretical Position
for Generating Knowledge	"...capacity to maintain stability is as important as the ability to adapt, or to transform." (Béné et al., 2012, p.24)	"The individual is affected by the wider community, organisations, institutions, and so on" (Britt et al., 2012, p.25)
	"...there is a need for better metrics to capture the contributions to desired results" (Thomas & Tominaga, 2010, p.376)	"...when trying to find empirical evidence that sport and events have actually contributed to intergroup togetherness and overall community development, it becomes obvious that a lot more qualitative and quantitative research is needed to either confirm or reject this claim"(Schulenkorf, 2012, p.2)
	"...difficulties notwithstanding, the discipline of having a cost–benefit framework of analysis can be enormously helpful in getting at the impact of a project in the context of alternative use of results" (Thomas & Tominaga, 2010, p.382)	"While monitoring can provide information about what is being achieved or not achieved, it typically cannot answer questions about why this is happening" (Thomas & Tominaga, 2010, p.375)
	"Of importance is the identification of cross-boundary effects to encourage project teams to explore further opportunities given that working across boundaries often faces organisational momentum to stay within silos" (Thomas & Tominaga, 2010, p.379)	"Although appropriate for some aspects of resilience, [concrete preparedness] measurements do not adequately account for the holistic, unpredictable and messy characteristics of resilience and social capital" (WREMO, 2012, p.22)
	"This is a living lab of how to build a resilient city" (David Johnston at Classroom in the Coach, 2013)	The gap between discipline-specific definitions of resilience has not been bridged (Setiadi & Chang Seng, 2012)

[19] Table 10, Final Statement Sample, was originally published with the online version of: Huggins, T.J., Peace, R., Hill, S.R., Johnston, D.M., & Cuevas, A. (2015a). Politics of practical and academic knowledge: A Q-method analysis of gauging community disaster resilience. *Journal of Contingencies and Crisis Management*, *23*, 246-256.

"...few development organisations have effective outcome monitoring systems, although they often have much informal knowledge about outcomes." (De Coninck et al., 2008, p.19)	"resilience exists at multiple levels or scales: individual, household, community, system, society, etc." (IDS, 2012, p.11)
"As ‘knowledge producers’, [Universities, other academic groups and consultants] can participate in the design and testing of new [planning monitoring and evaluation] systems…" (De Coninck et al., 2008, p.134)	"...earthquake beliefs were not directly related to household earthquake adjustment adoption, suggesting that such beliefs might be indirectly related, or irrelevant, to undertaking preparedness activities" (Becker et al., 2013, p.2)
"Lack of baseline data not only makes it difficult... ...to assess the effectiveness of activities, but also leads to unrealistic targets and expectations" (Thomas & Tominaga, 2010, p.378)	In order to deal with complexity, it is important to specify which communities we are talking about (John Vargo, at Resilience Framework presentation)
"A composite set of quantifiable and qualifiable indicators will be considered (health, infrastructure, economy, ecology, culture)" (WREMO, 2012, p.22)	"Learning in the hazards domain is not enough: there is a need for cross-over, e.g. [with] climate change" (Glavovic, 2012, p.2)
Disaster impacts seem well worth considering for a community’s vulnerability profile and evaluation projects relating resilience to disaster impacts (Buckle, 2006)	"The focus then becomes one of developing insight into complex problems rather than necessarily finding the ‘right’ or ‘optimal’ solution" (Scott, 2005, p.697)
"...look for opportunities to create or strengthen relationships that are non-existent or barely existent throughout locational and relational communities" WREMO, 2012, p.10)	"It is not the strongest of the species that survives, nor the most intelligent that survives. It is the one that is most adaptable to change" (Charles Darwin, 1859, cited in WREMO, 2012, p. 2)
"...the process starts with an analysis of the current situation being addressed... ...before going on to identify potential ‘solutions’, i.e. what will constitute the program or initiative in question…" (Wimbush, Montague & Mulherin, 2012, p.313)	"...adopting a systemic approach recognises that a large number of the processes and dynamics that affect people and/or their environments are occurring across scales (from local to global)... ...and are often characterised by feedbacks..." (Béné et al., 2012, p.12)

"...the analysis of performance data collected for/against the [theory of change]... ...is used for learning/feedback and continuous improvement and thus improves understanding of the program and its implementation..." (Wimbush et al., 2012, p.313)	Discourse and policy around long-term recovery has not evolved (Abramson et al., 2011)
"...development organisations [can] become inward-looking, arguing that the location, or nature, of 'their' beneficiary group[s] is so specific that tailor-made solutions must be designed on the spot. ...justify an almost unconscious defence mechanism against criticism and a feeling that there is little to learn from elsewhere..." (De Coninck et al., 2008, p.122)	"[Scale] ...refers to the need to recognise the scale related nature of system dynamics, resilience and adaptation" (Béné et al., 2012, p.27)
"Engineering resilience, or 'resilience as resistance', differs from less mechanistic definitions. This requires a distinct set of practical, community resilience indicators" (EmBRACE, 2012).	"...more empirical case study research is needed to create a strong corpus of knowledge from which [key performance indicators] can be systematically extrapolated, so that measurement scales can be developed" (Schulenkorf, 2012, p.9)
"...people hold a number of salient beliefs about hazards and preparedness, some of which are helpful to motivating preparedness, others unhelpful" (Becker et al., 2013, p.14)	"[Social network analysis] provides a means to develop, represent and assess different types of change processes and their consequences" (Horelli, 2009, p.211)
A rapid thumbprint survey is roughly equivalent to a full survey of organisational resilience. (John Vargo at Resilience Framework presentation)	"[Resilience has a] technical role as a pertinent concept to characterize dynamic systems..." (Béné et al., 2012, p.45)
"while there has been considerable research on the predictors of resilience, there is little research which has operationalised these factors or evaluated interventions to address these factors in order to promote resilience" (Britt et al., 2012, p.11)	"Assessing impacts requires far more methodological sophistication than measuring outputs, and is much more difficult to reconcile with objectives-based evaluation designs" (Thomas & Tominaga, 2010, p.372)
"...too much is now expected from resilience" (Béné et al., 2012, p.46)	"...the evaluation of networks is critical, because it can lead to greater clarity and agreement on their significance" (Horelli, 2009,

		p.206)
	"Thorough research during the developmental stages of the program will help reveal the reality of the situation – characteristics of clients and their lifestyle, likely levels of need and issues to confront – to enable the program to most effectively meet its objectives" (Stubbs & Achat, 2011, p.194)	"...the potential synergy (as opposed to trade-off or even opposition) between these three dimensions [of stability, adaptability & transformability] need to be acknowledged and more systematically built upon" (Béné et al., 2012, p.46)
for Planning & Management	"Information technology also shapes [planning, monitoring and evaluation] systems, whose sophistication largely depends on whether an organisation has access to such technology" (De Coninck, 2008, p.132)	"[Community resilience] could be viewed as a web, where relationships and capabilities are interwoven; strategic objectives, stakeholders and resilience tools crossover and are interdependent upon one another. At the centre of this web is a resilient community which comprises a diverse set of relationships and capabilities" (WREMO, 2012, p.20)
	"As a consequence of monitoring activities... ...may for example decide to adjust programs, change team patterns, or facilitate social bonds between individuals and groups" (Schulenkorf, 2012, p.8)	"The capacity to recover and the degree of preparedness of communities are more important than poverty status" (Béné et al., 2012, p. 10)
	"A stronger focus on results starts from constructing a framework with projects and programmes integrated within the overall results chain" (Thomas & Tominaga, 2010, p.377)	"[Resilient communities are] able to maintain basic community functions in times of disaster" (Birkmann, Chang Seng and Abelin et al., 2012)
	"The [Community Resilience Team] will be the primary facilitator in areas directly related to emergency preparedness and act as networker to provide opportunities that lead to more connected communities" (WREMO, 2012, p.5)	"[Resilience is] a policy narrative... ...that offers the ability to bring people... ..., organisations with different initial agendas, and communities of practice from different sectors, together around the same table with the unique objective of 'strengthening resilience'" (Béné et al., 2012, p.45)

"...look for opportunities to create or strengthen relationships that are non-existent or barely existent throughout locational and relational communities" WREMO, 2012, p.10)	"...if the change required is so large that it overwhelms the adaptive capacity of the household, community or (eco)system, transformation will have to happen" (Béné et al., 2012, p.22)
"As people get increasingly prepared and connected, they can access many other opportunities to link into their community and enhance their resilience" (WREMO, 2012, p.13)	Vulnerability represents underlying obstacles to resilience (Béné et al., 2012, p.15-16)
"When accepting referrals and/or working in partnership with other organisations, be clear about each service’s role with the client and the terms of collaboration between services" (Stubbs & Achat, 2011, p.194)	"...stability is not simply a pre-requisite for the accumulation of assets and poverty alleviation, it is also instrumental for building strong institutions... ...and for the emergence of coordinated actions... ...necessary conditions for adaptations" (Béné et al., 2012, p.24)
"Along with impartiality, organisations should promote the use of evaluative findings" (Thomas & Tominaga, 2010, p.382)	“...community resilience promotes a more rapid social and economic recovery following a devastating natural disaster...” (Opus International, 2012)
"...a systemic approach is relevant because many of the various types of shocks that affect households and/or societies, are now becoming covariant, i.e. simultaneously affecting groups of households or even entire communities..." (Béné et al., 2012, p.11-12)	"...the regional scale... ...provide[s] a coherent albeit fuzzy basis for planning and/or learning and the development, through “place-making processes”, of “place attachment” and global sense of place identifications" (Morgan, 2009, p.454)
"Equally important is the governance framework that is truly conducive to finding and adopting what matters to improve results" (Thomas & Tominaga, 2010, p.382)	"[Resilience is] similar to many marketing strategies that offer a diverse range of products, which cater for different interests and budgets" (WREMO, 2012, p.13)

