

**Resilient Organisations
Research Report 2007/01**

Resilience Management

A Framework for Assessing and Improving the Resilience of Organisations

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Executive Summary

There is an intrinsic relationship between organisational resilience and improving the resilience of communities. Enabling the continued operation of organisations, in and following crises, significantly impacts on the medium to long term recovery and health of the wider community. Increased resilience is also important when considering the interconnectedness of modern organisations, where disruptions can have significant and widespread impacts globally. There is increasing demand for organisations to exhibit high reliability in the face of adversity; decision makers must address not only the crises that they know will happen, but also those that they cannot foresee.

The term resilience has been used freely across a wide range of academic disciplines and in many different contexts. There is little consensus regarding what resilience is, what it means for organisations and, more importantly, how organisations might achieve greater resilience in the face of increasing threats. This study offers a definition of resilience that is applicable to organisations.

Resilience is a function of an organisation's:

- *situation awareness,*
- *management of keystone vulnerabilities and*
- *adaptive capacity*

in a complex, dynamic and interconnected environment.

The research described in this report looks at ten New Zealand organisations from a range of industry sectors, sizes, localities and types to discover common issues that foster or create barriers to increased resilience. A process for Resilience Management is described for both evaluating and improving an organisation's resilience.

The Resilience Management process involves:

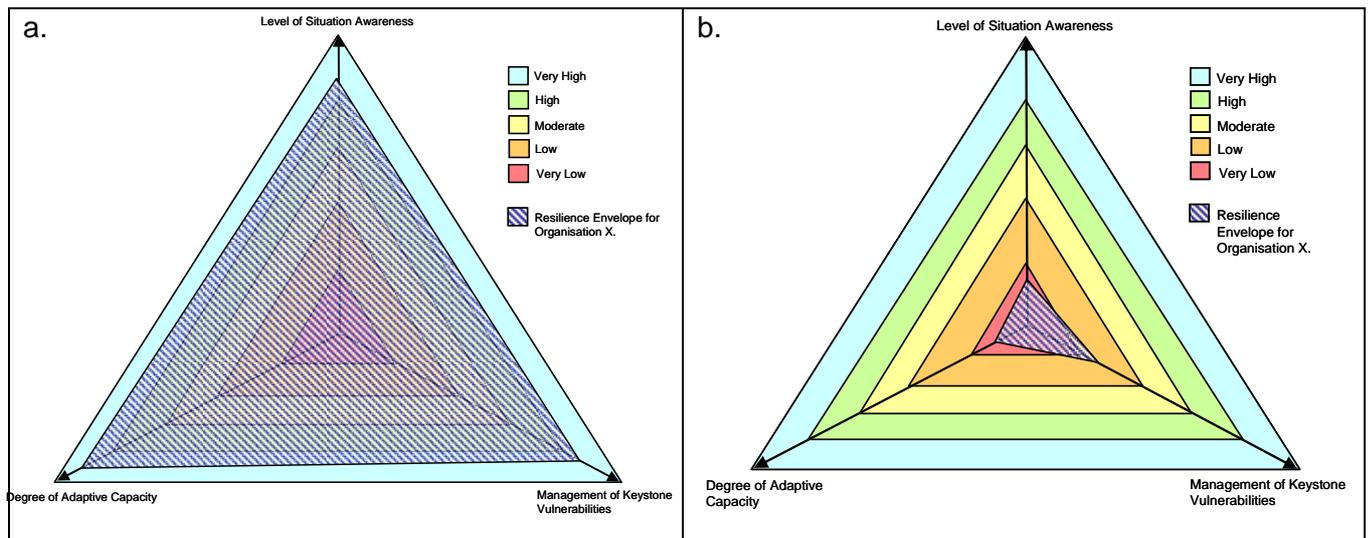
- **Element 1: Building an Awareness of Resilience Issues.** The tools used to achieve an increased awareness of resilience issues include the use of semi-formal, open ended interviews, surveys, reporting of observations back to the organisations and brainstorming hazard events using Consequence Scenarios.
- **Element 2: Selection of Essential Organisational Components.** Essential organisational components are those parts of an organisation critical to ongoing operations and functions. These components are mapped from an internal and external perspective, including the identification of key stakeholder groups.
- **Element 3: Self Assessment of Vulnerability.** The organisation then assesses each of the selected essential components for criticality to operations (both during the immediate response and recovery periods of a crisis) and preparedness for disaster. Additionally, organisations that want to investigate a specific event, or embark on planning for a specific purpose, can assess the susceptibility of components to that event. Assessments are all completed on a qualitative scale.

- **Element 4: Identification and Prioritisation of Keystone Vulnerabilities.** Information from the vulnerability assessments is then plotted onto Vulnerability Matrices that allow the organisation to visualise those components that present the greatest threat in a crisis. Matrices are produced from an all-hazards perspective (using only criticality and preparedness information) and from a hazard specific perspective (using criticality, preparedness and susceptibility data).
- **Element 5: Increasing Adaptive Capacity.** The tool used in this part of the process is the Readiness Exercises and Disaster Simulations (REDS). REDS offer a way for organisations to practise and test their crisis preparedness, leadership skills, decision making and communication skills in a time and resource efficient way. Desktop REDS can be completed in a matter of two hours and can be scaled to include only a small group of key decision makers through to the entire organisation. They can also extend to include key external partners via a multi-organisational approach.

From the data obtained with the case-study organisations a set of 15 generic resilience indicators have been identified. These indicators represent the key resilience issues that apply to all of the organisations in this study. They have been subdivided into the specific, but intrinsically related categories of *situation awareness*, *management of keystone vulnerabilities* and *adaptive capacity*. The 15 resilience indicators are outlined in the following table.

Resilience Indicators					
Situation Awareness		Management of Keystone Vulnerabilities		Adaptive Capacity	
SA ₁	Roles and Responsibilities	KV ₁	Planning Strategies	AC ₁	Silo Mentality
SA ₂	Understanding of Hazards and Consequences	KV ₂	Participation in Exercises	AC ₂	Communications and Relationships
SA ₃	Connectivity Awareness	KV ₃	Capability and Capacity of Internal Resources	AC ₃	Strategic Vision and Outcome Expectancy
SA ₄	Insurance Awareness	KV ₄	Capability and Capacity of External Resources	AC ₄	Information and Knowledge
SA ₅	Recovery Priorities	KV ₅	Organisational Connectivity	AC ₅	Leadership, Management and Governance Structures

Each organisation that took part in this study was assessed for all of the indicators relative to the other case-study organisations. This assessment produced a relative overall resilience profile for each organisation. Resilience profiles have been developed to give organisations a visual description of their resilience and indicate areas of strength and weakness. Two examples of resilience profiles are presented below showing (a) an organisation with very high organisational resilience compared to one that has a very low resilience (b).



Each of the ten case-study organisations were found to have distinct personalities and expressed different resilience qualities. Observations included:

- Many organisations are so busy dealing with day-to-day crises that they often don't consider how to cope with hazards that they haven't experienced before. Other organisations have difficulty moving past previous events and focus planning on preparations should that same type of event happen again.
- The organisational vision is not widely used as a critical crisis response tool to provide a framework for identifying where the organisation should be heading. In its absence, many organisations approach emergency management from a 'fighting fires' perspective.
- There are often different views among decision makers as to what an effective crisis plan might look like. Some expect a 'magic box' holding all the answers, providing all required actions for all hazards. Others see a plan as little more than a collection of key contact details and some basic procedures for staff from a health and safety perspective.
- Assumptions of key recovery priorities are generally not well understood, particularly amongst the executive or senior management teams. Problems that are often exposed during exercises or actual events, highlight that priorities are only common knowledge for individuals or specific departments and not the organisation as a whole.
- Almost all of the organisations displayed significant shortcomings with knowledge of stakeholder roles and responsibilities in day-to-day operations. Those organisations that had experienced crises in the past also indicated that this issue was exacerbated in stressful situations.
- It appears that few organisations consider their staff as stakeholders, and as such the awareness of employee fears and expectations in a crisis are very poorly understood.

Many of the larger organisations commented on the difficulties of informing and engaging staff in planning strategies for emergency management, particularly regarding pandemic (staff not wanting to know, decision makers not wanting to frighten staff unnecessarily etc). However, few of these organisations had made any effort to increase the awareness of key decision makers about staff issues.

- In this study few organisations had considered that crises may occur coincidentally with a need to continue business-as-usual and the demands this could place on resources.
- The organisations all appeared to have expectations of other organisations (including emergency services, government agencies and Civil Defence) that are disproportionate with the support these organisations could reasonably offer.
- Many organisations do not have an accurate vision of their own importance in the community. Following a crisis most organisations expect that support would be immediately available; extra staff, water supplies, builders, insurance assessors. Other organisations that do have an important role to play in community recovery had poor knowledge of this role and how to manage community expectations.

Common issues for management teams that emerged from the REDS exercise during the case studies included:

- Many groups felt overwhelmed by the crisis scenario and spent much of the first phase metaphorically with their 'head in their hands' thinking that there was little they could do to manage the crisis. It is important for management teams to quickly shift from this natural response to become more proactive, with strategies needed to encourage them to seek out information and to focus more positively on what 'can be done'.
- A few groups were observed to be very proactive, but in their rush to make and implement decisions quickly they failed to fully scope the full implications of the crisis. Often this meant they 'solved the wrong problems', highlighting the value of time taken to identify the full scope of potential impacts before moving onto solutions.
- Some management teams performed very well, so long as strong leadership was in place. Removing this leader under the context of the crisis scenario sometimes saw the team collapse, providing a graphic illustration of the importance of succession planning.
- Most organisations believed that their day-to-day relationships with critically linked organisations (including customers and competitors) were excellent and that this would be enough to ensure a continuation of expected levels of service and communications in a crisis. In saying this, many identified that their most important suppliers and consultants were likely to be limited in their ability to provide support in a crisis, but these organisations had made no steps to ensuring the services of alternative organisations, or establishing preferential service agreements.

Two generic Resilience Management strategies have been developed for organisations looking to improve their resilience; a Resilient Communications Strategy and an Emergency Planning Strategy. Used together, these two strategies target all of the resilience indicators identified to increase overall organisational resilience. It is important to realise, however that

Resilience Management is designed as an iterative process for long term organisational development and not as a one-off crisis management tool. The process is scalable and can be accessed by organisations of all manner of size and type, and can be applied at various levels within an organisation.

Future work under the Resilient Organisations research programme is to include further quantification of the methodology and the resilience indicators, resilience maturity models, understanding resilient leadership, communication of resilience concepts and international case studies to further determine the range of resilience for organisations.

Resilient Organisations Research Programme

The Resilient Organisations Research Programme aims to improve the resilience of New Zealand organisations to major hazard events. Organisations manage, maintain and operate our infrastructure, create our economy and contribute to our society. The ability of organisations to respond effectively following a hazard event will have a large influence on the length of time that essential services are unavailable, and ultimately how well our communities cope with major disaster.

Particular aspects of organisational response and recovery focused on by the research team include:

- how organisations plan for hazard events,
- their ability to direct resources effectively during crises, and
- the legal and contractual frameworks within which they will need to operate, and the specific challenges of post-disaster reconstruction.

The Resilient Organisations research programme is funded by the Foundation for Research Science and Technology (FRST) of New Zealand.

For more information on Resilient Organisations, see our website at www.resorgs.org.nz

Using this Report

This research report has been developed with the support of public-good research funding. As such we are happy for both practitioners and researchers to copy, distribute and use this report to further encourage organisations, both in New Zealand and internationally, to strive for greater resilience. All that we ask is that you appropriately reference and acknowledge this report in your work.

This research report has specifically been written with a practitioner audience in mind. If you would like a more detailed explanation of the research on which this report is based, please visit our website: www.resorgs.org.nz/publications and download the full Ph.D. thesis which sets out the research methodology and findings in more detail:

McManus. S. T. (2007) Organisational Resilience in New Zealand. PhD thesis, Department of Civil Engineering, University of Canterbury, New Zealand

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1 Introduction

Organisations today are increasingly aware of the need to prepare for the unexpected. High profile international events of the last decade, such as the September 11th terrorist attacks, the Indian Ocean tsunami, Hurricane Katrina and the emerging threat of a pandemic all serve to remind organisations that the unimaginable can and does happen.

Stories emerge from these events of organisations that survived or failed; at first glance there does not appear to be a particular pattern. Some survivors had excellent disaster response plans in place; others had none, surviving purely on the merits of strong leadership and the commitment and determination of staff. Many organisations that are devastated simply never reopen again; others evolve so radically that they are hard to recognise from their pre-crisis form.

This research project seeks to explore what it is that makes some organisations more able to survive a major crisis than others, and suggests a framework for both evaluating and improving the resilience of individual organisations.

1.1 What is Resilience and Why is it Important?

There is an intrinsic relationship between organisational resilience and improving the resilience of communities. Enabling the continued operation of organisations, in and following crises, significantly impacts on the medium to long term recovery and health of the wider community. Increased resilience is also important when considering the interconnectedness of modern organisations, where disruptions can have significant and widespread impacts globally. Additionally, the increasing reliance on technology and technology providers influences the desire for organisations, and the communities that they serve, to become more resilient. There is increasing demand for organisations to exhibit high reliability in the face of adversity; decision makers must address not only the crises that they know will happen, but also those that they cannot foresee.

Resilience is a concept that has had many definitions, depending on the areas of application; from the deformation of materials, the resilience of ecological systems through to the resilience of children and vulnerable community groups. The need to identify what resilience means to organisations is the focus of this report.

Essentially, an organisation that has an enhanced resilience is one that is more likely to weather both the problems of day-to-day business and successfully navigate the issues that arise in a crisis. Therefore, the following definition of organisational resilience, arising from this research, is proposed.

Resilience is a function of an organisation's:

- *situation awareness,*
- *management of keystone vulnerabilities and*
- *adaptive capacity*

in a complex, dynamic and interconnected environment.

Situation awareness is a measure of an organisation's understanding and perception of its entire operating environment. This includes:

- the ability to look forward for opportunities as well as potential crises,
- the ability to identify crises and their consequences accurately,
- an enhanced understanding of the trigger factors for crises,
- an increased awareness of the resources available both internally and externally,
- a better understanding of minimum operating requirements from a recovery perspective; and,
- an enhanced awareness of expectations, obligations and limitations in relation to the community of stakeholders, both internally (staff) and externally (customers, suppliers, consultants etc).

Management of keystone vulnerabilities defines those aspects of an organisation, operational and managerial, that have the potential to have significant negative impacts in a crisis situation. The impacts of keystone vulnerabilities may be either instantaneous (occur suddenly and take the failure of only one component to have a significant negative impact) or insidious (small failures of key components lead to a large scale cascading-type failure over time). It is important for organisations to also have a clear understanding of the links between components and the vulnerabilities that may arise from these. These may include specific tangible organisational components such as:

- buildings, structures and critical supplies,
- computers, services and specialised equipment,
- individual managers, decision makers and subject matter experts.

They may also include less tangible components, for example:

- relationships between key groups internally and externally,
- communications structures, and
- perception of the organisational strategic vision.

Adaptive capacity is a measure of the culture and dynamics of an organisation that allow it to make decisions in a timely and appropriate manner both in day-to-day business and also in crises. Adaptive capacity considers aspects of an organisation that may include (but not be limited to):

- leadership and decision making structures,
- the acquisition, dissemination and retention of information and knowledge, and
- the degree of creativity and flexibility that the organisation promotes or tolerates.

A resilient organisation has three main qualities above a non-resilient organisation:

- A greater awareness of itself, its key stakeholders and the environment within which it conducts its business.
- An increased knowledge of its keystone vulnerabilities, and the impacts that those vulnerabilities could have on the organisation; both negative and positive.
- The ability to adapt to changed situations with new and innovative solutions and/or the ability to adapt the tools that it already has to cope with new and unforeseen situations.

An organisation with heightened resilience is able to quickly identify and respond to those situations that present potentially negative consequences and find solutions to minimise these impacts. Furthermore, resilience enables an organisation to see opportunities in even the most difficult circumstances which may allow it to move forward even in times of adversity.

1.2 Scope of this Project

This research project has been designed to achieve two important objectives:

- To identify features which contribute to an organisation's resilience, irrespective of the size, type or nature of the organisation in question.
- To develop tools that will both assess and improve resilience for these organisations.

The project used a total of ten case-study organisations, specifically selected to provide the greatest possible representation of organisations in New Zealand; private, public, large, small and from a wide range of industry sectors.

A pilot study was conducted with the first case-study organisation, and from this study a preliminary framework for Resilience Management was developed. This framework, the basis of much of this report, was subsequently refined and modified with the following nine case-study organisations.

2 Resilience Management

In many organisations, risk management, business continuity and emergency management planning are commonly viewed as closely related, but a practical means of linking them is often not achieved. The Resilience Management framework brings together all the planning that an organisation may have done under one umbrella called Resilience Management.

Resilience Management can also help an organisation to be successful following any crisis by making resilience part of the day-to-day operations and by helping organisations effectively deal with high stress crisis situations.

An organisation undertaking Resilience Management will increase its situation awareness and have a greater understanding of the vulnerabilities that can critically undermine its performance. It will also improve its adaptive capacity as decision makers learn more about the underlying value systems of the organisation and of key individuals in the organisation. The process highlights the expectations that decision makers have of their enterprise and key stakeholders, and it offers a way to test existing plans and create new ones.

Each of the elements in this framework can be used in combination with other elements or in isolation to progressively increase an organisation's resilience. For optimum results, the elements should be used consecutively and in a relatively short time frame so that the knowledge is retained and used to its best advantage. Depending on the size of the organisation and the level that is targeted for improved resilience (the leadership team versus the entire organisation, for example), the Resilience Management process may take between one week and one month.

This report describes the tools and techniques developed for undertaking Resilience Management as part of an iterative process. The elements of the process, and the tools that are used to develop each element, are shown in Table 1 and explained further in the following sections.

Situation Awareness	Management of Keystone Vulnerabilities	Adaptive Capacity
<p>Element 1 <u>Building an Awareness of Resilience Issues</u></p> <ul style="list-style-type: none"> • Interviews, Surveys and Reports Gathering information from key stakeholders and validating that data. • Consequence Scenarios Building an awareness of crises causes and consequences. 	<p>Element 2 <u>Selection of Critical Organisational Components</u></p> <p>Identifying the critical components for continued service, operations and essential functions. Achieved from an internal and an external perspective.</p>	<p>Element 5 <u>Readiness Exercises and Disaster Simulations (REDS)</u></p> <p>Improvement of adaptive capacity looking at:</p> <ul style="list-style-type: none"> • Environment within which the organisation conducts its operations, services and functions. • Leadership and decision making for crises • Communications structures • Testing and execution of existing or proposed plans including understanding of minimum operating requirements. • Assessment of organisational strategic vision as a crisis management tool. • Observation of understanding of key stakeholder limitations, expectations and requirements.
<p>Element 2 <u>Selection of Critical Organisational Components</u></p> <p>Building an awareness of essential components for ongoing services, operations and functions from an internal and external perspective.</p>	<p>Element 3 <u>Self-Assessment of Vulnerability</u></p> <p>A facilitated or independent self-assessment of selected components for criticality, preparedness and susceptibility to determine vulnerability.</p>	
<p>Element 5 <u>Readiness Exercises and Disaster Simulations (REDS)</u></p> <p>Using the Consequence Scenarios to build awareness of the range and impacts of various crisis events.</p>	<p>Element 4 <u>Prioritisation of Keystone Vulnerabilities</u></p> <p>Using a vulnerability matrix to map the data from the vulnerability self-assessment, identification and prioritisation of keystone vulnerabilities is achieved.</p>	
	<p>Element 5 <u>Readiness Exercises and Disaster Simulations (REDS)</u></p> <p>Identification and ongoing testing of identified vulnerabilities in simulated crisis situations.</p>	

Table 1. The tools used for each element of the Resilience Management process and the relationships between them.

2.1 Step 1 - Building Awareness of Resilience Issues

In order for resilience management to be effective an organisation must have a clear understanding of the issues that contribute to its resilience, in a day-to-day environment as well as in a potential crisis. This is called building situation awareness and includes:

- the current, and expected future, operating environment;
- the resources that the organisation has at its disposal;
- the expectations and limitations of all stakeholders, and;
- the positive and negative impacts of various types of crises.

2.1.1 Interviews, Surveys and Reporting

Interviewing key stakeholders internally (staff, shareholders etc) and externally (customers, suppliers, contractors and even the wider community etc) is an excellent way to assess situation awareness.

WHO REALLY KNOWS?

Often, during interviewing key decision makers had a different perspective on the organisation and its resilience compared to the views of staff at other levels.

Even when targeting Resilience Management at a senior decision making level it is important to gather data from other people in the organisation, at a variety of operational and decision making levels. The validity of viewpoints can be later determined with a targeted survey.

Interviewers ideally should have some experience in conducting interviews, have a good understanding of resilience management and be able to provide an objective perspective for the organisation. Interviewers also need to be aware of the relative importance of the information they gather. Comments made by only one person may not be representative of the entire organisation. However, if a senior employee and decision maker seems to have a different perspective to others in the organisation, this may indicate some significant resilience issues. Therefore it is important that the interviewer remains objective and open to all potential resilience issues that arise.

Interviews should be conducted in a semi-structured and open-ended format with the employee being encouraged to expand on specific leads given by the interviewer. These leads relate to the specific resilience indicators that are presented in Section 3 in this report.

After all interviews have been completed and the information collated, it is important to present the main themes uncovered in the interviews back to the organisation. Discussion reports are an ideal way of doing this because they encourage the organisation to look at itself and its perceptions from an external perspective. These types of reports also offer the organisation a mirror of the perceptions (and possibly misconceptions) that pervade the organisation, and of which they may be unaware.

Surveys can also be created and, when based on information in the discussion document, help to ensure the validity of the interviewers observations. The surveys help in assessing the degree to which particular views or perceptions permeate the organisation or even external stakeholders. Surveys are also valuable in determining how well particular strategies or procedures are progressing in an organisation and highlighting areas for improvement. Many organisations have versions of staff/stakeholder engagement surveys and these can be a valuable source of information for developing resilience management.

2.1.2 Consequence Scenarios

A simple technique developed for helping to evaluate an organisation's situation awareness is the use of Consequence Scenarios. These Consequence Scenarios are used to assess how well an organisation understands the types of hazards it may one day face, and the potential impacts these may have on the organisation.

The Woods for the Trees

Many organisations are so busy dealing with their day-to-day crises that they never take the time to consider the events that they haven't yet experienced. Others have difficulty moving past previous events and insist on focusing on preparing for a repeat of the same crisis!

Very few of the organisations in this study had considered that crises may occur coincidentally with a need to continue business-as-usual and what this might mean from a human resources perspective.

Consequence Scenarios help organisations to recognise that although the breadth of potential hazards they face is vast, there are common management strategies they can use to cope with whatever comes their way.

A set of four Consequence Scenarios have been developed to help organisations improve their awareness of crises and consequences and are designed to simulate a wide range of potential effects on organisations. Due to the variability in how specific threats may affect an organisation, the focus moves from individual hazards to a set of particular event consequences.

Of course, there will always be events that cannot be foreseen and events that, even if foreseen, the consequences may not be accurately anticipated. The aim of the Consequence Scenarios is therefore three-fold:

- Firstly, they encourage organisations to identify those events that are foreseeable and consider how they might cope with the outcomes that they cannot foresee. They also expand an organisation’s knowledge about the range and scope of different hazard types and their potential consequences, rather than just focusing on a few high profile, previously experienced or well known hazards. The Consequence Scenarios are a valuable way to begin assessing and training decision makers to adapt to situations outside of their expected outcomes.
- Secondly, the Consequence Scenarios help assess how an organisation might address the failure, temporary or otherwise, of linked organisations. It is important for organisations to consider how the downfall of an important ally or rival will affect them.
- Thirdly, they allow organisations to prepare for different hazard events that have similar consequences at the same time and offer a more holistic planning framework that is more economical than planning for individual hazards; often the strategies used to mitigate the consequences for one hazard can be used for other hazards. Therefore Consequence Scenarios offer an organisation a way of collating the critical components of crisis situations and maximise its resources in preparing for these types of hazards. In addition, the Consequence Scenarios allow organisations to consider the opportunities that may arise from a crisis rather than only focusing on the negative impacts.

The principal characteristics of the Consequence Scenarios are presented in Table 2.

Scenario Type	Scenario Characteristics
Regional	Investigates an organisation’s response to and recovery from significant physical damage to buildings, contents, and resources, coupled with severe disruptions to lifeline services such as transportation, electricity, water and telecommunications.
Societal	This scenario focuses on an event resulting in extended staffing absences. In this event physical infrastructure is intact, but staff are either unable or unwilling to be at work.
Localised	Focuses on an organisation specific incident resulting in severe disruption to normal operations and reputation impacts and may include loss of life or injury. The intense focus of media and regulatory agencies requires the organisation to focus on managing stakeholder perception as well as the physical response and recovery from the event.
Distal	Tests organisational response and recovery regarding impacts on business flow through the organisational network such as key suppliers or customers. This could include, for example, the impacts of government restrictions on fuel supplies or the collapse of infrastructure such as electricity or telecommunications.

Table 2. The Consequence Scenarios.

2.2 Element 2 – Selection of Organisational Components

It is important near the start of the Resilience Management process to clearly define the scope and scale of the assessment. For example, is the organisation interested in developing the resilience of its principal decision maker, senior management team, a specific department such as IT, the entire organisation, or in conjunction with critically linked organisations? Ideally of course the overarching goal is to improve the resilience of the whole organisation. In the face of resource, budget or buy-in limitations however, it may be necessary to limit the scope. The methodology is equally valid at any scale, but does require a well defined purpose and scope to provide context for the analysis.

Fighting Fires

The use of the organisational vision as a critical crisis response tool was not widely recognised by many of the case-study organisations. The organisational vision provides a framework for identifying where the organisation should be heading in a crisis. In the absence of this, many organisations commented that their approach to emergency management was one of 'fighting fires'.

Once the scope has been defined, the organisation can then start to build up a systems map that identifies those aspects of the organisation that are integral to its continued operation. This systems map eventually forms the basis for assessing keystone vulnerabilities.

For the sake of simplicity and manageability, it is important that this systems map is developed at an appropriate level of detail for the scale and scope of the assessment. Although a very detailed systems map provides for more accurate assessment of vulnerabilities, it is also likely to make the assessment much more daunting for managers. Examples of organisational components at a senior management level are presented in Table 3.