"...the traditional evaluation approaches to assessing attribution (controlled and randomized study designs) are not feasible for routine performance-reporting purposes..." (Wimbush et al., 2012, p.312)	"[Resilience includes] effective governance and institutions which may enhance community cohesion. These should be decentralised, flexible and in touch with local realities; should facilitate systemwide learning; and perform other specialised functions such as translating scientific data on climate change into actionable guidance for policymakers" (Béné et al., 2012, p.20)
"Scalability means that programs can rapidly expand coverage during crises and scale back afterwards; it also means ability to scale up levels of support to existing beneficiaries to cope with the impact of shocks" (Béné et al., 2012, p. 26)	The meaning of resilience varies according to the approach to achieving resilience (i.e. anticipatory or recovery orientated) (Birkmann, Changseng and Wolfertz et al., 2012)
"Carefully review proposed data items, sifting out those that are desirable but unnecessary. This is particularly relevant for new or innovative programmes" (Stubbs & Achat, 2011, p.194-195)	"Other key influences on the development of beliefs included uncertainty, emotions and feelings, and social norms. Such factors need to be considered when earthquake education programs are devised" (Becker et al., 2013, p.16)
"Keeping eye and mind open to unintended as well as intended outcomes and impacts is part of this: these can be crucial for planning, re-planning and ultimate success" (De Coninck, 2008, p. 19)	"[Community resilience includes] recovering in a way that restores the community to a state of self-sufficiency and at least the same level of health and social functioning after a health incident" (Chandra et al., 2011, p. XV)
"Making it easy for [small to medium enterprises] to prepare increases the probability that the region's economy can recover, and even thrive, after an emergency event" (WREMO, 2012, p.15)	"[Resilience is characterised by] a high level of diversity in groups performing different functions in an ecosystem; in the availability of economic opportunities; in the voices included in a resilience-building policy process; in partnerships within a community; in the natural resources on which communities may rely; and in planning, response and recovery activities" (Béné et al., 2012, p.20).

	"...project-level [attributions are] not enough to capture the synergies created in public–private partnerships" (Thomas & Tominaga, 2010, p.379)	"There is a risk that understanding resilience as 'buffering' may prevent necessary changes that would enable more sustainable development" (Berman, Quinn and Paavola (2012, p. 89)
	"Evaluation is... ...at times—wrongly—defined as meeting information needs for consumption outside the implementing organisation, whereas monitoring is inward-looking" (De Coninck et al., 2008, p.13)	Bouncing back' is a simple economic rationale, based on a cumulative capacity to resume economic activity (Resilient US, 2012)
	"...a scale-sensitive approach would help in particular to acknowledge that adaptations at the village level can sometimes impede adaptation at the household level" (Béné et al., 2012, p.27)	"Any approach to building resilience should not work with an idea of restoring equilibrium because systems do not have a stable state to which they should return after a disturbance" (Béné et al., 2012, p.20)
	"In reality... ...all decisions have more than one dimension or criterion to them or else there would not be much deciding to be done" (Scott, 2005, p.696)	The meaning of resilience varies according to the nature of disturbance: Source, awareness, severity, exposure, timing (Birkmann, Changseng and Wolfertz et al., 2012)
	"...those spheres over which an organization or partnership has direct control are distinguished from those spheres where it has only direct or indirect influence (i.e. outcomes)..." (Wimbush et al., 2012, p.313)	"community resilience in particular depends on not only the volume of economic resources, but also on their diversity and accessibility" (Britt et al., 2012, p.3)
for Transparency & Democracy	"Attributes of a resilient community [include that] …Our communities have realistic expectations of the levels of support available during an event" (WREMO, 2012, p.9)	"The focus needs to be on making things happen, rather than leaving them to chance, which suggests that the communities should be seen as both the source and the beneficiaries of the social development concept" (Schulenkorf, 2012, p.8)
	"A qualitative measure can... ...be as effective as a quantitative one, better adapted to the beneficiaries' reality, cheaper and faster to use" (De Coninck et al., 2008, p.118)	"It would be extremely useful for instance to start talking about 'bad resilience' (the same way that people were/are talking about good or bad governance)" (Béné et al., 2012, p.47)

"...risk management is always political and questions of power, i.e. who is the beneficiary and what are the short v long-term implications need to be asked" (2012 EQC Workshop notes, p.2)	A clearer, more consistent approach to planning, monitoring and evaluation from funders is essential (De Coninck et al., 2008, p.129)
"Building a common [planning, monitoring and evaluation] language understood by all... ...becomes a challenge in itself" (De Coninck et al., 2008, p.114)	The political rhetoric of resistence as resilience needs to be distinct from technical concepts of resilient, complex dynamic systems (Béné et al., 2012, p.45)
"While [outcomes analyses] make it more difficult to attribute results to individual interventions, scrutiny by government and civil society to ensure accountability of development spending has become more intense" (Thomas & Tominaga, 2010, p.372)	"…to gain a thorough understanding of the community and its vulnerabilities and to take them into account in planning" (Hamilton, 2012, p.2)
"Output monitoring, apart from ways to allocate all costs to an output, is generally fairly easy to conduct and... ...partner organisations have appropriate systems for this" (De Coninck et al., 2008, p. 16)	"...resilience... ...public policy... ...has all sorts of connotations from its more everyday meaning and usage – of rigidity, stoicism, self-sacrifice – that many... ...theorists would argue are not what is captured in the technical concept of resilience" (Béné et al., 2012, p.45)
"...a tool to implement a certain political vision and to ensure that particularly important groupings and issues... ...are not allowed to fall off the agenda" (Scott, 2005, p.700)	"Transformative measures include policies and interventions that seek to address concerns of social justice and exclusion..." (Béné et al., 2012, p.29-30)
"Giving gender imbalances... ...a clear practical form helps organisations rethink their change agenda and establish indicators for [relevant] changes" (De Coninck et al., 2008, p.117)	"The analysis could be strengthened by measuring [attributions] at the project, programme, and systemic levels" (Thomas & Tominaga, 2010, p.379)
"continuous engagement, increasing responsibility and local event ownership are described as success factors for projects in disadvantaged communities" (Schulenkorf, 2012, p.9)	"[Effective planning, monitoring and evaluation] takes into consideration the organisations' environment, its partners and competitors, in a context informed, among other factors, by local and national cultures" (De Coninck, 2008, p.23)

"There is a need to look beyond what is visible under the lamp post and to resist temptation to measure only things that are easy to measure with readily available tools" (Thomas & Tominaga, 2010, p.381)	A logic model framework provides: A tool to design evaluation assumptions, questions and activities through illustrating relationships between “mission, activities, and outcomes, and the surrounding external factors” (Zantal-Wiener & Horwood, 2010, p.58)
"Each engagement will have a clear purpose and measurable outcome" (WREMO, 2012, p.8)	"[Key performance indicators] would allow for a more rigorous evaluation of impacts, outcomes, strengths and weaknesses of... ...projects" (Schulenkorf, 2012, p.9)
"[Collecting frequent follow-up data] would need to be weighed against possible negative outcomes, such as clients feeling they are being pressured" (Stubbs & Achat, 2011, p.195)	"The most recent strategies for creating the conditions and content of supportive networks in the 21st century have been accelerated by a global women’s movement concerned with place-based politics" (Horelli, 2009, p.206)
"...a straight-forward, well documented data collection process for implementation by program staff" is a key component of community-based programme assessment" (Stubbs & Achat, 2011, p.195)	"...while the analytical and conceptual dimension of resilience... ...amongst academics has failed to provide appropriate responses to these issues of power and agency, those interested in the practical and operational dimensions of the concept have" (Béné et al., 2012, p. 20)
"In reality... ...all decisions have more than one dimension or criterion to them or else there would not be much deciding to be done" (Scott, 2005, p.696)	"Individual and household culture and values should be considered, respected and valued" (Britt et al., 2012, p.25)
"Public bodies need to provide a convincing picture of their unique contribution to shared outcomes, while also recognizing the limits of their influence and the unpredictability of the external environment" (Wimbush et al., 2012, p.312)	"Given the difficulty, contribution, rather than attribution, may need to be assessed, with clear acceptance that what we are doing is to reduce the uncertainty about the contribution made, not to prove the contribution made" (Thomas & Tominaga, 2010, p.381)

"Bottom-up approach that embraces local and tailored solutions" (Neely, 2012)	"Particular attention is paid to the issues of learning, capacity-building and the balancing of interdependences, which enhance the voice of the participants" (Horelli, 2009, p.220)
"The evaluation head would report to the Board, not to Management, and would provide the findings of the evaluation without negotiating or clearing with Management..." (Thomas & Tominaga, 2010, p.383)	"Choices have to be made... ...to balance the involvement of different groups (or their representatives) to tackle distrust and make a [planning, monitoring and evaluation] system fair and effective" (De Coninck et al., 2008, p.110)
"Collecting follow-up data more frequently could increase the proportion of clients from whom information is obtained" (Stubbs & Achat, 2011, p.195)	“...consensus-based planning or efforts directed by local communities... ...may simply reinforce short-sighted, parochial viewpoints” (Wheeler, 2004, p. 46)
"...communities will record their issues under a set of headings (referred to as clusters) which capture the higher order objectives of the municipality" (Scott, 2005, p.701)	"community development and participation should occur within a democratic environment that promotes procedural and distributive justice" (Britt et al., 2012, p.6)
"Giving gender imbalances... ...a clear practical form helps organisations rethink their change agenda and establish indicators for [relevant] changes" (De Coninck et al., 2008, p.117)	"...the facilitator chairs and coordinates the meetings or workshops... ...and focuses the participants to find the preferred way to provide a basis for comparing needs across areas, and a basis for establishing priority needs... ...as a whole as well as for each area" (Scott, 2005, p.701)

Table 9

Final Statement Sample[20]

Edited Statement	Original Source	Sampling Matrix Quadrant[1]
1. Those interested in practical and operational dimensions of resilience have found appropriate responses to the issues of power and agency.	Béné et al. (2012)	Theoretical x Democracy & Transparency
2. Communities should be both the source and the beneficiaries of making things happen, rather than leaving these things to chance.	Schulenkorf (2012)	Theoretical x Democracy & Transparency
3. Individual and household culture and values should be considered, respected and valued.	Britt et al. (2012)	Theoretical x Democracy & Transparency
4. It is essential to have a clearer, more consistent approach to planning, monitoring and evaluating community resilience.	De Coninck et al. (2008)	Theoretical x Democracy & Transparency
5. We need to consider connotations from the more everyday meaning and usage of resilience, for example: rigidity, stoicism, self-sacrifice.	Béné et al. (2012)	Theoretical x Democracy & Transparency
6. Attention to the issues of learning, capacity-building and balancing interdependencies will enhance the voice of community members.	Horelli (2009)	Theoretical x Democracy & Transparency
7. There is no need to talk about 'bad resilience' in the same way people talk about bad governance.[2]	Béné et al. (2012)	Theoretical x Democracy & Transparency
8. Choices have to be made to balance the involvement of different groups (or their representatives) to tackle distrust and make a planning, monitoring and evaluation system fair and effective.	Coninck et al. (2008)	Theoretical x Democracy & Transparency
9. We only need a basic understanding of the community and its vulnerabilities.[2]	Hamilton (2012)	Theoretical x Democracy & Transparency
10. Key performance indicators allow for a more rigorous evaluation of impacts, outcomes, strengths and weaknesses of projects.	Schulenkorf (2012)	Theoretical x Democracy & Transparency
11. Education programs need to consider beliefs including: uncertainty; emotions and feelings; and social norms.	Becker et al. (2013)	Theoretical x Planning & Management

[20] Originally published

12. Resilient communities are able to maintain basic community functions in times of disaster.	UNISDR (2005)	Theoretical x Planning & Management
13. Relationships and capabilities are interwoven.	WREMO (2012)	Theoretical x Planning & Management
14. The regional scale provides an obscure frame for planning and development.[2]	Morgan (2009)	Theoretical x Planning & Management
15. Resilience brings people and organisations with different initial agendas together around the same table, with the unique objective of ‘strengthening resilience’.	Béné et al. (2012)	Theoretical x Planning & Management
16. The capacity to recover and the degree of preparedness in communities are more important than poverty status.	Béné et al. (2012)	Theoretical x Planning & Management
17. The meaning of resilience is consistent regardless of whether the approach is anticipatory or recovery orientated.[2]	Birkmann, Changseng & Wolfertz et al. (2012)	Theoretical x Planning & Management
18. Our approach to community engagement is similar to many marketing strategies that offer a diverse range of products, and which cater for different interests and budgets.	WREMO (2012)	Theoretical x Planning & Management
19. Community cohesion does not require effective governance or institutions.[2]	Béné et al. (2012)	Theoretical x Planning & Management
20. Community resilience promotes a more rapid social and economic recovery following a devastating natural disaster.	Opus (2012)	Theoretical x Planning & Management
21. Volunteers are facilitative leaders for their community.	WREMO (2012)	Practical x Democracy & Transparency
22. Public bodies do not need to account for their unique contribution to shared outcomes.[2]	Wimbush et al. (2012)	Practical x Democracy & Transparency
23. A resilient community has realistic expectations of the levels of support available during an event.	WREMO (2012)	Practical x Democracy & Transparency
24. It is hard to build a common planning, monitoring and evaluation language understood by all.	De Coninck et al. (2008)	Practical x Democracy & Transparency

25. Each community development engagement should have a clear purpose and measurable outcome.	WREMO (2012)	Practical x Democracy & Transparency
26. A straight-forward, well documented data collection process is a key component of community-based programme assessment.	Stubbs & Achat (2011)	Practical x Democracy & Transparency
27. Risk management is never political. Questions of power, about who is the beneficiary and short versus long-term implications do not need to be asked.[2]	Glavovic (2012)	Practical x Democracy & Transparency
28. Collecting frequent follow-up data can make people feel pressured.	Stubbs & Achat (2011)	Practical x Democracy & Transparency
29. A bottom-up approach embraces local and tailored solutions.	Dan Neely (2012)	Practical x Democracy & Transparency
30. A qualitative measure can be as effective as a quantitative one, better adapted to the beneficiaries' reality, cheaper and faster to use.	De Coninck et al. (2008)	Practical x Democracy & Transparency
31. As people get increasingly prepared and connected, they can access many other opportunities to link into their community and enhance their resilience.	WREMO (2012)	Practical x Planning & Management
32. A systemic approach to community resilience is relevant because various types of shocks are now affecting groups of households or even entire communities.	Béné et al. (2012)	Practical x Planning & Management
33. Practitioners should be the primary facilitators in areas directly related to emergency preparedness.	WREMO (2012)	Practical x Planning & Management
34. The sophistication of monitoring and evaluation depends on access to relevant information technology.	De Coninck et al. (2008)	Practical x Planning & Management
35. We do not need to define collaborating agencies' role or their terms of collaboration.[2]	Stubbs & Achat (2011)	Practical x Planning & Management
36. A stronger focus on results starts from constructing a framework with projects and programmes integrated within the overall results chain.	Thomas & Tominaga (2010)	Practical x Planning & Management
37. Organisations have no use for evaluative findings.[2]	Thomas & Tominaga (2010)	Practical x Planning & Management
38. Regulations set standards that affect planning, monitoring and evaluation practice. Examples are government procedures, reporting formats, and accounting requirements.	De Coninck et al. (2008)	Practical x Planning & Management

39. It is important to have a governance framework that truly helps to find and adopt what matters to improve results.	Thomas & Tominaga (2010)	Practical x Planning & Management
40. As a consequence of monitoring, we may decide to adjust programs, change team patterns, or facilitate social bonds between individuals and groups.	Schulenkorf (2012)	Practical x Planning & Management
41. We already have enough good measures to capture contributions to desired results.[2]	Thomas & Tominaga (2010)	Practical x Generating Knowledge
42. Disaster impacts are well worth considering for a community's vulnerability profile.	Buckle (2006)	Practical x Generating Knowledge
43. Project teams should not waste their time exploring further opportunities across organisational boundaries.[2]	Thomas & Tominaga (2010)	Practical x Generating Knowledge
44. A combined set of quantifiable and qualifiable indicators should be considered, across several aspects of resilience.	WREMO (2012)	Practical x Generating Knowledge
45. Practitioners need to step back, consider the objectives of their interventions and then consider how resilience may support or actually hinder these objectives.	Béné et al. (2012)	Practical x Generating Knowledge
46. As 'knowledge producers', academic groups and consultants can participate in the design and testing of new planning, monitoring and evaluation systems.	De Coninck et al. (2008)	Practical x Generating Knowledge
47. The effectiveness of activities can be assessed without depending on baseline data.[2]	Thomas & Tominaga (2010)	Practical x Generating Knowledge
48. Cost-benefit analysis does not get at the impact of a project.	Thomas & Tominaga (2010)	Practical x Generating Knowledge
49. Organisations have a lot of informal knowledge about outcomes.	De Coninck et al. (2008)	Practical x Generating Knowledge
50. This is a living lab of how to build a resilient city.	David Johnston, at 2012 Emergency Management Summer Institute (field note)	Practical x Generating Knowledge
51. Earthquake beliefs are irrelevant to actual preparedness activities.	Becker et al. (2012)	Theoretical x Generating Knowledge

52. The focus becomes finding the 'right' or 'optimal' solution, rather than developing insight into complex problems.[2]	Scott (2005)	Theoretical x Generating Knowledge
53. The gap between discipline-specific definitions of resilience has been bridged.[2]	Birkmann, Changseng & Wolfertz et al. (2012)	Theoretical x Generating Knowledge
54. While monitoring can provide information about what is being achieved or not achieved, it cannot answer questions about why this is happening.	Thomas & Tominaga (2010)	Theoretical x Generating Knowledge
55. Traditional survival measures (e.g. water stored) do not adequately account for the holistic, unpredictable and messy characteristics of social capital.	WREMO (2012)	Theoretical x Generating Knowledge
56. Resilience exists at multiple levels or scales: individual, household, community, system, society, etc.	Paton (2006)	Theoretical x Generating Knowledge
57. Learning in the hazards domain is not enough. There is a need for cross-over, e.g. with climate change.	Glavovic (2012)	Theoretical x Generating Knowledge
58. A lot more qualitative and quantitative research is needed to either confirm or reject that sport and events have actually contributed to community development.	Schulenkorf (2012)	Theoretical x Generating Knowledge
59. In order to deal with complexity, it is important to specify which communities we are talking about.	John Vargo at 2012 launch of Canterbury University resilience framework. (field note)	Theoretical x Generating Knowledge
60. Individuals are independent from the wider community, organisations, institutions, and so on.	Britt et al. (2012)	Theoretical x Generating Knowledge

[1]Allocated to these categories by piloting representatives

[2]Direction reversed as result of piloting

Appendix E: Study One Data Set

Practitioner 1

-5	-4	-3	-2	-1	0	+1	+2	+3	+4	+5
60	37	26	32	46	42	44	39	29	12	3
28	43	53	36	8	45	10	58	2	49	23
	51	22	52	24	18	50	15	54	7	
		19	30	14	59	48	55	33		
			38	6	47	21	20			
			27	17	4	56	31			
			57	16	41	11	13			
				9	35	1				
				5	25	40				
					34					

Practitioner 2

-5	-4	-3	-2	-1	0	+1	+2	+3	+4	+5
9	37	22	19	34	58	59	4	49	21	12
60	48	54	47	41	33	55	18	31	13	56
	27	5	7	39	8	45	26	23	29	
		53	24	38	46	36	15	44		
			43	51	3	10	50			
			35	30	6	28	20			
			14	52	2	16	25			
				17	40	42				
				1	11	32				
					57					

Practitioner 3

-5	-4	-3	-2	-1	0	+1	+2	+3	+4	+5
60	53	25	37	51	45	4	31	13	20	2
43	35	47	41	5	49	44	3	12	56	29
	27	22	17	28	16	40	46	23	21	
		24	19	58	39	1	32	6		
			9	54	42	59	50			
			36	34	30	11	15			
			7	14	26	48	55			
				10	52	38				
				8	33	18				
					57					

Practitioner 4

-5	-4	-3	-2	-1	0	+1	+2	+3	+4	+5
37	22	60	52	54	5	27	56	2	29	21
43	10	45	14	28	19	38	31	12	18	36
	41	35	24	32	11	17	47	6	23	
		58	9	33	16	40	7	20		
			53	26	49	44	46			
			59	34	4	50	15			
			30	39	3	57	25			
				48	42	55				
				51	1	13				
					8					

Practitioner 5

-5	-4	-3	-2	-1	0	+1	+2	+3	+4	+5
60	52	8	1	50	7	2	6	31	12	29
51	43	22	10	30	44	25	15	3	20	56
	54	9	18	14	45	19	16	49	23	
		27	37	5	4	42	21	11		
			41	53	34	28	32			
			59	26	46	17	55			
			48	58	36	38	13			
				47	35	33				
				24	40	57				
					39					

Figure 18. Practitioner Q-sort data.