There is a distinction between internal components and external components for an organisation. Internal components are those that the organisation has the direct ability to manage in terms of resilience. For example, employment contracts with staff would be an internal component. External components on the other hand are those that, while potentially having some influence over their management, an organisation has no direct ability to change. For example, the supply of telecommunications services by a third party supplier would be an external component because although the organisation may be able to manage its *response* to such an outage, it cannot control the *cause* of that outage.

Successful resilience management requires ongoing development of situation awareness within an organisation. The involvement of the organisation in producing the organisational component maps is critical to this development. The people who will be implementing resilience management in an organisation should be involved as much as possible in this mapping process to increase their own situation awareness.

INTERNAL COMPONENTS					
Physical Components		Human Components		Process Components	
Buildings & Equipment	Offices	Communication & Relationships	General Staff	Direct Planning	Risk Management
	IT Hardware		Senior Staff		Continuity Planning
	Security		Board		Emergency Management
	Vehicles	Management	Leadership		Cash Flow
	Software/IP		Succession		Market/brand Knowledge
	Inventory		Staff Welfare		Insurance
Services	Generators	Information/ Knowledge	Backup		
	Fuel Supplies		Privacy/ Protection		
	IT networks		Training/Review		
EXTERNAL COMPONENTS					
Physical Components		Human Components		Process Components	
Services	Electricity	Communication & Relationships	Emergency Services	Indirect Planning	Inter-connectedness
	Water		Local Authorities		Statutory Compliance
	Sewerage		Customers		Contracts
	Telecommunications		Suppliers		Reputation/Image
	Transportation		Media		

Table 3. An example of the types of internal and external organisational components mapped for organisations in this study.

2.3 Element 3 – Self-Assessment of Vulnerability

An assessment of vulnerability is important in resilience management because it contributes to increased situation awareness, promotes the development of adaptive capacity and also gives the organisation tangible objectives to work towards.

Vulnerability is self-assessed to improve the organisational buy-in. There is always a danger in having an external facilitator assessing vulnerability as some people can feel misunderstood or misrepresented by the facilitator and not accept the recommendations. Using a self-assessment technique for vulnerability the organisation is encouraged to take ownership of the issues that emerge, and consequently can accept accountability for improving vulnerabilities.

Initially vulnerability assessments should be conducted from an all hazards perspective. The vulnerability assessment looks at the criticality and preparedness of critical organisational components (Element 2). If required, a scenario can be created using the Consequence Scenarios to provide a more specific context if an organisation wants to target a particular hazard, or threat (pandemic planning, for example). An assessment of the susceptibility of critical organisational components is used in this instance. The details of the vulnerability assessment process are described below.

2.3.1 Criticality

The key question to ask when assessing criticality is:

“How important is this particular component to the organisation’s ability to respond to/recover from crises?”

The assessment process is applied to two distinct time frames in relation to crises; response and recovery. The immediate response phase occurs either during or immediately following the onset of a crisis. This may differ depending on the nature of the event. The response phase for an earthquake may be a matter of hours or days while the response to the outbreak of infectious disease nationwide may be weeks or months. An organisation moves into recovery when it starts to think about returning to business-as-usual conditions. The move from response to recovery is not always observed as a discrete period following a crisis and recovery may not be recognisable as ‘business-as-usual’ conditions because the operating environment has changed dramatically due to the crisis event.

Criticality for both response and recovery is divided into four broad categories; very high, high, moderate, low.

2.3.2 Preparedness

For preparedness assessments the key question is:

“What level of planning or redundancy is in place to enable an effective response and recovery if this particular component is not functional?”

Preparedness is measured qualitatively; high, moderate, low, none. For example, electricity services may have a high level of preparedness because the organisation has chosen to purchase a generator. However, an organisation without a generator might consider that its level of planning for the loss of electricity is low.

The Magic Box

There are often different perspectives within organisations on what an effective response and recovery plan might look like.

Some staff expect a plan to be a ‘magic box’ with all the answers that spells out all required actions for all hazards. Others think the plan should be little more than a collection of key contact details and some basic procedures for staff from a health and safety perspective.

2.3.3 Susceptibility

A susceptibility assessment encourages an organisation to isolate the potential impacts of specific types of crises. This is likely to be required when an organisation wants, or is

required, to plan for a particular event, for example pandemic or earthquake. For each organisational component an organisation asks:

“How severely impacted is the (component’s) performance likely to be in this particular scenario?”

For example, electricity services may be highly susceptible to a regional crisis that impacts infrastructure such as an earthquake, but have a very low susceptibility to social disruption such as an influenza pandemic.

Susceptibility is assessed as very high, high, moderate, or low.

The context of the assessment is important. Organisations can use any number of techniques to provide an appropriate context; using the experience of a previous crisis situation or using the impetus of media exposure for impending events. In this study, the Consequence Scenarios have provided the crisis context for the susceptibility assessment.

Often, elements from two or more of the Consequence Scenarios are used. Not only does this enable organisations to investigate vulnerabilities for more than one scenario at a time, but it also simulates the complex nature of crisis events. This helps convey the reality of a crisis and provides a more detailed picture of the organisation’s strengths, weaknesses and the connectivity between components.

2.4 Element 4 – Prioritisation of Keystone Vulnerabilities

As mentioned in Section 2.3, there are two ways for an organisation to use the vulnerability information. Using just criticality and preparedness information it is possible to view vulnerabilities from an all hazards perspective. Using the additional susceptibility information an organisation can look at vulnerabilities for an event of specific concern. By looking at where all of this data intersects an organisation can identify its keystone vulnerabilities.

Keystone vulnerabilities are components (or links between components) that are likely to have a significant negative impact on the organisation. There are two aspects to keystone vulnerabilities. Firstly is the speed at which a component failure has a negative impact (rapid or insidious) and secondly is the number of component failures required to have a significant negative impact on an organisation (discrete or cascading). It is important that an organisation views and treats keystone vulnerabilities as interconnected parts of a system and not in isolation.

Common to All

In this study a number of organisational components were identified as keystone vulnerabilities for most of the case-study organisations. These included:

- electricity and telecommunications services;
- governance structures in an organisation;
- communications and relationships with general staff, media, local authorities and emergency services, and;
- the flow of information into and throughout the organisation.

There is the potential that some components are more vulnerable when considered as part of a system rather than in isolation. For example, electricity supply may be a vulnerability on its own, but when considered as part of a system, its failure may cause other components to become keystone vulnerabilities. The opposite is also true. When viewed in isolation some organisational components may be more significant vulnerabilities than if considered as part of the whole system. Therefore, it is vital that organisations have tools available to clearly identify their keystone vulnerabilities in order to assign appropriate resources to the areas of most concern.

The following discussion outlines the vulnerability matrix; a tool developed in the study that presents keystone vulnerabilities in a visual format and helps organisations to clearly identify and prioritise them.

2.4.1 The Vulnerability Matrix

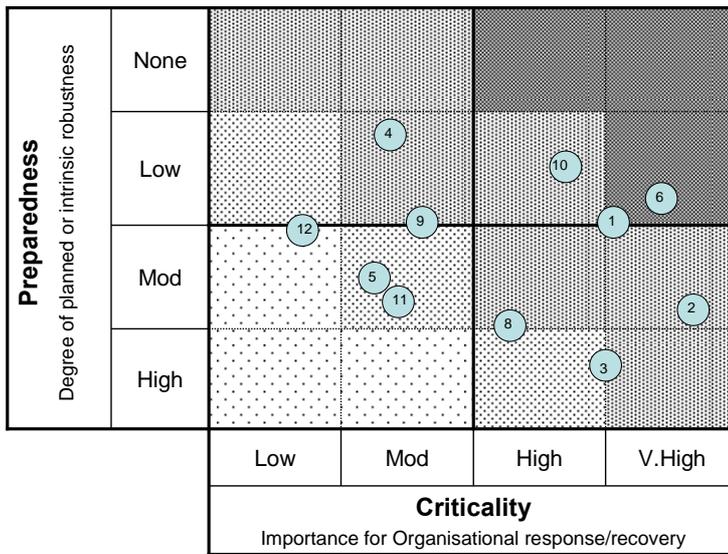
The Vulnerability Matrix (Figure 1) is a powerful tool that helps decision makers to visually identify those components that present the greatest potential threat, which can then be treated accordingly. In this way, the matrix is an important vulnerability prioritisation tool for an organisation and can greatly assist in helping focus attention and resources to where they will provide the greatest value for an organisation.

Vulnerability matrices are produced using preparedness and criticality information obtained in Element 3. This produces an assessment of vulnerability at an 'all-hazards' level. Additionally, susceptibility information is used to produce a context specific matrix. Examples of both types of vulnerability matrices are presented in Figure 1

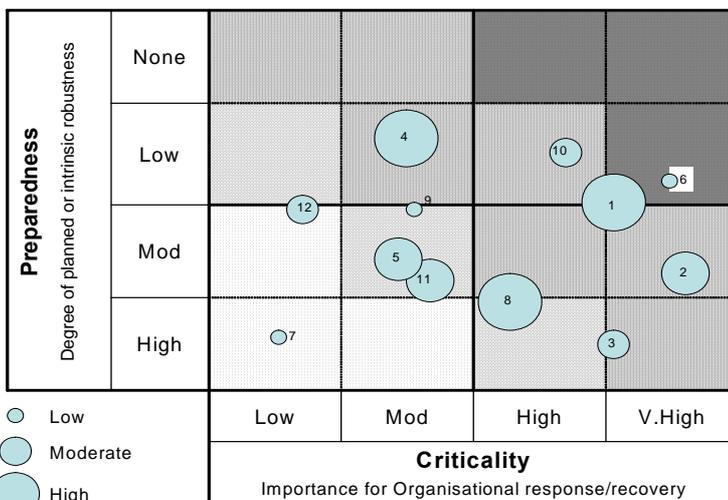
Criticality is plotted on the x-axis and preparedness on the y-axis. Each organisational component is represented by a 'hole' in the matrix. For the 'all-hazards' matrix, all the holes are of equal size and it is their position on the matrix that determines their status as keystone vulnerabilities.

Susceptibility data is indicated by different sized 'holes'; the larger the 'hole' the greater the degree susceptibility. For these context-specific matrices, keystone vulnerabilities are identified both by the size of the hole they produce as well as their position on the matrix.

Keystone vulnerabilities are those, sometimes innocuous, components and links that have the potential to be show-stoppers for an organisation. They should be identified as quickly as possible and as part of an integrated vulnerability assessment. Further, matrices can be produced to look at different aspects of an organisation, concentrating on human resources, external stakeholder links, or essential infrastructure for example. They can also be used to look at keystone vulnerabilities for different business units or departments and compared to overall vulnerability for the entire organisation.



(a) Vulnerability Matrix showing organisational components in an all-hazards context. Circles represent components.



(b) Vulnerability Matrix showing organisational components in a context specific matrix. Circle size represents susceptibility to a given context.

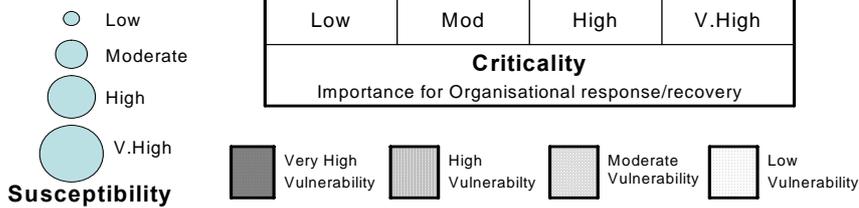


Figure 1. Sample vulnerability matrices showing (a) an all-hazards approach and (b) a context specific approach to determine keystone vulnerabilities for organisational resilience.

Staff Communications

It appears that few organisations consider their staff as stakeholders, and as such the awareness of employee fears and expectations in a crisis are very poorly understood.

Many of the larger organisations commented on the difficulties of informing and engaging staff in planning strategies for emergency management, particularly regarding pandemic (staff not wanting to know, decision makers not wanting to frighten staff unnecessarily etc).

Few organisations had made any effort to increasing the awareness of key decision makers about staff issues.

2.4.2 Prioritisation of Keystone Vulnerabilities

The Vulnerability Matrix is divided into four categories of vulnerability. The highest vulnerability category is in the top right-hand quadrant moving through to the lowest vulnerability in the bottom left-hand quadrant (Figure 1). For the 'all-hazards' matrix, all organisational components that fall within the highest vulnerability categories on the matrix are likely to be the most important keystone vulnerabilities and should be the ones addressed first in any planning strategies. In Figure 1 (a) the matrix shows that components #6 and #1 would be considered as the most important followed by #4, #10 and #2, then #9, #8 and #3.

Organisations assessing vulnerability for a specific crisis also interpret the susceptibility information. Components that leave a large 'hole' in the highest vulnerability category on the matrix are likely to be the most significant keystone vulnerabilities for that particular event. In Figure 1 (b), the susceptibility information has been imposed on the vulnerability matrix. In this example component #1 is more of a keystone vulnerability in this type of event than #6 because it represents a larger 'hole' in the matrix within the same vulnerability category (in Figure 1 (a) these components would have been considered relatively equally). Components #4 and possibly #2 also present as significant keystone vulnerabilities, and would be addressing before component #1; principally because of the size of the 'holes' they leave in the matrix. In this way the organisation can more specifically target those components that present the greatest keystone vulnerabilities for the particular context of concern.