Researcher 1

-5	-4	-3	-2	-1	0	+1	+2	+3	+4	+5
24	33	53	25	29	54	10	42	56	20	57
37	35	28	52	59	16	49	4	15	40	19
	22	38	36	58	41	2	44	55	13	
		43	51	23	48	21	31	1		
			9	12	27	8	11			
			60	14	6	47	46			
			34	39	3	18	45			
				17	7	50				
				32	30	26				
					5					

Researcher 2

-5	-4	-3	-2	-1	0	+1	+2	+3	+4	+5
47	37	16	60	5	54	15	21	50	46	12
41	43	27	17	39	31	26	4	45	2	55
	9	19	36	53	7	32	11	25	20	
		51	48	28	49	59	10	29		
			14	58	8	3	40			
			1	52	33	38	44			
			35	22	6	42	56			
				34	18	23				
				24	13	30				
					57					

Researcher 3

-5	-4	-3	-2	-1	0	+1	+2	+3	+4	+5
47	34	53	19	51	58	13	45	4	11	56
60	43	22	18	17	10	30	29	2	40	20
	9	35	37	36	15	42	23	46	26	
		27	1	7	31	50	55	6		
			16	33	3	38	59			
			32	24	41	48	44			
			52	5	21	25	54			
				14	8	57				
				28	49	12				
					39					

Researcher 4

-5	-4	-3	-2	-1	0	+1	+2	+3	+4	+5
60	37	9	53	1	15	32	28	12	50	56
27	22	47	33	18	58	59	21	10	44	20
	51	19	43	7	24	5	31	57	48	
		52	16	2	6	45	25	40		
			35	38	23	46	26			
			17	14	13	54	42			
			34	41	36	4	11			
				39	49	29				
				8	55	3				
					30					

Researcher 5

-5	-4	-3	-2	-1	0	+1	+2	+3	+4	+5
47	35	37	43	7	22	11	39	40	57	56
27	1	16	8	18	34	44	45	3	49	54
	51	21	14	19	13	2	42	31	38	
		24	26	9	36	55	25	12		
			17	33	52	59	4			
			50	30	53	10	15			
			28	20	46	48	23			
				60	41	5				
				29	6	58				
					32					

Figure 19. Researcher Q-sort data

Appendix F: Tables Showing Initial Results from Study One Factor Analysis

Table 10

Correlations between Q-Sorts

Sort*	P 1	P 2	P 3	P 4	P 5	R 1	R 2	R 3	R 4	R 5
P 1	1.00	.47	.57	.44	.55	.32	.48	.42	.41	.43
P 2	.47	1.00	.71	.57	.70	.42	.65	.58	.63	.34
P 3	.57	.71	1.00	.61	.66	.49	.68	.70	.59	.37
P 4	.44	.57	.61	1.00	.60	.42	.45	.38	.35	.15
P 5	.55	.70	.66	.60	1.00	.34	.54	.50	.51	.38
R 1	.32	.42	.49	.42	.34	1.00	.38	.51	.48	.30
R 2	.48	.65	.68	.45	.54	.38	1.00	.73	.66	.49
R 3	.42	.58	.70	.38	.50	.51	.73	1.00	.74	.52
R 4	.41	.63	.59	.35	.51	.48	.66	.74	1.00	.51
R 5	.43	.34	.37	.15	.38	.30	.49	.52	.51	1.00

*P = Practitioner Sort, R = Researcher Sort

Table 11

Initial Factors from Centroid Extraction

	Factors		
	1	2	3
Practitioner Sort 1	0.6293	-0.1133	0.016
Practitioner Sort 2	0.801	-0.159	0.0317
Practitioner Sort 3	0.861	-0.1326	0.0225
Practitioner Sort 4	0.6079	-0.3764	0.2128
Practitioner Sort 5	0.7522	-0.3422	0.1665
Researcher Sort 1	0.5559	0.0425	0.0013
Researcher Sort 2	0.801	0.1156	0.0138
Researcher Sort 3	0.8063	0.387	0.2118
Researcher Sort 4	0.7705	0.3275	0.137
Researcher Sort 5	0.5306	0.2627	0.0811
Eigenvalues	5.1903	0.6557	0.1451
% Variance Explained	52	7	1

Appendix G: Characteristics of Factor B in Order of Descending Z-Scores[21]

Characteristic Q Statements	Z-Score	Qualitative Explanations
56. Resilience exists at multiple levels or scales: individual, household, community, system, society, etc.	2.35*	"Indicators of resilience exist and can be measured across different levels" (researcher sort 4);
47. The effectiveness of activities can be assessed without depending on baseline data.	-2.04*	"Assessment requires data" (researcher sort 2).
60. Individuals are independent from the wider community, organisations, institutions, and so on.	-2.04	"I strongly believe individuals are dependent on other parts of society to be resilient" (researcher sort 4).
20. Community resilience promotes a more rapid social and economic recovery following a devastating natural disaster.	1.88	"This is an outcome of a resilient community" (researcher sort 4).
27. Risk management is never political. Questions of power, about who is the beneficiary and short versus long-term implications do not need to be asked.	-1.88	"Assessment of what risk treatment methods are acceptable or not will require an assessment of effects and some judgements will need to be made" (researcher sort 4).
40. As a consequence of monitoring, we may decide to adjust programs, change team patterns, or facilitate social bonds between individuals and groups.	1.65**	Nil.

*Statements distinguishing factor B from factors A and C at $p < .05$ level.
**Statements distinguishing factor B from factors A and C at $p < .01$ level.

[21] This table originally published with online version of: Huggins, T.J., Peace, R., Hill, S.R., Johnston, D.M., & Cuevas, A. (2015a). Politics of practical and academic knowledge: A Q-method analysis of gauging community disaster resilience. *Journal of Contingencies and Crisis Management*, *23*, 246-256.

Appendix H: Characteristics of Factor C in Order of Descending Z-Scores[22]

Characteristic Q Statements	Z-Score	Qualitative Explanations
60. Individuals are independent from the wider community, organisations, institutions, and so on.	-2.04	"If you were to create tags for an individual for all the different groups they are connected to somehow, it would be a really long list. Family, household, street, a suburb, the shops they visit, the sports team they play for or support, the doctor they visit, the support they receive. No man is an island" (practitioner sort 3); "Individuals are part of the wider system – community, business environment etc." (practitioner sort 2).
43. Project teams should not waste their time exploring further opportunities across organisational boundaries.	-1.90	"Emergency preparedness and resilience applies to all organisations, so we need to learn to work with other organisations to improve that. While we may know our stuff when it comes to emergency management and hazards, the organisations know best what impacts an event will have on themselves." (practitioner sort 3).
37. Organisations have no use for evaluative findings.	-1.85	"Without proper evaluation techniques, how can organisations determine the success of any programmes or projects?" (researcher sort 1).
12. Resilient communities are able to maintain basic community functions in times of disaster.	1.82*	"Communities should be able [to] look after one another with the basic essentials immediately after an emergency event – people are housed and medical facilities are operating, for example" (practitioner sort 2).

[22] This table originally published with online version of: Huggins, T.J., Peace, R., Hill, S.R., Johnston, D.M., & Cuevas, A. (2015a). Politics of practical and academic knowledge: A Q-method analysis of gauging community disaster resilience. *Journal of Contingencies and Crisis Management*, *23*, 246-256.

29. A bottom-up approach embraces local and tailored solutions.	1.68**	"There isn't a silver bullet that will work for everyone due to whatever unique circumstances affect them. Local communities have different profiles of risk and vulnerability to impacts, and different levels of resilience" (practitioner sort 3).
20. Community resilience promotes a more rapid social and economic recovery following a devastating natural disaster.	1.66	"This is an outcome of a resilient community" (researcher sort 4).

*Statements distinguishing factor B from factors A and C at $p < .05$ level.
**Statements distinguishing factor B from factors A and C at $p < .01$ level.

Appendix I: VMEP Logic Model Design

For Study Two, Active participation needed to be fostered through the careful design of evaluability assessment information. Although a visual logic model provides a simplified, action-orientated, representation of dynamics within a complex domain, the drawing rules for VMEP logic models outlined by Duignan (2012b) are relatively un-prescriptive. This means that the level and methods of simplification used to build a VMEP logic model can vary widely. Information design guidelines, and associated cognitive aspects, became important considerations for carrying out a VMEP process during Study Two action research.

The importance of information design for constructing VMEP-like logic models was highlighted by Huggins and Jones (2012), whose participants described the acute cognitive strain of trying to follow a visual logic modelling process combining many visual cues on the same display. Likewise, Iwasaki (2007) found that research participants became more stressed when they were asked to respond to multiple visual cues over a shorter time period, rather than working through the same visual elements at a more measured pace. Attention to these cognitive aspects of visual information design represented a response to commentary from Hegarty (2011), that “although cognitive science is central to the design of visual displays, the development of new display technologies is often uninformed by cognitive science” (p. 447). The following considerations also represent a response to a prior conclusion from Scaife and Rogers (2008), that a cognitive analysis is required to “inform the selection and design of….graphical technology” (p. 185).

Cairo (2012) illustrated how a display depicting one clear dimension at a time demands fewer cognitive resources from the display user. This was achieved by comparing graphical representations of military budgets along the same horizontal axis. Cairo (2012) achieved this by positioning the x axes of a series of bar charts along the same level. Simplifying a logic model into a clear series of levels may help minimise the strain of considering multiple interactions within complex systems all at the same time. As illustrated in Huggins and Jones (2012), a layered approach could minimise the amount of information which Study Two participants needed to process at any one time. Other cognitive considerations were outlined by Cairo (2012), in his wheel of information design characteristics. An iteration of this wheel is shown in figure 20.

The accumulated design experience represented by Cairo’s (2012) visualization wheel reinforced an assumption outlined in Chapter 1, that the regional community resilience strategy may have been too abstract to represent in one coherent diagram. Although the WREMO (2012) strategy outlined a number of tangible activities, the general concept of systematic community resilience remained relatively ephemeral. Furthermore, the VMEP logic model developed in Study Two was focused on how to plan, monitor and evaluate this regional strategy. This required simultaneous representations of strategic priorities and key performance indicator placement which were multidimensional, abstract and functional features. According to figure 20, these features added to the complexity and depth of the VMEP logic model display. As a “complex and deeper” (Cairo, 2012, ch. 3, para. 24) infographic, the VMEP logic model was likely to be challenging for some of the workshop participants.

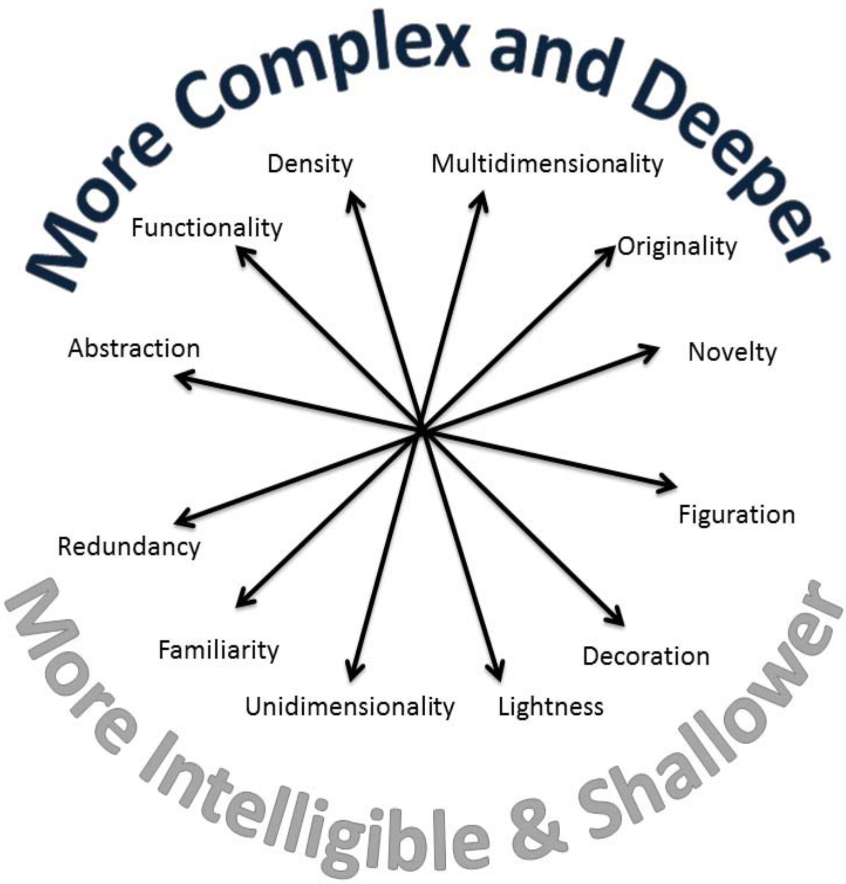

Figure 20. Dimensions of infographic complexity. Adapted from *The Functional Art* (ch. 3, para. 24) by A. Cairo, 2012, Berkley, CA: New Riders. Copyright 2012 by New Riders. Adapted with permission.

In an effort to make the VMEP logic model more intelligible, it was simplified as much as possible. The majority of terms contained in the logic model were reproduced from the existing WREMO (2012) document to increase the likelihood of familiarity. The density of information was reduced through displaying a simple set of two columns of information on a single page. However, Cairo (2012) also advised not to underestimate the audience, many of whom may appreciate having further detail available. VMEP logic modelling can include a layered approach to information through drill-down layers and hyperlinks. This meant further layers would be incorporated where the need for a greater depth of information was raised by workshop participants.

Considering Colour

Heller (2013) surveyed German adults working in a range of professional roles to compile an extensive list of colour preferences and connotations. Her survey data helped build colour priorities and weights for communicating certain emotional themes and other connotations amongst professional adults. The colour scheme for figure 21 was selected because it reflected Heller's (2013) colour weightings for a connotation of intelligence. It was assumed that connotations of intelligence would be associated with research activities. However, Heller's (2013) connotations also needed to be tested against the perceptions of a pilot group of New Zealand professionals. This pilot group reported the following connotations when presented with the colour scheme shown in figure 21: funeral, cold, boring, cloudy, windy, pastel, sand, quiet, respectable, non-threatening, bland.

According to Heller (2013), the colour scheme shown in figure 22 represented connotations of security. The New Zealand based pilot group reported the following connotations when presented with this colour scheme: forest, nature, cold, spring, fresh, welcome, pastel, pretty, non-threatening, clean. These connotations seemed more positive and more closely related to the purpose of the VMEP process compared to connotations concerning the previous colour scheme. The second colour scheme was therefore selected as the more engaging option for a New Zealand audience. This colour scheme also made use of the default colours provided by proprietary DoView (Version 4.0, 2013) software. Given the high contrast between these default colours and black lettering, these colours appear to have been designed to make embedded text as clear as possible.

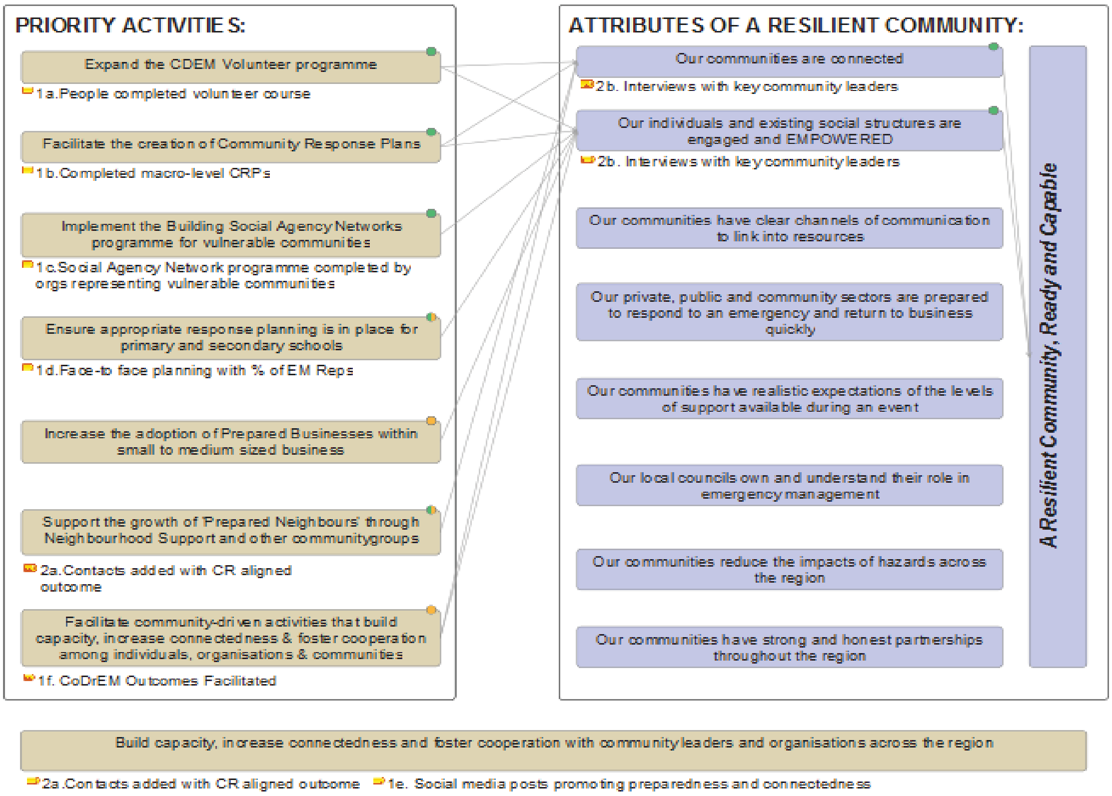

Figure 21. Potential colour scheme 1 to denote ‘intelligence’.