2.5 Element 5 – Increasing Adaptive Capacity

The final stage in the Resilience Management process focuses predominantly, but not exclusively, on identifying and developing adaptive capacity in an organisation. Adaptive capacity is largely concerned with the cultural capital of an organisation and there are several detailed methodologies in existence to measure some of the psychological aspects of this culture (for a review see Chernyshenko and Stark, 2005). It may be difficult for organisations to incorporate these methodologies into their day-to-day business due to the complexity of these models, financial constraints and the availability and skill of staff to perform the assessments. For this reason, the tools in Element 5 are designed to provide a time and

resource efficient way to assess and improve overall resilience for organisations via developing adaptive capacity, without getting lost in too much detail.

Element 5 is intended to provide tangible outcomes for organisations, and assist them in developing immediate action plans to address key resilience issues, particularly in relation to adaptive capacity, but also in terms of situation awareness and keystone vulnerabilities.

2.5.1 Readiness Exercises and Disaster Simulations (REDS)

Ultimately, the Resilience Management process is about providing simple and practical tools for decision makers to assess and increase an organisation's resilience for times of crisis. The Readiness Exercises and Disaster Simulations (REDS) is one such tool.

REDS encourage organisations to experience their vulnerabilities and strengths in a simulated crisis setting and offer a platform from which to critically assess decision making and communications. Scenario exercises help an organisation to increase its awareness of the operating environment in a crisis and the potential impacts of different event types. For those organisations that have engaged in producing emergency plans or business continuity planning, simulations offer an excellent opportunity to test these plans before they are needed in a real situation.

Ideally REDS are conducted with groups of between 8-12 individuals who have wide ranging knowledge of the organisation and represent key decision makers. REDS can be modified for smaller organisations, but for larger organisations, groups should number no more than 12. Additional exercises should be conducted if more people are to be involved.

REDS are structured into six distinct operational stages and are conducted sequentially. These stages are described in Table 4 below. Using REDS on a regular basis, with different consequence scenarios as the basis for each exercise, can help to highlight some of the cultural strengths and weaknesses in an organisation. REDS also help the organisation to assess and subsequently improve its capacity to meet its obligations in various crisis situations.

Participants are responsible for all outputs from the REDS and are encouraged to write everything down onto wall charts to help structure their thinking during the exercise. Additionally, it is important to have impartial observers to help facilitate the REDS. During REDS it is possible for an observer to determine the (relative) level of awareness about hazards and the potential impacts on the organisation resulting from these hazards. Observers can also:

- Observe the decision making process in action.
- See how well the decision makers understand minimum operating requirements.
- See how well decision makers communicate the minimum operating requirements to other decision makers.
- Assess levels of awareness regarding roles and responsibilities of key stakeholders.
- Encourage participants to view the simulated crisis situation both from an internal and external perspective.

- Assess the organisation's awareness of its connection with stakeholders and the impacts that may arise from disturbance to these links.
- Assess the organisation's strategic vision and purpose and how well this is understood throughout the organisation.

REDS is an excellent way to provide the necessary context for making vulnerability assessments. REDS allows stakeholders and decision makers (both internally and externally) to actually experience these vulnerabilities in an environment simulating a real emergency. REDS help organisations to see not only their own vulnerabilities more clearly (and in context), but also the potential vulnerabilities in other linked organisations or systems.

The REDS Process	
Stage 1.	<p><u>Group Selection and Scenario Presentation</u></p> <p>If the group numbers more than eight individuals, it should be divided into two smaller groups with equal numbers. The groups are presented with a detailed event scenario and are asked to consider this event from a specific time frame for the immediate response phase. (This may be minutes, hours, or days depending on the nature of the event).</p>
Stage 2.	<p><u>The Response Phase</u></p> <p>Each group is asked to consider the following four questions.</p> <ul style="list-style-type: none"> ○ <u>Question 1. What are the major issues facing the organisation at this time (following the crisis)?</u> This encourages the group to brainstorm all the potential problems that the organisation faces to ensure that the full scope of the problem is identified. ○ <u>Question 2. What are the main priorities that the organisation must consider?</u> The participants must plan what they actually need to do, how, in what order and who will be responsible for what actions. ○ <u>Question 3. What are the lesser priorities and how long until these become critical?</u> This offers participants an opportunity to view the crisis from alternative time frames. This question encourages participants to do a horizon scan of the issues and to consider within what time frame these are likely to become important? ○ <u>Question 4. What could the organisation do prior to a crisis to better prepare for this situation?</u> This question is designed to produce an action-plan that can be immediately developed by the organisation to improve its resilience. Here the participants are asked to consider the most significant gaps in the response approach during the REDS and what they could do prior to an event to minimise their impact on the organisation. As part of the action-plan approach, time frames for implementing the plan should also be considered.
Stage 3.	<p><u>Break and Review</u></p> <p>Participants are encouraged to take a break from the exercise and facilitators can offer comments on how the groups are doing, as well as suggest tips and advice for improvement. This is a valuable chance for participants to reflect on how well they achieved what they were asked to do, and how they might improve their performance, individually and as a group.</p>

The REDS Process (ctd)	
Stage 4.	<p><u>The Recovery Phase</u></p> <p>Groups are then brought together for the recovery phase of the REDS. Each group is given an overview of the scenario from a different time perspective. Typically this time frame is well into the organisational recovery from the event. Participants are asked to consider the same questions as in Stage 2, using the new scenario time frame and taking into consideration the comments and advice given during the break in Stage 3.</p>
Stage 5.	<p><u>The External Perspective</u></p> <p>In the recovery phase of the exercise one individual from each group is taken aside and asked to consider the scenario from the perspective of one or more key stakeholder groups. These perspectives are later presented as part of a debriefing to determine if the organisation adequately considered these stakeholders and their concerns/ demands/ expectations.</p>
Stage 6.	<p><u>Debriefing and Action Plans</u></p> <p>At the conclusion of the REDS, the participants take part in a group debriefing. Debriefing is very important and a way for the organisation to create an action plan that can be addressed immediately. The action plan can quickly reduce vulnerability as well as improve awareness, adaptive capacity and therefore overall organisational resilience. Creating an action plan at the conclusion of the REDS has another benefit; it can capitalise on the momentum and enthusiasm of participants that often arises from these exercises.</p>

Table 4. Description of the six stages of REDS to improve organisational resilience.

2.6 Synthesis

The Resilience Management process described above has been developed in conjunction with ten case-study organisations. The steps are used to increase overall resilience by improving situation awareness, advancing the identification and management of keystone vulnerabilities and increasing adaptive capacity. The tools that have been developed and used in each step have been instrumental in gathering valuable data about common resilience issues for organisations in New Zealand. These issues are the subject of the next section in this report and are subsequently used to develop resilience profiles for each of the case-study organisations.

3 Resilience Indicators

All of the case-study organisations were analysed to identify resilience issues that are common to many organisations, independent of size or sector. This discussion details these issues and categorises them according to the attributes of resilience; *situation awareness*, *management of keystone vulnerabilities* and *adaptive capacity*. These resilience indicators are shown in Table 5. For each organisation in this study, the indicators were assessed to produce a relative resilience profile and these will be discussed in the following section.

It is important to recognise the relationships between the indicators in each section. Situation awareness has influence over the performance of an organisation in identifying and managing keystone vulnerabilities, and both of these influence adaptive capacity for organisations. Where possible, the following discussion details specific issues but the reader is urged to be mindful of these intrinsic inter-relationships.

Resilience Indicators					
Situation Awareness		Management of Keystone Vulnerabilities		Adaptive Capacity	
SA ₁	Roles and Responsibilities	KV ₁	Planning Strategies	AC ₁	Silo Mentality
SA ₂	Understanding of Hazards and Consequences	KV ₂	Participation in Exercises	AC ₂	Communications and Relationships
SA ₃	Connectivity Awareness	KV ₃	Capability and Capacity of Internal Resources	AC ₃	Strategic Vision and Outcome Expectancy
SA ₄	Insurance Awareness	KV ₄	Capability and Capacity of External Resources	AC ₄	Information and Knowledge
SA ₅	Recovery Priorities	KV ₅	Organisational Connectivity	AC ₅	Leadership, Management and Governance Structures

Table 5. Summary of the 15 Resilience Indicators.

3.1 Situation Awareness

Situation awareness refers to an organisation’s awareness of its entire operating system, including threats and opportunities, connectivity and internal and external stakeholders. A total of five resilience indicators were identified under the banner of situation awareness and these are discussed below.

3.1.1 Roles and Responsibilities (SA₁)

A key awareness issue for all organisations in this study was that of roles and responsibilities. This translates to the knowledge of one's own role in the organisation as well as knowledge of roles and responsibilities of others in the organisation. The symptoms of poor awareness of roles and responsibilities included:

- Staff feeling undervalued,
- Staff not being consulted in areas where they had expertise,
- Increasing levels of mistrust of decision makers, and
- Feelings of disengagement with the organisational vision.

Who, What, Where and How?

Almost all of the organisations displayed significant shortcomings with knowledge of roles and responsibilities in day-to-day operations. Those organisations that had experienced crises in the past also indicated that these problems were exacerbated in stressful situations.

Many organisations had difficulty in balancing the desire for autonomous decision making and decentralisation with maintaining essential connections between staff, particularly where there is a significant geographic distribution of offices and staff. Even in organisations where the geographic distribution of offices was not a factor, staff in different departments often had little or no knowledge of what others in the organisation were doing, or the potential roles that they might play in a crisis. This was a surprising outcome at an executive level in some of the case-studies, and is thought to reflect an underlying silo mentality in these organisations (Silo mentality is described in Section 3.3.1 below). Only one organisation did not appear to have a significant problem with knowledge of roles and responsibilities. This is thought to be partially due to the relatively small number of staff, a single office environment, and a 'family' philosophy in decision making where all staff are expected and encouraged to contribute to finding solutions for problems.

Another aspect of this issue is the strict definition of roles and responsibilities in an organisation, and a strong adherence to these descriptions. Two organisations exhibited this clearly. In both, staff have very defined roles in the organisational structure and their mandate for decision making, and associated responsibilities, are clearly spelled out. These employees tend to work strictly within the boundaries of these roles and seem to be very reluctant to step outside of these. Not only does this appear to be a barrier to the flow of knowledge in the organisation, especially of the roles, responsibilities and expectations of others in the organisation, but also reduces the flexibility of the organisation from a decision making perspective. This, in turn, has an impact on the organisation's adaptive capacity.

The impact of awareness of roles and responsibilities for external stakeholders are discussed in Section 3.1.3.

3.1.2 Understanding of Hazards and Consequences (SA₂)

Some case-study organisations had a good awareness of both the impacts and risks for some hazards. These were typically high profile potential events or events already experienced by the organisation, for example a major earthquake, the threat of influenza pandemic outbreak or a high intensity rainstorm or flood. Overall, however, there was a limited awareness of the range of hazards the organisations may be exposed to as well as the potential impacts of these events. Furthermore, there was also a poor understanding of how manageable these events could be. Even those organisations displaying the highest situation awareness tended to be reactionary in their dealing with crises, and this is partially a function of a low awareness of what threats and opportunity these events may present.

The awareness of high profile events was also limited for many organisations. Those organisations that had experience of significant crises were very aware of the problems associated with any reoccurrence of these events. However, despite good planning in some instances, the planning was very event specific and there was little consideration of extending the planning to incorporate other events with similar consequences.

Many of the organisations in this study had a good awareness of potential pandemic outbreaks and some had invested time in planning for such an event. However, none of these organisations had considered the long-term effects of large scale human resources shortages in such an event. Furthermore discussion of pandemic typically exposed a perception that pandemic is largely irrelevant as a potential threat. While some organisations had considered what the consequences might be if New Zealand's borders were closed, few interviewees believed that this would actually happen.

It's a Disaster!

One organisation, when faced with the loss of telecommunications networks for a week, claimed that they would simply shut up shop and go home with absolutely no consideration of what they would do once the service was restored.

Another organisation discussing the consequences of an earthquake were of the view that the 'ground would just turn to water and we would all be toast'.

Despite the high awareness and the wealth of information available to organisations regarding planning for pandemic, little had been done by most. There were some exceptions; two organisations had pandemic plans in place, or were developing them. However, even in these organisations decision makers had not considered the applicability of their pandemic planning to other potential hazard events, or attempted to expand planning into an all-hazards approach. One organisation claimed that it was embarking on an all-hazards planning strategy but there was little evidence that it was successful in this.

3.1.3 Connectivity Awareness (SA₃)

Most of the organisations in this study had a good awareness and understanding of their immediate operating environment and the impacts of the loss of key customers, key suppliers and other critically linked organisations. However, an advanced awareness of their connectivity with the entire community of stakeholders was not widely observed. Several organisations claimed that they had a good understanding of the expectations and limitations of their stakeholders, but as the study progressed this understanding was shown to be more limited than anticipated. For example, some organisations highlighted that they have no ability to monitor customer's satisfaction, movement or demand, and have no substantial awareness of what might be expected by these customers in various types of crises.

The awareness of internal stakeholders was also limited in most of the organisations and few considered their staff as stakeholders. Only one organisation specifically gathered information about the fears and expectations of staff, using staff engagement surveys. The size of the organisation appeared to be significant in the degree of awareness of internal stakeholders; the smaller the organisation (number of employees) the greater the awareness. One organisation was making an effort to engage with staff by making them responsible for planning and business continuity in individual offices. However on the other hand, some key decision makers in another organisation viewed staff as a potential liability in a crisis.