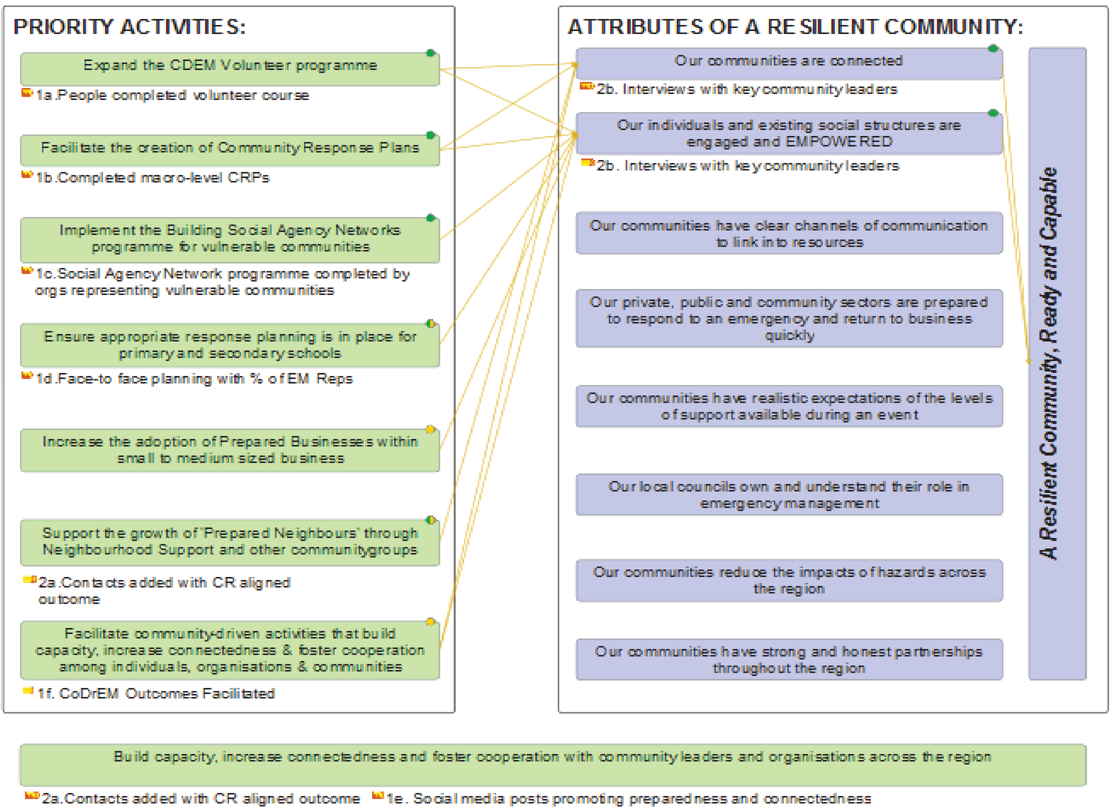

Figure 22. Potential colour scheme 2 to denote ‘security’.

Appendix J: Final Study Two Interview Schedule

I'm going to ask you about the workshop we ran at Wellington Region Emergency Management Office on Thursday the 20th of March. It is important that I get your views on the tools and processes that we used. I would especially like to hear about how you contributed to the workshop, using those tools and processes.

I will take some notes but the audio recording is the main thing. Can I turn the recorder on now, and can I ask you to turn your phone onto silent or off?

1. How did you find the introduction to the workshop?

-How did you find Dan's introduction? -How did you find my introduction?

2. Please describe what you thought about this initial WREMO outcomes framework? *[Place initial framework on desk]*

-What happened during the discussions of the framework?

3. Did you provide any ideas, to be put back onto the framework? [Refer to post-model?]

-How did that go? -What did your group offer?

4. What did you think of the reports back, from each group?

5. What did you think of the working framework, once groups had reported back?

-How did this compare to prior experiences of collaborative research planning?

6. What did you think about the framework, once it had been tidied up and emailed to you? *[Place tidied framework on desk]*

7. How could the tidied-up framework be used from here?

-How do you think it will probably be used? -Are you interested in providing further feedback on it?

8. What is resilience? …Why not just preparedness?

9. How do we know the characteristics of resilience are valid?

Appendix K: Detailed Assessment of the Study Two Action Research Intervention

As outlined in Chapter 5, a six-step evaluability assessment focuses on “whether programs are ready for useful evaluation; get agreement on program goals and evaluation criteria; clarify the focus and intended use of further evaluation” (Wholey, 2010, p. 83). These six steps were modified to incorporate the VMEP process and certain steps of evaluability assessment were better implemented than others. The following reflection on each of the six steps was constructed by combining field notes taken during the action research with the analyses of participant interviews outlined in 6.3 and 7.1. It is framed by description of the step, an identification of problems that emerged and an explanation of the measures taken to address those problems.

1. Engage Stakeholders and Other Users

This step of evaluability assessment was carried out prior to the main consultation workshop. It focused on fostering a wider approach to community representation, beyond WREMO and its associated research organisations, the Joint Centre for Disaster Research and GNS Science. The scope of stakeholder engagement during Study One was therefore widened to include a number of representatives from Wellington-based research institutions who had been working in disaster-related areas. To maximise participation, up to seven weeks of notice was given ahead of the workshop and invitees were asked to nominate a replacement if they were not personally available.

The workshop process outlined in Chapter 5 was relatively technical so my preference was to engage an even wider range of community representatives at a later stage. It seemed best to involve community representatives in discussions about monitoring and evaluation at the more local scales which they represented, rather than a workshop to cover the entire region. Inviting community representatives at this very early stage of the ICoE:CR may have sounded egalitarian. However, it also threatened to sacrifice the coherence of what this new ICoE:CR was and what they were trying to achieve. The strong differences identified between researchers and practitioners in Study One still had to be accommodated, before these professionals could present their centre's *raison d'être* to a wider set of stakeholders.

The previous chapter outlined how researcher and practitioner differences were both accommodated and mitigated during Study Two. Content from post-workshop interviews relating to localised, operational issues was much more evenly distributed than the distribution of an equivalent pre-workshop viewpoint, identified in Study One. This shift in distribution indicates that researchers' attention became much more closely aligned with practitioners during the evaluability assessment process.

As outlined in Chapter 5, an apparent alignment between disparate viewpoints had the potential to avoid an escalating cycle of inter-group friction. However, this only concerned the working relationship between researchers and WREMO practitioners. Progress made in this area did not reflect a broadly inclusive approach to stakeholder engagement. The three problems outlined below contributed to the narrow representation of stakeholders during Study Two. These problems concerned researcher, practitioner and even wider community representation.

Efforts to engage a range of researcher stakeholders through considerable communication leading up to the Study Two workshop were only partially successful. I was unable to secure participation from the National Institute of Water and Atmospheric Research and the University of Otago. Each of these organisations had substantial expertise in disaster-related areas. The absence of their representatives therefore represented the loss of important contributions to the Study Two workshop and consequent ICoE:CR initiatives.

Regarding practitioner participants, WREMO's partner agencies had not yet been identified. This meant that, in the absence of allied practitioner representatives, only WREMO practitioners were invited to the Study Two workshop. This second of three issues for stakeholder engagement meant the evaluation assessment did not address the need for collaborations between multiple emergency management agencies outlined by Kapucu (2012) and discussed in the Initial Literature Review chapter. Considering the need for widely collaborative approaches to contemporary emergency management operations in urban contexts, the evaluability assessment plainly did not represent the full range of agencies involved in emergency management across the Wellington region.

A wider range of community representatives was invited to participate, but only very late in the workshop planning process. This was the third problem emerging during the evaluability assessment process. Despite my preference for involving the wider community at more local scales, WREMO managers insisted on inviting volunteer representatives only. WREMO subsequently promoted participation from their community volunteers within the last two weeks leading up to the workshop but there appeared to be very little interest. Of the two volunteer representatives who attended, one identified themselves as a researcher by profession and the other as an emergency manager.

The general breadth of stakeholder engagement was partially addressed by incorporating a greater range of research institutions. Interviews used to help document and analyse the evaluability assessment offered a way to enhance this broader approach to engagement with researchers in particular. This included adjusting the Study Two interview schedule, to give participants the opportunity to add further questions to the post-workshop VMEP model.

2. Clarify Program Design

The design of the WREMO community resilience strategy was largely clarified for the purposes of evaluation before the main workshop. As outlined in the previous chapter, the VMEP logic model was designed in collaboration with the WREMO Community Resilience Manager. The logic model approved by this manager and by the manager of WREMO as a whole summarised all major components outlined in WREMO's (2012) regional community resilience strategy document. The logic model also included the current set of indicators being used by WREMO to gauge progress on their objectives. This approach helped address major pitfalls outlined by Wholey (2010) which occur when a program has vague objectives or no clear way to measure progress on those objectives.

The resulting VMEP logic model also illustrated another problem emerging from the evaluability assessment process, that the WREMO community resilience strategy had taken a relatively short term view of community resilience outcomes. Neither the original WREMO (2012) strategy document nor the VMEP logic model outlined a coherent set of down-stream outcomes that would result from WREMO community resilience activities and objectives. This shortfall did not appear addressed by the consensus identified in factor C of Study One, concerning a shared focus on improving long-term, post-disaster outcomes.

As with problems emerging during step one of the evaluability assessment, I was largely unable to mitigate this focus on short term objectives. Developing a detailed set of potential downstream outcomes would have probably taken many more months, outside both the timeframe and scope of the current thesis. The VMEP logic model was therefore developed as a representation, rather than an improvement on, the original WREMO (2012) strategy. WREMO's apparently unmitigated focus on short term objectives appeared to extend into the main Study Two workshop. Many excerpts from participants' accounts of the workshop and surrounding evaluability assessment related to the code of 'Positive Resilience Outcomes'. However, as outlined in the previous chapter, almost all of these excerpts concerned characteristics of a resilient community –rather than downstream, post-disaster outcomes benefitting such communities. The relevance of higher-level, downstream outcomes is further discussed in Chapter 11.

3. Explore Program Reality

Step three of the current approach to evaluability assessment focused on further developing the VMEP logic model, in order to explore real constraints on the WREMO (2012) Community Resilience Strategy. It was assumed that distinguishing organisational priorities would more closely reflect actual WREMO capacities, rather than a more idealistic interpretation of their program. Like steps one and two, this step was largely completed prior to the workshop, in meetings with the Manager, WREMO Community Resilience. It included selecting priorities amongst the broad span of WREMO community resilience activities and objectives while making more explicit links about which prioritised activities would lead to which objectives.