3.1.4 Insurance Awareness (SA₄)

The knowledge of levels of business interruption insurance (although not all organisations in this study had such cover), the availability of other insurance products and other aid options varied considerably in the case-study organisations. In most organisations this knowledge only extended to an assumption that there was some level of coverage or aid available, but few knew any details of what this involved. Most participants in this study assumed that financial assistance would be immediately accessible following a crisis, and also that insurance or government aid for example would provide adequate coverage for the duration of the event and expected recovery. After discussions during interviews and REDS some participants commented that the current expectations were inadequate for the duration of several types of events. In addition, there is a general lack of awareness of the expected limited availability of damage assessors and other professionals to process insurance claims in a large scale physical event.

3.1.5 Recovery Priorities (SA₅)

Another important component in situation awareness is the level of understanding about minimum business requirements and organisational recovery priorities. All of the organisations in this study had a limited awareness of what might be required of them in a large scale, or long duration disaster. Several of the case-study organisations were very introspective and had little awareness of the ability of other organisations to meet their needs. These same organisations had a poor perception of the importance of their own needs over the needs of others in the wider community; organisations or individuals. While most of the case-studies seemed to have a clear understanding of their business priorities during day-to-day operations, this was not apparent from a crisis perspective.

Only one organisation clearly identified its key response and recovery priorities and the relationship with business continuity. In contrast, another organisation was unable to identify key recovery priorities, and did not have a clear idea of minimum operating requirements following a crisis. This was true for most of the organisations.

The Main Priorities

Many organisations make the incorrect assumption that key priorities are well understood, particularly amongst the executive or senior management teams. These assumptions are often exposed during exercises, which highlights that these priorities are actually only common knowledge for individual departments and not the organisation as a whole.

3.2 Management of Keystone Vulnerabilities

This section discusses common issues surrounding the identification and management of keystone vulnerabilities and their impact on overall organisational resilience. Keystone vulnerabilities are those components of an organisational system that have the potential to cause the greatest negative impact, either catastrophically or insidiously. The following discussion divides keystone vulnerabilities up into a set of five indicators as described below.

3.2.1 Planning Strategies (KV₁)

Several of the organisations in this study have ongoing risk identification processes and have engaged in some emergency and recovery planning. These are typically the larger organisations in terms of employee numbers and often have the backing or driving force of a parent company, or even other organisations within the industry. Often when the planning process is directed by (but not performed by) the parent company it is considered to only have partial relevance to the organisation at a local level. As highlighted in Section 3.1.2 above, often planning centres on a small number of specific events or risks. Only one organisation claimed that it was attempting an all-hazards approach with its planning strategies, but even in this organisation evidence suggested that the focus was on a small number of specific events. One of the smaller organisations indicated that it was not even aware of relevant risk management standards in New Zealand.

There appeared to be a handful of drivers for organisations in terms of risk management and planning.

- One case-study organisation indicated that it was engaging in business continuity planning because of insurance company demands. This business was enthusiastic about creating a business continuity plan in order to potentially reduce its business interruption insurance premiums. However there were significant reservations in the organisation about the effectiveness of this as a driver.

- In several organisations the increasing awareness of pandemic proved a clear driver for planning. However, as previously mentioned, this planning was specifically for pandemic, and not extended to include other related hazards or similar hazards at a variety of scales.
- Directives from other linked organisations or from the parent company were also identified as drivers for planning.
- Some of the organisations in this study have a mutual working relationship for day-to-day operations, and thus the planning strategies of one organisation have the potential to impact on the other. Also, the parent company or group has an influence on the implementation of risk management and other planning strategies. Again, there are concerns that the lack of an internal driver for planning has a negative impact on the enthusiasm for the planning process as well as engagement with all stakeholders.

The vision of what an emergency plan or business continuity plan should consist of was also a contentious issue in this study. Typically the problems arose when different decision makers in an organisation had different visions of the structure of the plan and planning process and what the end product should be; a detailed collection of specific tasks and actions for every conceivable event or a simple list of contact details for key stakeholders.

3.2.2 Participation in Exercises (KV₂)

Participation in exercises for emergency management is typically restricted in most organisations to fire evacuation drills on a regular (6-12 monthly) basis. However, for some of the organisations in this study, participation in either in-house or externally managed exercises is a regular part of the planning process. During this study the researcher was able to observe three of the case-study organisations in independent exercises. Two organisations participated in an exercise at a regional scale and another ran its own in-house exercise during the interview phase of the study.

The value of exercises for emergency management and business recovery is perceived differently by different people and organisations in this study. Exercises, in the form of REDS, were an integral part of this research, and engagement of organisations was often difficult to secure. Overall, organisations claimed that a major barrier to exercising plans was the availability of appropriate staff, as well as an unwillingness to have any impact on day-to-day business, albeit short-term. One organisation expressed a significant reluctance to exercise claiming that it was not confident in the ability of its plan to meet the demands of the exercise.

To Plan or not to Plan: that is the question.

One organisation claimed that its experience in real world events meant that it did not have to exercise. This organisation was very focused on previous experiences, and was largely unaware of the benefits that could be gained taking these experiences into their planning processes. The danger for this organisation was that without exercises, positive lessons from the past would not be transferred to future event management, or to new staff and stakeholders.

3.2.3 Capability and Capacity of Internal Resources (KV₃)

The following discussion about internal resources is subdivided into three components; *physical* resources, *human* resources and *process* resources. Physical resources include buildings and other structures, internal services and critical contents and equipment. Human resources involve the capability and capacity of employees in the organisation. Process resources include the capability and capacity of economic and administrative resources.

Buildings and Structures

- A substantial proportion of case-study organisations had no planning in place for alternative office space. Most had made significant assumptions regarding the continuation of critical services, and also had high expectations about their ability to work remotely in a crisis. Additionally all of the organisations had not considered limitations on the availability of external trades-people and professionals to assist in rebuilding following a crisis. While some organisations had made significant efforts towards ensuring that their chosen emergency operations centres were well equipped, there were some potentially disastrous omissions or assumptions made. Many of these related to the availability of essential services (water, electricity, telecommunications etc) for these operations centres.
- Few organisations had enough understanding of co-dependencies between internal services. Information technology is a case in point. Several organisations had identified the potential for failure of critical information systems, and had chosen to create backup systems, some even in different cities. However the impact of the loss of electricity for these technology services was not widely recognised. While some of the organisations had purchased diesel generators to provide continued electricity for some key functions, only a few people knew which functions these were. Interestingly, some of the smallest organisations in this study had generators compared to larger organisations.

Human Resources

- The importance of human resources is highly regarded by all of the case-study organisations. However, many of these organisations do not have a full appreciation for how difficult it may be to engage, retain, recruit or support staff in the aftermath of a crisis. Most of the organisations had considered the pandemic scenario prior to their participation in this study and some had engaged in specific planning for pandemic. However, few of these organisations had a full understanding of the extent of the potential human resources shortage, or the duration over which this might be a problem. Other types of crises were largely overlooked from a human resources perspective.
- For most organisations, the loss of human resources would probably be the result of death, injury or mental trauma in the aftermath of a physical emergency, for example an earthquake, a fire or an explosion. The impacts on staff as a result of reputation impacts (fraud, health and safety problems, and legal proceedings) were typically not regarded by any of the organisations other than in passing. This limited the levels of

engagement with staff, and potentially has negative impacts for the organisation in communicating with staff in a crisis.

- The issue of an ageing workforce and a workforce that is increasingly unwilling to do manual work is also a problem for some organisations.
- Succession of staff from an emergency management perspective was shown to be a significant issue. Some of the organisations have clearly identified successors for key senior staff and decision makers, even if this has not been translated into a formal planning process. Two organisations favour identifying the most appropriate people for an emergency situation based on the nature of the event. However this technique was not observed during the REDS for one of these organisations. Often some of the most important individuals for crisis management are those who have a vast or critical knowledge and these people are typically not included in any succession planning. Mentoring is often disregarded because of the availability of suitable staff, and the economics of having two or more people learning the same job.

Whose turn is it now?

One organisation has already been through the trauma of a major event and identified the problems associated with not having a roster system in place for emergency staff. Despite the recognition of this significant problem, one year after the event, this organisation had still not put any structure in place to remedy this situation.

- There are also issues related to the strategic vision of an organisation and the succession of staff in a crisis, particularly at a decision making level. During the exercise with one particular organisation staff were very reluctant to express their strategic objectives for the emergency response. Decision makers in this organisation had not adequately considered the impacts of large scale events, particularly physical crises, nor had they made provision for adequate numbers of staff to manage such an event.
- Very few of the organisations in this study had considered that crises may occur coincidentally with a need to continue business-as-usual and what this might mean from a human resources perspective. During the debriefing with one organisation, the designated emergency controller expressed his surprise at how many people were needed in the emergency operations centre to ensure the smooth management of the event. Typically the organisations in this study were unprepared for the demands placed on staff in a crisis, and for the numbers of staff that may be required as well as where additional staff may be sourced from.

Process Resources

- The standardisation of systems and procedures for organisations is a resilience issue. The creation of systems and procedures that extend across an organisation are typically seen as favourable. However, some organisations that did have these available chose not to use them because they were seen as not being applicable, having been developed by a parent or other linked company. In contrast,

organisations that did have effective, well communicated and flexible systems and procedures that were understood by the entire organisation were typically better equipped for crisis than those that did not.

- An organisation's financial position, its economic stability and that of any relevant parent or governing organisation were identified as significant strengths. Those organisations that had no debt, a large balance sheet, or the availability of large amounts of money in a relatively short period were often more flexible and creative with their decision making processes. However, there were some notable exceptions where an organisation's assumption of the resources available to it seems to foster an air of complacency in decision making during a crisis.

3.2.4 Capability and Capacity of External Resources (KV₄)

The capability and capacity of external resources highlight concerns for organisations. The development of systems and protocols to reduce these vulnerabilities is very much related to the organisation's awareness of its role and its connectivity with key stakeholders. It is also related to an organisation's overall recovery priorities as well as the limitations and expectations of linked organisations. The following discussion focuses on the expected availability of external resources for the organisations and the degree of preparation for the loss of external services and supplies/equipment.

External Assistance

- For most of these organisations there was little or no consideration that other organisations would be seen as more important from both a response and recovery perspective in a large scale event. There were some exceptions to this; one organisation viewed itself as a critical lifeline and was attempting to engage with critically linked external organisations. However, this view was not necessarily supported by these organisations. Another organisation considered that its role in community recovery was considerably less than the expectations of the community itself.

The Knights in Shining Armour

The organisations all appeared to have expectations of emergency services, government agencies and Civil Defence that are disproportionate with the support these organisations could reasonably offer, particularly in a large scale emergency. Many organisations do not have an accurate vision of their own importance in the community and expect that support would be immediately available; extra staff, water supplies, builders, insurance assessors.

Services

- Electricity was the critical service that all organisations were acutely aware of as a keystone vulnerability, closely followed by telecommunications and information technology services. Transportation was considered a vital service for some types of

events for all case-study organisations, and from a recovery perspective water and sewerage services were critical. However, many of the organisations in this study did not have a full awareness of what the loss of these services might mean to continued operations. Therefore they did not adequately plan for either the loss of services or for continued operations once services were restored. Several organisations had considered or purchased backup generators to ensure the continuation of electrical supply to key parts of the business. One organisation claimed that it was too difficult to get resource consent and other permits to install a generator, and that the cost of this process was prohibitive. Other organisations with generators identified that the availability of fuel to run the generator was critical. There was no formal planning for continuation of fuel supply by any of the organisations in this study. Most organisations with generators had partially tested their generators, but there was a significant amount of disagreement within most of these organisations regarding what the generators were actually providing power for.

- A key problem for organisations in planning for service outages is the perception that they cannot control when they happen or their duration. This appears to encourage a climate of disempowerment in organisations regarding planning for service outages which extends through to limited planning for the return of services to the organisation. The lack of planning therefore is heavily influenced by the organisation's awareness of the severity of the event and a tendency for limited strategic thinking and a 'fighting fires' approach to emergency management planning.

Supply Network

- The degree to which organisations plan for continued supply of essential goods and services is also identified as a significant keystone vulnerability issue. Only one organisation had approached its most critical suppliers and attempted to establish preferential supply in a crisis situation. This same organisation also had well established and ongoing relationships with a communications consultant for media management in a crisis. Some organisations identified that their most important suppliers and consultants were likely to be limited in their ability to provide support in a crisis, but these organisations had made no steps to ensuring the services of alternative organisations, or establishing preferential service agreements.

But we have an agreement...

Most organisations in this study believed that their day-to-day relationships with critically linked organisations (including customers and competitors) were excellent and that this would be enough to ensure a continuation of expected levels of service and communications in a crisis.

None of the organisations had considered in any detail the problems associated with a large scale crisis; for example, the availability of builders, plumbers and electricians or the availability of damage assessors for insurance in a large scale regional wide earthquake.

3.2.5 Organisational Connectivity (KV₅)

Some organisations seemed to have excellent relationships and a good understanding of the connectivity to other critical organisations in day-to-day operations. However, there was significantly less thought put into how to maintain these relationships in a crisis. Even with a clear understanding of the relationships between contractors, suppliers, consultants and staff, for example, very few organisations had actually formally (or even semi-formally) engaged in planning to address these issues.

As previously mentioned, most organisations in this study believed that their day-to-day connections would be the same ones they would need in a crisis. Only one organisation had considered a different perspective and was actively approaching emergency management agencies to establish contacts. Some organisations had ongoing relationships with the emergency response organisations. This was due to their regular participation in multi-organisational exercises or because of their role in the community. Those organisations that viewed their contribution to society as being critical to emergency response and/or recovery typically had endeavoured to establish emergency relationships with key response organisations like Civil Defence.

3.3 Adaptive Capacity

Adaptive capacity includes the elements that make up the culture of an organisation and that allow it to make decisions in both a timely and appropriate manner in a crisis as well as to identify and maximise opportunities. The indicators of adaptive capacity identified in this study are discussed below.

3.3.1 Silo Mentality (AC₁)

The concept of silo mentality is not new. It has been widely recognised in the literature (for example see Gill, (2006), Davidson, (2005), and Hasanali, (2002)) and in organisations often represents a decentralised structure, an individualistic approach to achieving goals, and a limited understanding of the overall vision of the organisation. Typically, silo mentality is viewed as a feature of organisations that experience considerable growth (Cote, 2002), but in this study, silo mentality was observed in all of the case-studies irrespective of their size.

The incidence of silo mentality in organisations was not unexpected. However, the degree to which silo mentality appears to underpin many critical aspects of organisational resilience was a significant feature of this study. The occurrence of silo mentality is perceived as being something that organisations are both unable and unwilling to remove. It is an intrinsic feature of the autonomous decision making structures that feature in modern organisations, and is important for ensuring loyalty and pride, as well as competition, into an organisational framework. However, the negative aspects of silo mentality appear to be poorly identified and largely misunderstood by the organisations in this study. These effects include:

- poor knowledge of roles and responsibilities of others in the organisation,
- poorly understood and utilised communications pathways,

- destructive and detrimental relationships developing both internally and externally,
- non-transparent governance and decision making structures, and
- low levels of trust and loyalty from staff and others.

It is important therefore to realise the impact of silo mentality on the overall resilience for organisations. For example, one organisation had identified the negative impacts that silo mentality was having on staff and on the overall work environment. Decision makers chose to address this at executive levels, hoping that the positive spin-offs would filter down to other levels in the organisation. This approach was not apparently successful and the negative effects of silo mentality were having a profound impact. Other organisations claimed that silo mentality had no great influence on operations and on decision making. However, the symptoms of negative silo mentality were evident, particularly during the REDS and other crisis exercises. These manifested in an observed lack of respectful communications, poorly understood roles and responsibilities, unrealistic expectations of key stakeholders, to name a few.

3.3.2 Communications and Relationships (AC₂)

As mentioned above, the effectiveness of communications and relationships in an organisation is influenced by the negative aspects of silo mentality. The importance of creating effective communications pathways based on mutually respectful relationships is apparent to all organisations in this study. However, while most of the organisations recognise that these communications and relationships issues are a problem, the full extent of their potential impact on the organisation in a crisis is largely unrecognised. There were some exceptions, mainly those organisations that experience small scale crises on a relatively regular basis but even these organisations had a limited understanding of the potential impact in a large scale emergency.

Internal communications and relationships were viewed as problematic, particularly for general staff seeking to communicate upwards in the organisation. Typically, between senior and executive staff, communications and relationships were viewed as healthy and effective. These senior staff also viewed their communications to general staff as effective. Those that did recognise problems in communication strategies at different levels of the organisation were doing very little to encourage engagement and ensure a better understanding of staff expectations and limitations.

Let them eat cake...

The senior decision makers in one organisation clearly understood the need to engage with the general staff, and were endeavouring to break down the silo mentality by ensuring that staff at all levels in the organisation had breaks in the same cafeteria. A previous arrangement of one cafeteria for general staff and one for administrative staff was viewed negatively by most in the organisation. Therefore, a larger single café was being built to accommodate all staff on site. This was seen as a key action to improve relationships, enhance communications and begin to break down the negative impacts of silo mentality.

The awareness of roles and responsibilities has an influence on the development of effective communications and relationships. Several organisations in this study had offices and sites distributed throughout New Zealand and internationally. In most instances, staff do not move between offices and therefore an understanding of the key resilience issues including roles and responsibilities for different sites is limited. From an emergency communications perspective this has a negative impact on organisational resilience.

But geography is not the only barrier to resilience; it can be observed between departments in some organisations. One organisation had employees in different departments that had excellent communications and relationships internally. But communications across departments was fraught with difficulty. This was partially because there were no common or reciprocal strategies linking departments and employees were not confident that their communications needs would be met by these systems. Independent systems had developed as a result. This further isolated staff in department groups, perpetuating silo mentality. In another organisation, strategies for emergency management were well established in one department (information technology) but were not communicated throughout the organisation. Therefore, valuable management strategies were not being utilised as effectively or as extensively as possible. Staff outside this department had almost no knowledge of these communications strategies.

Clearly there is a link between effective communications pathways, respectful relationship development and the ability to acquire, transfer and retain critical information in a crisis. Most of the organisations had difficulty in addressing this problem. Effective information acquisition and transfer in a crisis is vital, but can only be effective if all employees appreciate who will need what information, in what type of format, and in an appropriate time frame. In the absence of clearly defined and efficient communications pathways most of the organisations in this study struggled with the successful flow of information in a crisis situation. Some of the case-study organisations were working towards addressing this problem however. One strategy being used to minimise the negative effects of silo mentality on communications and information flow was to encourage a more personal approach to communications; one organisation is actually quite dismissive of email communications. These case-study organisations generally have a wide distribution of offices and sites throughout New Zealand, and their senior staff members travel extensively to ensure that personal contact and communications are made.

Communications and relationships with external stakeholders were also observed to be an issue. Some problems stem from organisations having an inaccurate perception of their importance in the community of stakeholders post disaster. Few of the case-study organisations had engaged in discussions with these stakeholders specifically about emergency response and recovery, and even less have any sort of agreement or memorandum of understanding in this regard. Some of the organisations have not even considered how they may communicate with customers and clients in a crisis, or what sort of information would need to be communicated.

Relationships and communications with the media are often overlooked from an emergency perspective. Two organisations are notable in their poor understanding of clients and media relationships. For both organisations this appears to originate in their perceptions of the organisational vision, and strategic purpose. However, other organisations in this study have specific policies in place for these stakeholders, employing communications consultants to ensure that appropriate messages are created for particular stakeholders, and also to deal

with media exposure. These organisations view this as a positive way to maintain good relationships with external stakeholders.

3.3.3 Strategic Vision and Outcome Expectancy (AC₃)

The importance of the organisational vision for resilience was shown to be significant. All of the organisations in this study had some form of defined purpose or vision statement that underpinned their operations. Some organisations were driven by service to customers; some by supporting the community and some driven by improving the success of key stakeholders. However, the operational reality and the communication of this vision throughout the organisation were less successful. One organisation had two distinct groups representing two different organisational visions. The result was one group always feeling isolated and excluded from the decision making process because they don't perceive that process as representative of their organisational vision. Another organisation had such a strong vision, and was so structured around this vision that it was seen to have significantly reduced flexibility and creativity in decision making structures. No matter what degree of organisational vision each case-study had, there were three critical aspects to consider from an adaptive capacity perspective:

- How well is the vision articulated and communicated through the organisation?
- How well do the day-to-day operations represent that organisational vision?
- How well does the organisation look towards that vision for direction when engaging in emergency situations?

For those organisations with a clear sense of their purpose and vision, the ability to articulate and communicate this throughout the organisation was evident in their day-to-day operations. The impacts of a heightened situation awareness around the organisational vision was also an important factor; several of the case-study organisations were very clear about their roles in the aftermath of a crisis in terms of the wider community of stakeholders. Furthermore, those organisations that saw their role in the community post-crisis as integral to the overall recovery had a much higher expectation of their own organisational recovery. Some of the organisations in this study viewed their role as dispensable or unimportant for community recovery and had a lowered awareness of the overall organisational network. The outcome expectancy of these organisations was linked to this viewpoint and was subsequently also low; they didn't perceive that they would be able to weather the problems faced.

The use of the organisational vision as a critical crisis response tool was not widely recognised. Many of the organisation commented that their approach to emergency management was one of 'fighting fires'; an approach observed in several REDS and other exercises. These types of response appeared to be impacted by the decision maker's ability to make sense of large amounts of information in a relatively short period of time. For those decision makers without the ability to look towards the organisational vision, and identify where the organisation should be heading in a crisis, fire fighting is the alternative. For example when faced with a crisis that impacted on essential services for an extended period of time, the key decision maker in one organisation claimed that they would all just go home. After some coaching and strong suggestions by facilitators, this organisation began to use its

organisational vision for customer service as a motivating force and help determine the emergency response, also creating an easier transition to recovery.

3.3.4 Information and Knowledge (AC₄)

As previously mentioned, the strict adherence to set roles and responsibilities, and little motivation or expectation for staff to step outside these roles has a potentially negative impact on the effectiveness of communications pathways. It also impacts on the quality of the information being communicated. Two organisations in this study have a policy of encouraging staff to move around the organisation and to gain experience in a variety of roles and with a variety of responsibilities. However, even in these organisations there were still individuals that held a large amount of specialised knowledge which was not readily accessible for others in the organisation, particularly if these 'subject matter experts' were absent. All organisations were somewhat adverse to the introduction of additional systems and procedures to capture the information held by these individuals, and the availability of staff to participate in a mentoring program for the continuation of specialist information was difficult to facilitate.

Moving through the ranks.

For one organisation, many members of the leadership team had entered the organisation as general staff and worked their way up to executive positions; this was encouraged in other staff in the organisation. The broad knowledge of the organisation held by these decision makers was evident.

Another aspect of information and knowledge sharing is the nature and format of information to be shared. Very few organisations in this study had considered the sort of information that would be required to maintain an emergency response and ensure a successful recovery. These organisations had also given little thought to how information would be transferred to key people in the absence of traditional communications networks. An illustrative example was during one of the emergency exercises. This particular organisation needed to share information usually contained in maps and plans. However, with the loss of telecommunications, the fax and internet were unavailable. This organisation had not considered any alternative means for communicating this essential information in an emergency. The dependence on traditional telecommunications networks is a significant barrier to ensuring resilience of information and knowledge sharing during a crisis.

3.3.5 Leadership, Management and Governance Structures (AC₅)

One of the most important features for adaptive capacity and overall resilience in organisations is the way organisations are led and managed, both in day-to-day and crisis situations. Organisations in this study all clearly understood the link between developing resilient day-to-day operations as a way to improve their resilience for emergencies and crisis situations. All except one organisation expressed a strong preference for ensuring high levels of autonomy and decentralised decision making for day-to-day operations. However, most of these organisations had not considered or planned for the changed circumstances

that an emergency would present from a decision making perspective; even those organisations that have experience of significant events. There are several contributing factors.

- Firstly, organisations in this study had little awareness and understanding of the consequences of events that encompass a large geographic area (multi-regional) or affect a very large number of people (pandemic, war, civil disruption etc). Generally, their expectations for decision making in all crises is that individual offices or sites (even down to the scale of departments within an organisation) can continue to operate autonomously.
- Secondly, many organisations displayed inadequate emergency communication systems, both the physical network and from an information sharing and relationships perspective. The need to co-ordinate and communicate, not only with emergency services and civil defence organisations, but also with other offices, departments and decision makers within the organisation, is often not clearly appreciated. Critical decisions and their expected outcomes have not been considered, and communications and decision making structures have not been tested.
- Thirdly, many organisations do not have a clear view of their response and recovery priorities, minimum operating requirements or the support structures that are required to ensure these are achievable. There were some exceptions:
 - Two organisations working together in an emergency exercise displayed a much clearer understanding of these requirements, but one had yet to translate this into emergency decision making structures.
 - Another organisation in the study had not explored the realities of how decision making in an emergency could continue to be successful if communication pathways broke down, or even if key individuals were absent.
 - Yet another of the organisations was largely unaware of its minimum operating requirements other than in isolated pockets within the organisation.
 - One of the other organisations believed that it had a clear mandate to make decisions for some specific external stakeholder groups because of the history of good relationships and communications built up over time. However, this organisation seemed to be unaware of the expectations this bought from those stakeholders; that all key decisions could and would be deferred to the case-study organisation rather than the stakeholders taking responsibility in a crisis. This is likely to break down extensively if the physical communications network was compromised, as there is no clear decision making structure for this eventuality.

Leadership visibility, availability, and decision making transparency all have a marked impact on adaptive capacity. Those organisations with the highest degree of adaptive capacity all showed excellent visibility of the leadership and decision making team, and all staff were able to communicate directly with these individuals if required. Furthermore, the decision making process was relatively transparent, and was supported with good communications internally to all staff.

Access to the power.