A problem emerged from this step of the evaluability assessment when workshop participants suggested that the linkages were incomplete. In an effort to resolve this issue, I explained that the VMEP logic model displayed a highly selective view of the WREMO community resilience strategy, focused on the most active components. One link to a non-priority objective was requested despite my explanation. This link did not seem to overcomplicate the VMEP logic model as a whole. Adding the link appeared to ensure that the VMEP logic model provided an engaging medium for all participants. In evidence, it was observed that every research question agreed upon by the workshop as a whole was plotted onto at least one section of the logic model shown in figure 13.

4. Assess Program Plausibility

This step of evaluability assessment was undertaken as part of the Study Two workshop, in an effort to identify gaps between what WREMO was doing and what they were trying to achieve. As outlined in Chapter 5, participants were encouraged to develop research questions, rather than outright criticisms of the WREMO community resilience strategy. Discussion among workshop participants raised a number of issues in relation to the VMEP logic model components, priorities, linkages and existing indicators. The identification of these issues led to the formulation of 35 different research questions addressing issues raised. As outlined in the previous chapter, workshop participants plotted these questions back onto the working version of the VMEP logic model. This marks dual functions of the VMEP logic model, as a catalyst for both formulating and recording program-focused research questions. The notion of the VMEP logic model was also reflected in the content analysis code, ‘VMEP as a Catalyst’, as outlined in the previous chapter.

5. Agree on Program amendments

This step of evaluability assessment spanned before, during and following the workshop. Draft key performance indicators were mapped onto the logic model prior to the main workshop, to show performance measures being developed by the WREMO Community Resilience Team. This helped direct stakeholders' attention to the ways WREMO could inform amendments to their own community resilience program. The VMEP logic model illustrated how these indicators were almost exclusively focused at the output level, on the quantity rather than quality of community resilience interventions. The VMEP logic model therefore highlighted the need for program amendments which were not solely informed by internal key performance indicator data.

A large number of research questions raised by workshop participants represented a constructive critique of the regional strategy. However, these questions did not prompt immediate amendments to the strategy during the workshop. This lack of immediate amendments represented the loss of two major opportunities. As outlined in the previous chapter, there was still no research-based model being used to inform the initial WREMO strategy represented by the VMEP logic model. Several research-based models and relevant amendments could have been suggested by researcher participants, based on their relatively technical expertise. However, this did not occur, even when all participants were asked to suggest improvements to the VMEP logic model. Some critique of the model was raised by researchers during post-workshop interviews. In an attempt to mitigate the absence of research-informed critique during the workshop, these comments were converted to research questions before being added to the initial list.

Cultural perspectives on community resilience appeared to make little immediate impact on the overall framework, despite participation from a researcher from a highly relevant program of research in partnership with Te Rūnanga o Ngāi Tahu. One question was added to the overarching principles, concerning how these principles aligned with the principles of the Treaty of Waitangi. However, culturally-specific amendments raised during post-workshop interviews were not raised during the actual workshop. By this stage, it was too late to discuss these amendments with the group as a whole. As an aside, the ICoE:CR leadership group subsequently confirmed that cultural amendments to community resilience interventions in the Wellington region were being pursued outside of direct consultation with Study Two participants.

6. Agree on Further Evaluation

This aspect of evaluability assessment was pursued before, during and following the workshop. As outlined above, a draft set of key performance indicators for internal performance monitoring was added to the VMEP logic model prior to the main workshop. I had originally intended to include research design as one of the workshop activities. Hence invitations to the workshop called it the Collaborative Research Design Workshop.

Despite the use of this title, participants did not engage in any detailed research planning during the workshop. Instead, each sub-group of workshop participants agreed to leave research design to individual researchers and combined working groups, after the workshop. Following the Study Two workshop, participants said that they had very little interest in more detailed research planning. Researcher participants' interviews stated that, even though I had asked them to provide initial research designs, they felt this would have alienated practitioners. The lack of research designs was marked by very little information on drill down views of each research question. Practitioners' interviews did not include any substantive comments on this issue.

A lack of interest in more detailed research planning emerged near the end of the evaluability assessment process and was unable to be mitigated. It seems that collaborative research design was not such an appropriate name or objective for the main Study Two workshop. It could be assumed that the VMEP logic model was unable to accommodate detailed research designs. However, a previous case study by Huggins and Peace (2014), of using VMEP layers to plan and monitor complicated research into sustainability, has suggested otherwise. It seems more accurate to suggest that the practitioners in this case had other interests and priorities than engaging in collaborative research design. This does not suggest their lack of interest in research questions or findings. Regardless, the resulting lack of progress in step six of evaluability assessment marks how evaluative activities were highlighted and promoted, rather than planned, as a result of Study Two action research.

Appendix L: Expert Rating Form

1. Decision Accuracy[1]

1.1 How many genuine problems has the participant detected? #

1.2 How accurately has the participant described each problem?
(please mark with 'X' and continue at bottom of page if more than 5 anomalies detected)

	0 (not at all)	1	2	3	4	5 (perfectly)
Anomaly 1						
Anomaly 2						
Anomaly 3						
Anomaly 4						
Anomaly 5						
1.3 How accurate is their overall description of what has occurred?						

2. Situational Awareness

	0 (nil)	1	2	3	4	5 (complete)
2.1 Participant's awareness of what has happened with the programme[1]						
2.2 Participant's awareness of the implications of what has happened[1]						

2.3 Have they translated awareness into a feasible course of action?

	0 (not at all)	1	2	3	4	5 (perfectly)
a. Seeking further information[2]						
b. Amending the original strategy and/or indicator framework[3]						

[1] Mainly from question 1
[2] Mainly from question 2
[3] Mainly from question 3

Appendix M: Low Risk Notifications to Ethics Committee

Massey University
Te Kunenga ki Pūrehuroa

NOTIFICATION OF LOW RISK RESEARCH/EVALUATION INVOLVING HUMAN PARTICIPANTS

(All notifications are to be typed)
(Do not modify the content or formatting of this document in any way)

SECTION A:

1. **Project Title** Technical Aspects of Monitoring and Evaluation for Community Resilience

Projected start date for data collection 15 February, 2013 **Projected end date** 15 August, 2013

(Low risk notifications will not be processed if recruitment and/or data collection has already begun.)

2. **Applicant Details** *(Select the appropriate box and complete details)*

ACADEMIC STAFF NOTIFICATION

Full Name of Staff Applicant/s

School/Department/Institute

Region *(mark one only)* **Albany** ☐ **Palmerston North** ☐ **Wellington** ☐

Telephone **Email Address**

STUDENT NOTIFICATION

Full Name of Student Applicant Thomas Huggins

Postal Address 34a Mornington Road, Brooklyn, Wellington 6021

Telephone X62456 **Email Address** t.j.huggins@massey.ac.nz

Employer (if applicable) Joint Centre for Disaster Research, Massey University

Full Name of Supervisor(s) Associate Professor Robin Peace; Doctor Stephen Hill

School/Department/Institute School of People, Environment and Planning; School of Psychology

Region *(mark one only)* **Albany** ☐ **Palmerston North** ☐ **Wellington** √

Telephone x62172 ; x6566 **Email Address** r.peace@massey.ac.nz ; s.r.hill@massey.ac.nz

GENERAL STAFF NOTIFICATION

Full Name of Applicant

Section

Region *(mark one only)* **Albany** ☐ **Palmerston North** ☐ **Wellington** ☐

Telephone **Email Address**

Full Name of Line Manager

Section

Telephone **Email Address**

3 Type of Project *(provide detail as appropriate)*

Staff Research/Evaluation:		Student Research:		If other, please specify:
Academic Staff		Name of Qualification	PhD	
General Staff		Credit Value of Research	120	
Evaluation		(e.g. 30, 60, 90, 120, 240, 360)		

4. Describe the process that has been used to discuss and analyse the ethical issues present in this project.
(Please refer to the Low Risk Guidelines on the Massey University Human Ethics Committee website)

The researcher has read and discussed the Massey University Code of Human Ethics and the Ethical Guidelines in relation to the current research. These ethical considerations have been discussed with their supervisors Stephen Hill and Robin Peace, who is an expert in social sector evaluation. The same considerations have been discussed with David Johnston and Raj Prasanna, of the Joint Centre for Disaster Research. All concluded that the current proposal meets MUHEC criteria for a low risk application.

The research will focus on working interactions between operational personnel and disaster researchers, which are not considered personal or private. Participants are professional adults and are not vulnerable in the research context. There is no deception or conflict of interest involved.

The researcher will be providing technical assistance to the Wellington Regional Emergency Management Office (WREMO). Dissemination of planning documents and findings produced remains subject to release by the line manager of WREMO community resilience. This manager will also have the right to terminate the research at any stage.

Findings will also be produced through q-methodology, where participants sort statements common to community resilience monitoring and evaluation. These statements will not relate to individual performance and results are anonymised during analysis.

5. Summary of Project

Please outline the following (in no more than 200 words):

1. **The purpose of the research, and**
2. **The methods you will use.**

(Note: ALL the information provided in the notification is potentially available if a request is made under the Official Information Act. In the event that a request is made, the University, in the first instance, would endeavour to satisfy that request by providing this summary. Please ensure that the language used is comprehensible to all)

The purpose of the research is to identify a range of views about monitoring and evaluating community resilience, in order to contribute to the development of evaluation and monitoring initiatives. Wellington Regional Emergency Management Office (WREMO) personnel and the disaster researchers who assist them will comprise the participant groups.

Q Methodology will be used. In this instance, the researcher will collate and refine a list of ideas and common statements from accessible literatures (both formal research findings and grey literatures) relating to perceptions of practice in monitoring and evaluating community resilience. The final set of statements will be administered online using proprietary software to the research participants (who will be both field operational and researcher staff). These participants are required to sort and rank the statements according to their own perceptions of each statement's salience.