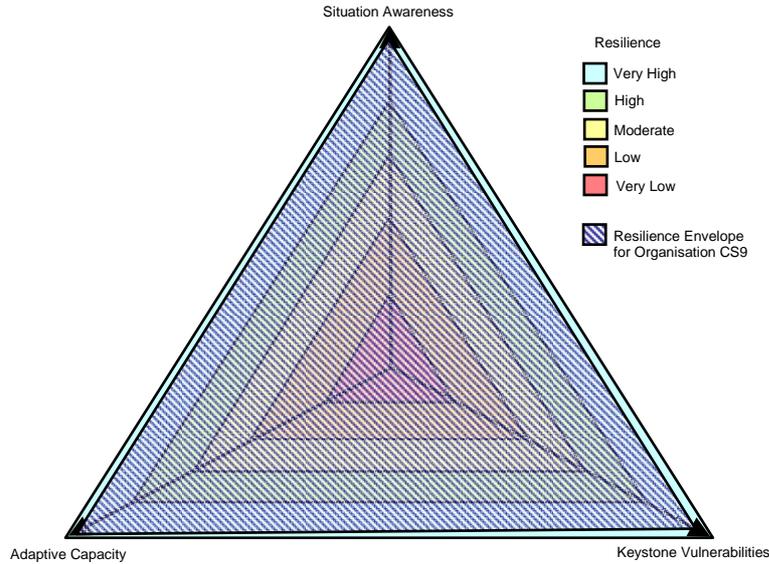
The organisation with the least adaptive capacity in this study had a very rigid hierarchy for decision making, and the ability to communicate with the leadership team was not equal for all employees. Additionally, this organisation had a very poor decision making transparency. For this organisation staff commented that they are often frustrated because the degree of accountability they have for decisions and the input they have into making those decisions are not comparable, nor do decision makers adequately communicate to all staff why decisions are made.

3.4 Synthesis for Resilience Indicators

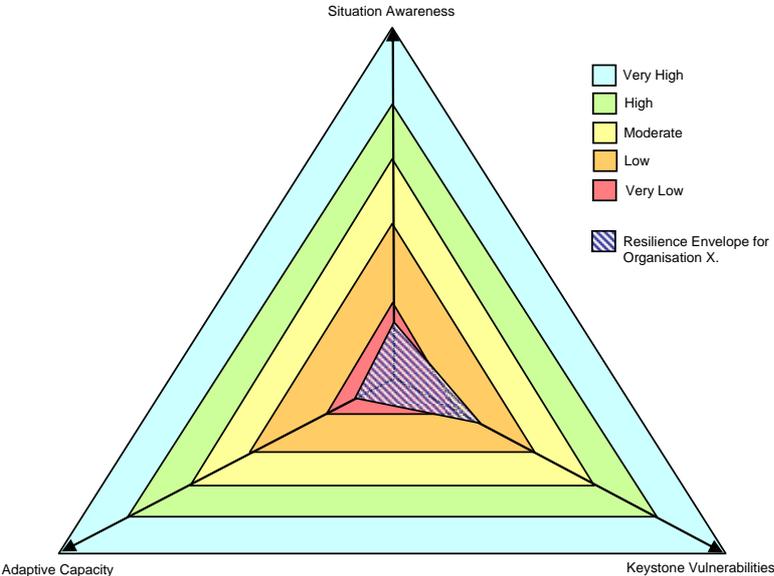
A number of indicators of organisational resilience have arisen from the case-study organisations. These organisations were selected specifically to represent the widest range of organisations possible to investigate the hypothesis that there are likely to be generic resilience indicators common to all organisations. From the set of ten organisations studied, a total of 15 generic indicators have been identified which have been categorised according to which aspects of resilience they impact most; situation awareness, management of keystone vulnerabilities or adaptive capacity. The case-study organisations have been given a relative rating for each indicator; comparing individual organisations with the others in this study. The individual ratings have then been collated to give an overall relative rating of situation awareness, management of keystone vulnerabilities, and adaptive capacity for each organisation. These profiles and how they are generated is the subject of the next section of this report.

4 Resilience Profiles

The resilience profile is a relative, qualitative representation of overall resilience in an organisation. An example of the resilience profile is presented in Figure 2. Each axis on the resilience profile is divided equally into five categories representing the degree of situation awareness, management of keystone vulnerabilities and adaptive capacity; very high, high, moderate, low and very low. An envelope of resilience is created by joining the points along each axis.



(a) Organisation with Very High Resilience



(b) Organisation with Very Low Resilience

Figure 2. The Resilience Profile. For an organisation with very high resilience (a) the resilience envelope (blue and white hashed area on the diagram) will plot close to the apex of each axis of the triangle, in the very high (blue) zone. For an organisation with very low resilience (b) the resilience envelope will plot much closer to the centre of the diagram for each axis.

As can be seen in Figure 2 (a) an organisation with a high degree of resilience will have an envelope of resilience that plots close to the end of each axis, and away from the centre of the diagram; the envelope of resilience is larger for organisations with higher resilience. An organisation with low resilience will plot much closer to the centre of the triangle on each axis. Figure 2 (b) shows an organisation with a low overall resilience for comparison.

The axes for situation awareness and adaptive capacity are relatively simple to conceptualise; an organisation with high situation awareness or adaptive capacity will plot in the high zone on the diagram. However, the axis for management of keystone vulnerabilities can be somewhat counter-intuitive. The very high zone on the axis represents increased resilience, and therefore an organisation that plots in the very high zone for keystone vulnerabilities is one which has these clearly identified and well managed.

The degree of situation awareness, management of keystone vulnerability or adaptive capacity is assessed on a qualitative basis by assessing the performance of an organisation relative to the resilience indicators. Appendix A describes the resilience qualities observed in each of the ten case-study organisations and also compares their respective resilience profiles.

5 Summary and Conclusions

5.1 Overview

The creation of more resilient organisations has significant implications for improving resilience of entire communities. This study has highlighted a set of 15 resilience indicators that are common to ten case-study organisations, selected to offer a wide representation of organisations in the New Zealand context. In addition, this study has developed a Resilience Management framework for both evaluation and improving the resilience of individual organisations. This framework has been created in conjunction with the case studies to provide a real world context and offer tangible, achievable goals for organisations seeking to become more resilient.

5.2 Strategies for Achieving Increased Resilience

During work with all of the case-study organisations, a set of tangible action plans were developed with workshop participants forming the beginnings of a strategy for improved resilience management. All of these plans have been collated and the information is distilled into two generic resilience management strategies for organisations. They include a resilient communications strategy and an emergency planning strategy. The two strategies, described in Table 6 and Table 7 below, are designed to target all of the resilience indicators outlined in this report.

Resilient Communications Strategy	
<i>What are we all about?</i>	Ensuring everyone in the organisation understands the long-term organisational vision and strategy. Identification and prioritisation of core business functions. Clear delineation of the organisation’s strategic goals and establishing effective means for articulating this vision to all employees. Further monitoring and ongoing involvement in exercises to ensure that the message is reaching all target groups.
<i>Leadership and Governance.</i>	Develop the ability of all key decision makers to have an equal voice in a crisis and build an understanding of the individual strengths and weaknesses of decision makers in the organisation.
<i>Stakeholder Welfare</i>	The development and maintenance of policies to ensure a clear and enduring understanding of the expectations and limitations of all stakeholders, internally and externally.

Table 6. Key elements of a Resilient Communications Strategy.

Emergency Planning Strategy

<i>What is important to us?</i>	Agreeing, in advance, the key priorities for the organisation in times of crisis and confirming that these reflect the core values of the organisation. Specifying minimum operating requirements. Identifying who we rely on and what others expect from us.
<i>What could hit us and how bad could it be?</i>	A deeper understanding of the range of potential events that the organisation may be exposed to and the expected consequences. This can involve brainstorming exercises, risk identification strategies and scenario creation to build awareness.
<i>What should our responses to crises be?</i>	Crises differ significantly from day-to-day business. Organisations need to develop business-as-usual resilience which is in turn complemented by emergency response principles for different types of crises. This will include rostering of staff, personal preparedness measures, establishing emergency operations centres and alternatives for crisis communications networks.
<i>What do we have at our disposal?</i>	Ensuring that the resources the organisation has available are adequately prepared to meet the requirements of the organisation in a crisis. This may involve an inventory of internal and external resources and their potential limitations. It will also involve identification of key employees and external stakeholders with specialist knowledge and/or skills in an emergency situation and may involve short term secondments or semi formal succession plans to build knowledge and awareness.
<i>What does Recovery mean to us?</i>	Recovery is rarely a discrete time frame, so organisations must consider how to stand down from an emergency, what external assistance may be available, how to assess the applicability of the strategic vision for potentially changed markets and environments and ongoing trauma for staff and external stakeholders.
<i>Should we participate in Exercises?</i>	Testing plans is vital as is adequately informing and training staff about expectations during a crisis. Exercises can be used to test and modify plans, train employees and engage with key external stakeholders.

Table 7. Key elements of an Emergency Planning Strategy.

5.3 Implementation Issues

Resilience Management is a process that can be scaled to meet the needs of the user; it can be applied to individuals, small groups (for example leadership teams) or organisations of all sizes. Additionally, Resilience Management can be used more collectively and tools applied at multi-organisational, industry sector or even community wide scales.

Ideally, Resilience Management will develop to a point where organisations can integrate resilience techniques and processes into everyday business, progressively building overall resilience in the face of identified and unforeseen crisis events. Resilience Management is likely to require some facilitation from external experts given that not all organisations will have the skills and resources required for successful implementation in-house. This is particularly likely to be so for micro businesses (less than 10 employees) and small-medium enterprises (SME's).

While the elements presented in this report are all important for the successful development of resilience in organisations, they do not have to be used in sequence or in great detail for some significant progress to be made. For example, an initial survey of resilience issues is possible with a short round of interviewing and a survey, generating a preliminary resilience profile. From this point, an organisation can decide the scale of approach, and the time frames that are most appropriate for it. Further, an organisation may choose to implement Resilience Management as a program of REDS, engaging in different scenarios over a set time frame and for different groups of stakeholders to improve overall resilience. For organisations that already have a working risk management system in place, the vulnerability assessments and matrices would identify clearly where resources could be best spent to address some of the keystone vulnerabilities, thereby reducing the overall identified risks.

Because the Resilience Management process is scalable, organisations can begin the process at one level (for example senior management teams and decision makers) and move through the organisation to identify and develop resilience at other levels. Or, an organisation that identifies critical resilience issues in conjunction with specific stakeholders can choose to implement the Resilience Management process with these groups and individuals.

It is important to note that Resilience Management is not a one-off tool for the assessment and development of organisational resilience. As such, it is designed to be an iterative system that an organisation implements at various levels and over a length of time. Resilience profiles, action plans and stakeholder relationships are likely to vary over time, and an organisation will change its resilience management plans following a crisis event. Therefore, organisations should not see Resilience Management as a crisis response and recovery tool; rather Resilience Management is a long term investment in the overall health and prosperity of the organisation and its community of stakeholders, including the wider community.

5.4 Future Work

Our research into the resilience of organisations will continue for the next three years. Further development of the methodology will include a more standardised approach to both keystone vulnerability prioritisation and for the measurement of the resilience indicators in organisations. This is likely to require a more quantifiable methodology than is currently available.

The extent of resilience examined in this study is limited to the case-study organisations. It is unlikely that any of the case-studies are close to being the most or least resilient organisations possible. Future work will include expanding the methodology to look at organisations that have experience with large scale disasters, as well as organisations from other countries to investigate the importance of cultural issues in resilience.

Further work also needs to be done to create maturity models of resilience; organisations need to have tangible and achievable goals in becoming more resilient in order to maintain their engagement with the process.

The next phase of this research programme will also look to develop strategies for benchmarking the resilience of organisations, both within and across market sectors.

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Appendix A. Resilience Profiles for Case-Study Organisations

This research involved working with ten case-study organisations to develop and test the Resilience Management methodology. The following discussion briefly outlines the key resilience issues for each organisation and presents their individual resilience profiles for comparison.

CS1 – Private Manufacturer

CS1 is a private manufacturing organisation that had the role of pilot case-study organisation in this research. Overall CS1 has a moderate resilience profile (Table 8). This arises from a moderate situation awareness based on limitations regarding awareness of hazards and impacts, and a poor understanding of stakeholders outside of its immediate operating environment; although CS1 understands its internal operating environment very well. CS1 also has a moderate ranking for keystone vulnerability identification and management. The lack of preparation for the loss of electrical services and poor emergency management protocols outside of its IT department are significant weaknesses in this area. As a result CS1 is very prone to a ‘fighting fires’ mentality when dealing with crises. Finally, CS1 also has moderate adaptive capacity due principally to the difficulty of communications and relationships internally. While the organisation has a very strong organisational vision, this is also somewhat limiting the flexibility and creativity needed in crisis decision making.

CS2 – Local Authority

CS2 is a local authority organisation consisting of less than 40 full time staff, serving a predominantly rural community. As a local authority CS2 is responsible for civil defence responses and this was an important facet to study, particularly given CS2’s recent experiences with natural disaster. Like CS1, CS2 has a moderate overall resilience (Table 8).

Situation awareness is the greatest weakness for CS2 with poorly communicated roles and responsibilities throughout the organisation. Also, the organisation’s perception of its role in the community is somewhat different to community expectations. In spite of its recent experiences with hazard events, CS2 also has a limited awareness of the range of hazards that it is exposed to and the extent of negative consequences. However CS2 does have clearly identified keystone vulnerabilities contributing to its high ranking in this category. This organisation has established a specialised emergency operations centre and has a generator for electricity outages. A strength for CS2 is its ability to gain support and resources from other local government and national government sources, as well as community groups and emergency service organisations, but these are restricted resources. It is likely to be only appropriate for some types of crises. Poor communications and a breakdown of these relationships in the recent crisis event is evidence for a strong silo mentality culture at CS2, impairing its adaptive capacity.