The online q-methodology protocol requires individual informed consent before commencing the activities. The statistical results produced are automatically anonymised and where participants have made comments in their responses these comments will be anonymised by the researcher.

These anonymised data will then be used to inform, through facilitated group discussions, the development of a monitoring and evaluation framework for WREMO.

Please submit this Low Risk Notification (with the completed Screening Questionnaire) to:

The Ethics Administrator
Research Ethics Office
Courtyard Complex, PN221
Massey University
Private Bag 11 222
Palmerston North

Massey University
Te Kunenga ki Pūrehuroa

NOTIFICATION OF LOW RISK RESEARCH/EVALUATION INVOLVING HUMAN PARTICIPANTS

(All notifications are to be typed)
(Do not modify the content or formatting of this document in any way)

SECTION A:

1. Project Title Technical Aspects of Monitoring and Evaluation for Community Resilience (Part II)

Projected start date for data collection 1 March, 2014 **Projected end date** 1 August, 2014

(Low risk notifications will not be processed if recruitment and/or data collection has already begun.)

2. Applicant Details *(Select the appropriate box and complete details)*

ACADEMIC STAFF NOTIFICATION

Full Name of Staff Applicant/s

School/Department/Institute

Region *(mark one only)* **Albany** ☐ **Palmerston North** ☐ **Wellington** ☐

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STUDENT NOTIFICATION

Full Name of Student Applicant Thomas Huggins

Postal Address 9 Ernest Street, Ranui Heights, Porirua 5024

Telephone x62456 **Email Address** t.j.huggins@massey.ac.nz

Employer (if applicable) Joint Centre for Disaster Research, Massey University

Full Name of Supervisor(s) Associate Professor Robin Peace; Doctor Stephen Hill; Professor David Johnston; Doctor Alicia Cuevas (University of Colima)

School/Department/Institute School of People, Environment and Planning; School of Psychology

Region *(mark one only)* **Albany** ☐ **Palmerston North** ☐ **Wellington** √

Telephone x62172 ; x6566; x62168 **Email Address** r.peace@massey.ac.nz ; s.r.hill@massey.ac.nz; david.johnston@gns.cri.nz; alicia_cuevas@ucol.mx

GENERAL STAFF NOTIFICATION

Full Name of Applicant

Section

Region *(mark one only)* **Albany** ☐ **Palmerston North** ☐ **Wellington** ☐

Telephone **Email Address**

Full Name of Line Manager

Section

Telephone ______ Email Address ______

3 **Type of Project** *(provide detail as appropriate)*

Staff Research/Evaluation:		Student Research:		If other, please specify:
Academic Staff		Name of Qualification	PhD	
General Staff		Credit Value of Research	120	
Evaluation		(e.g. 30, 60, 90, 120, 240, 360)		

4. **Describe the process that has been used to discuss and analyse the ethical issues present in this project.**
(Please refer to the Low Risk Guidelines on the Massey University Human Ethics Committee website)

The researcher has read and discussed the Massey University Code of Human Ethics and the Ethical Guidelines in relation to the current research. These ethical considerations have been discussed with their supervisors, who have substantial research expertise in areas from emergency management to cognitive research and social sector evaluation. All concluded that the current proposal meets MUHEC criteria for a low risk application.

The research will focus on working interactions between operational personnel and disaster researchers, which are not considered personal or private. Participants are professional researchers, emergency management professionals or trained civil defence volunteers. All participants are adults and are not vulnerable in the research context. They will need to provide individual informed consent before commencing the activities. There is no deception or conflict of interest involved.

The researcher will be providing technical assistance to the Wellington Regional Emergency Management Office (WREMO) and other researchers collaborating with that office. Publication of planning documents and findings produced remains subject to release by the line manager of WREMO community resilience. This manager will also have the right to terminate the research at any stage.

Findings will be produced through workshops, interviews, and on-going correspondence. No research data will relate to individual performance and content will anonymised during analysis. To further mitigate any potential risk to organisations involved, workshops will constitute a simulation of deploying the monitoring and evaluation framework, rather than real-time operational activities. All participants will be informed that any discussions generated during simulations will need to be formalised outside of the research context.

5. Summary of Project

Please outline the following (in no more than 200 words):

1. **The purpose of the research, and**
2. **The methods you will use.**

(Note: ALL the information provided in the notification is potentially available if a request is made under the Official Information Act. In the event that a request is made, the University, in the first instance, would endeavour to satisfy that request by providing this summary. Please ensure that the language used is comprehensible to all)

The purpose of the research is to build documents for planning monitoring and evaluating disaster resilience initiatives. Wellington Regional Emergency Management Office (WREMO) personnel and the disaster researchers who assist them will comprise the participant groups. This is a continuation of a prior research project titled, 'Technical Aspects of Monitoring and Evaluation for Community Resilience'.

Workshops, semi-structured interviews and ongoing correspondence will be used to refine a monitoring and evaluation framework for WREMO community resilience initiatives. That framework will then be used to explore potentials for new collaborative research activities.

Data management will involve transcription and data entry into thematic analysis software. Framework versions, other workshop outputs, and earlier opinion factor findings will be combined with our thematic analysis. This mixed-method approach will look at how action research transformed the monitoring and evaluation framework over time.

Please submit this Low Risk Notification (with the completed Screening Questionnaire) to:

The Ethics Administrator
Research Ethics Office
Courtyard Complex, PN221
Massey University
Private Bag 11 222
Palmerston North

Massey University
Te Kunenga ki Pūrehuroa

NOTIFICATION OF LOW RISK RESEARCH/EVALUATION INVOLVING HUMAN PARTICIPANTS

(All notifications are to be typed)
(Do not modify the content or formatting of this document in any way)

SECTION A:

1. Project Title Cognitive Differences in Responses to Different Monitoring and Evaluation Formats

Projected start date for data collection 27 October, 2014 **Projected end date** 1 March, 2015

(Low risk notifications will not be processed if recruitment and/or data collection has already begun.)

2. Applicant Details *(Select the appropriate box and complete details)*

ACADEMIC STAFF NOTIFICATION

Full Name of Staff Applicant/s

School/Department/Institute

Region *(mark one only)* **Albany** ☐ **Palmerston North** ☐ **Wellington** ☐

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STUDENT NOTIFICATION

Full Name of Student Applicant Thomas Huggins

Postal Address 9 Ernest Street, Ranui Heights, Porirua 5024

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Employer (if applicable) Joint Centre for Disaster Research, Massey University

Full Name of Supervisor(s) Associate Professor Robin Peace; Doctor Stephen Hill; Professor David Johnston; Doctor Alicia Cuevas (University of Colima)

School/Department/Institute School of People, Environment and Planning; School of Psychology

Region *(mark one only)* **Albany** ☐ **Palmerston North** ☐ **Wellington** √

Telephone x62172 ; x6566; x62168 **Email Address** r.peace@massey.ac.nz ; s.r.hill@massey.ac.nz; david.johnston@gns.cri.nz; alicia_cuevas@ucol.mx

GENERAL STAFF NOTIFICATION

Full Name of Applicant

Section

Region *(mark one only)* **Albany** ☐ **Palmerston North** ☐ **Wellington** ☐

Telephone **Email Address**

Full Name of Line Manager

Section

Telephone **Email Address**

3 Type of Project *(provide detail as appropriate)*

Staff Research/Evaluation:		Student Research:		If other, please specify:
Academic Staff		**Name of Qualification**	**PhD**	
General Staff		**Credit Value of Research**	**120**	
Evaluation		**(e.g. 30, 60, 90, 120, 240, 360)**		

4. Describe the process that has been used to discuss and analyse the ethical issues present in this project.
(Please refer to the Low Risk Guidelines on the Massey University Human Ethics Committee website)

The researcher has read and discussed the Massey University Code of Human Ethics and the Ethical Guidelines in relation to the current research. These ethical considerations have been discussed with their supervisors, who have substantial research expertise in areas ranging from emergency management, to social sector evaluation, and cognitive psychology. All supervisors concluded that the current proposal meets MUHEC criteria for a low risk application.

The research will focus on responses to different formats for monitoring and evaluating community disaster resilience. Participant responses are a simulation of operational decisions made in participants' normal working lives and are not considered personal or private. Participants are professional adults and are not vulnerable in the research context. There is no deception or conflict of interest involved.

Research data will be submitted anonymously, through an online interface and will be further anonymised during analysis. All participants will need to provide individual informed consent before commencing the activities.

5. Summary of Project

Please outline the following (in no more than 200 words):

1. **The purpose of the research, and**
2. **The methods you will use.**

(Note: ALL the information provided in the notification is potentially available if a request is made under the Official Information Act. In the event that a request is made, the University, in the first instance, would endeavour to satisfy that request by providing this summary. Please ensure that the language used is comprehensible to all)

This is a continuation of a research project, titled: Technical Aspects of Monitoring and Evaluation for Community Resilience, parts I and II. The current purpose is to compare an innovative monitoring and evaluation framework with a standard key performance indicator chart, for gauging community disaster resilience interventions.

Practicing emergency managers will be randomly allocated to either the framework or table format, presented online. They will be presented with incremental changes in indicators within the formats, showing a progression over time.

Participants will be asked to identify a planning issue revealed by the format, before being asked to outline a solution, and outline needs for further information. The protocol will conclude by asking participants about how long they have been working with visual outcomes frameworks, how long they have been working in emergency management, their age and their gender. All participants will then be given a code to enter a prize draw for a $100 Amazon gift voucher.

Statistical analyses of variance and relationships between variables will be used to detect patterns of different responses between the two indicator formats. This analysis will include: frames taken to detect planning issue, expert-rated quality of solution; and expert-rated quality of information seeking.

Please submit this Low Risk Notification (<u>with the completed Screening Questionnaire</u>) to:

The Ethics Administrator
Research Ethics Office
Courtyard Complex, PN221
Massey University
Private Bag 11 222
Palmerston North