CS3 – Private Contractor

CS3 is a large private contracting firm that has offices throughout New Zealand and which has a very high relative resilience in this study (Table 8).

There appears to be some issues with knowledge of roles and responsibilities throughout the organisation. This issue is particularly apparent within the Head Office environment regarding awareness of its own role in any regional or multi-regional crisis. Additionally, CS3 has a clear understanding of a handful of crisis events, but planning for emergencies is dominated by its experience of previous crises; typically small to medium events that are dealt with at a regional level. In general, CS3 has clearly identified many of its keystone vulnerabilities and is working towards appropriately managing them. This includes identifying alternative sites for emergency co-ordination and consideration of the impacts from the loss of key services. Keystone vulnerabilities identified at CS3 relate specifically to the failure of infrastructure networks, the availability of supplies, equipment and fuel, together with the understanding of contract obligations in a crisis, and the availability of services from the Head Office supporting the regional offices. Typically CS3 has a high adaptive capacity based on an organisational culture of responsibility, autonomy and empowerment and good communications between staff in individual offices. Weaknesses include communications that are less robust between different regional offices, and with sub-contractors and clients. Further, the 'hands-off' approach to regional management of crises and emergency planning by Head Office is potentially limiting for CS3.

CS4 – Public Utility Provider

CS4 is a moderately sized public utility organisation with regional offices in numerous centres throughout New Zealand.

CS4's overall resilience was shown to be high (Table 8). While situation awareness is shown to be high, CS4 still has a significant issue with the understanding of roles and responsibilities, particularly in terms of crisis response and recovery. However CS4 has a very clear understanding of its recovery priorities for itself as an organisation and from the perspective of its community of stakeholders. Generally keystone vulnerabilities appear well managed and identified. Prominent vulnerabilities include the fragility of the communications network, protocols for succession in a crisis, and the transfer of information throughout the organisation. CS4 has also taken part in several training exercises for emergencies contributing to a very high ranking in the keystone vulnerabilities category. In terms of adaptive capacity, governance and leadership at CS4 reflects a strongly autonomous culture, but it is one that has a limited strategic outlook in a crisis. Additional weaknesses are observed prominently in communication and relationship difficulties for CS4. Adaptive capacity is enhanced by CS4's clear vision of its role in an emergency, although this is not always well communicated between offices internally. Overall CS4 has moderate adaptive capacity.

CS5 – Education Provider

CS5 is an education provider, a large employer for the local community and has an established reputation both within the New Zealand context and internationally. Compared to

the other organisations in this study, CS5 has a low overall resilience (Table 8) based predominantly on poor situation awareness, poor understanding of keystone vulnerabilities and limited adaptive capacity.

Overall, there are significant issues with internal perceptions of the organisation's core business which in turn affect recovery priorities. A considerable contributing factor is a poor understanding of other people's roles and responsibilities at CS5. People are very reluctant to step outside of their designated roles and responsibilities to broaden their understanding of the rest of the organisation. Overall, CS5 has gone some way towards identifying and managing its keystone vulnerabilities. However, a poor understanding of the less operational vulnerabilities, a limited application of planning as exercises and training for all staff, together with some significant physical vulnerabilities leads to a low rating on the resilience profile. The most significant resilience issue for CS5 is the negative impact of a strong silo mentality in relation to communication, relationships and the transfer of information in the organisation. There is also a perceived lack of transparency in decision making; particularly where an employee's ability to make decisions and their accountability for the results of those decisions are perceived to be at odds. Overall, adaptive capacity at CS5 is low.

CS6 – Private Wholesale Distributor

CS6 is a wholesale distribution organisation with a reputation throughout its workforce as a family oriented working environment. This organisation has a high overall resilience (Table 8) based on moderate situation awareness, a high ranking for keystone vulnerabilities and very high adaptive capacity.

CS6's greatest weaknesses relate to a somewhat limited awareness of what key stakeholders may expect of the organisation in a crisis response and recovery, extending to awareness of the consequences of various hazards CS6 may be exposed to. CS6 has made some very good progress on identifying its keystone vulnerabilities and managing them accordingly, due in part to the longevity of key decision makers in the organisation and their detailed knowledge of the business. However, CS6 had not considered the full implications of the loss of electricity and the reality of a breakdown in the telecommunications network on a regional scale. In addition the organisation has some very vulnerable buildings and equipment to some types of hazard and has not considered alternative plans for continued operations. Typically CS6's adaptive capacity is a significant strength, supported by the structure of the organisation and the inherent trust of key customers that provides the mandate to make decisions quickly and authoritatively. Barriers to improving adaptive capacity at CS6 include an inability to gather appropriate information to support decision making in a crisis and a lack of specific strategies to disseminate this information. In addition, the principal decision makers at CS6 have developed some incorrect assumptions about their ability to communicate effectively during a crisis.

CS7 – Private Utility Provider

CS7 is a discrete business unit within a large private organisation that has a widespread distribution of offices throughout New Zealand. CS7 was shown to have a moderate relative overall resilience (Table 8).

Situation awareness at CS7 is low as a result of poor understanding of roles and responsibilities outside of departments and business units. Additionally, the situation awareness of CS7 is let down by a poor understanding of the potential impacts of some key hazards and the ability of the organisation to effectively respond to them; for example the organisation's expectation that it could work remotely. Another significant weakness for CS7 is its poor connection to customers, having no ability to map customer movement or demands. CS7 has made some attempt at crisis and business continuity planning, but there is a significant reliance on the parent company to perform this task. Additionally the organisation is heavily vulnerable to the loss of key services and also buildings and equipment, the loss of telecommunications services, poor staff welfare systems as well as the potential loss of intellectual property and security of databases and critical information. CS7 has an experienced team of people available through its parent company to help in the identification of risks and associated vulnerabilities, but due to the very autonomous nature of the organisation this resource is not widely utilised. Silo mentality has become entrenched in the organisational structure over time, although CS7 is very well aware of this. The greatest weakness in CS7 is the poor ability to make decisions in an appropriate and timely manner. This is primarily because the organisation does not currently have the necessary systems in place to ensure that the information it is gathering (either in day-to-day business or in a crisis situation) is accurate or appropriate for the given situation. While CS7 is relatively agile in its decision making in-house, it is limited by the decision making ability of its parent company; a reflection on the size and structure of the parent organisation. Adaptive capacity for CS7 is moderate.

CS8 – Private Retailer

CS8 is a medium sized retail operation that services a rural community in New Zealand. CS8 is also part of a group of other branded organisations throughout New Zealand. CS8 is serviced by a wide range of organisations and is a significant social and information hub for the local community. Overall resilience for CS8 was ranked as high (Table 8).

Internally CS8 has a good awareness of individual roles and responsibilities, but there is almost no movement of staff between departments. There is also a lack of understanding and awareness regarding hazards and impacts, both those affecting CS8 and those that affect the community CS8 serves. However, CS8 has a good awareness of its importance to the community and to its customers and of its recovery priorities. This awareness of the importance to the community may be overly positive, with CS8 seemingly unaware of the potential negative impacts of rumour and gossip. Overall situation awareness at CS8 was moderate. Keystone vulnerabilities were ranked as moderate with the most significant limitation being a reliance on the network of organisations CS8 is affiliated with from a decision making perspective. CS8 has not engaged in any planning independently from its organisational network, and has never participated in emergency exercises other than for fire evacuation. CS8's strength, however, lies in its adaptive capacity. The organisation is relatively flexible, has the capacity for creative decision making, the support of a large organisational network and inspirational, hands-on leadership. This organisation also favoured a substantial degree of autonomy in the workplace for decision makers, but this resulted in senior management being unaware of some key issues because staff believed they had responsibility for decision making.

CS9 – Private Primary Producer

CS9 is the New Zealand operation of a large primary producer with international markets and a strong relationship with its multi-national parent company. This organisation is widely distributed in New Zealand with approximately 35 centres around the country. CS9 is ranked very high in all three categories of resilience; situation awareness, management of keystone vulnerabilities and adaptive capacity, resulting in an overall resilience ranking of very high (Table 8).

Typically the organisation has a good awareness of its operating environment, its reputation in that environment, its key stakeholders and its risk profile. However, where the organisation does lack awareness is in its knowledge of the impacts of large scale events that impact the regional networks CS9 relies upon such as electricity and telecommunications. Further, the organisation has a limited awareness of the potential expectations other organisations may have of it in some types of crises, as a primary producer. There are some significant keystone vulnerabilities identified for CS9 in this study. Most of these are already identified by CS9, and many are being actively managed at the present time. Significant vulnerabilities identified for CS9 include the fragility of the telecommunications network and changes to the legislative environment in New Zealand. This organisation conducts extensive risk management programs on a regular basis and also engages regularly in emergency scenario exercises, based predominantly on emergency communications. From an adaptive capacity perspective, CS9 has significant flexibility in decision making due to the financial, logistical and technical support of the parent organisation. The other side of this coin however, is that for very large events, the distal nature of the parent organisation may impact on effective and timely communications and consequently on the resilience of CS9. Silo mentality is also an issue, but improving communications and awareness of this issue limit the impact on resilience. CS9 has indicated that in some areas it is difficult to recruit employees, and also the organisation has an ageing workforce; the handover of responsibility being something that CS9 has yet to manage adequately.

CS10 – Private Technology Provider

CS10 is the smallest organisation involved in this study with just eight full time employees. The organisation is a private business that operates in the supply of technological services to clients. The organisation has a high overall resilience ranking (Table 8) based on a high situation awareness, moderate ranking for keystone vulnerabilities and a very high adaptive capacity.

CS10 has a good awareness of its operating environment and how its place in that environment may change quickly. The organisation is limited in its ability to prioritise customers in terms of recovery because it doesn't adequately understand the requirements and dependencies of its customer base. Additionally, the organisation is only just beginning to appreciate the range of hazards that it may face and their potential ongoing consequences for the business. Situation awareness is considered to be high at CS10. Despite some significant keystone vulnerabilities, most notably the telecommunications and electricity services, CS10 generally identifies and manages its keystone vulnerabilities well. This is due in large part to the organisation's understanding of its operating environment. The organisation's principal keystone vulnerabilities include the availability of fuel and maintenance for its generator as well as the limited communication of strategic direction

throughout the company. The organisation has not yet engaged in planning exercises, but it has performed some planning, and this is an ongoing priority for CS10. The organisation's high adaptive capacity is based around the culture of the organisation, a strong balance sheet, financial stability, as well as excellent communications internally and good communications externally. CS10 does identify a lack of a strategic direction being clearly articulated in the organisation, leading to a 'fighting fires' mentality when dealing with crises. Typically CS10 has very high levels of adaptive capacity.

Comparison Across Case-study Organisations

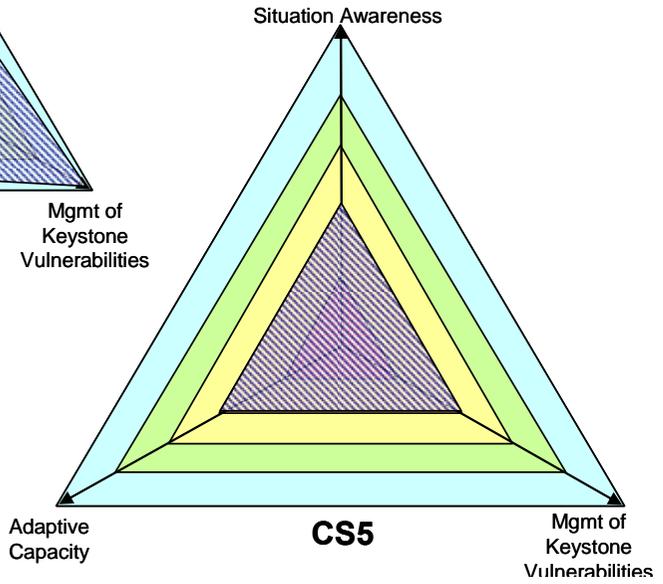
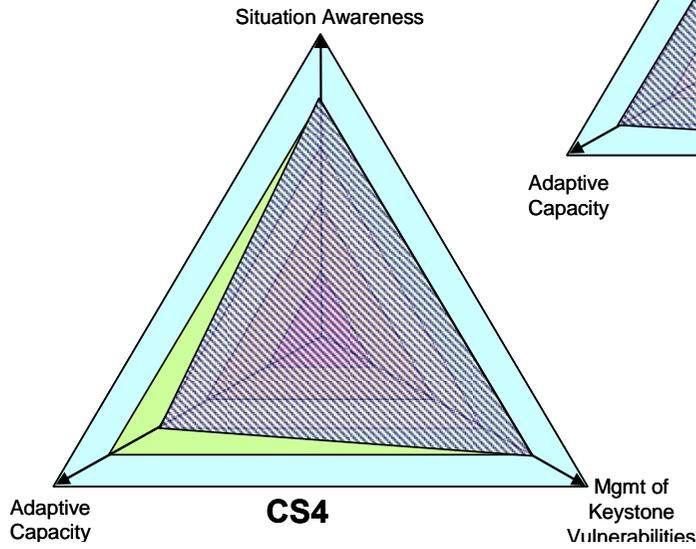
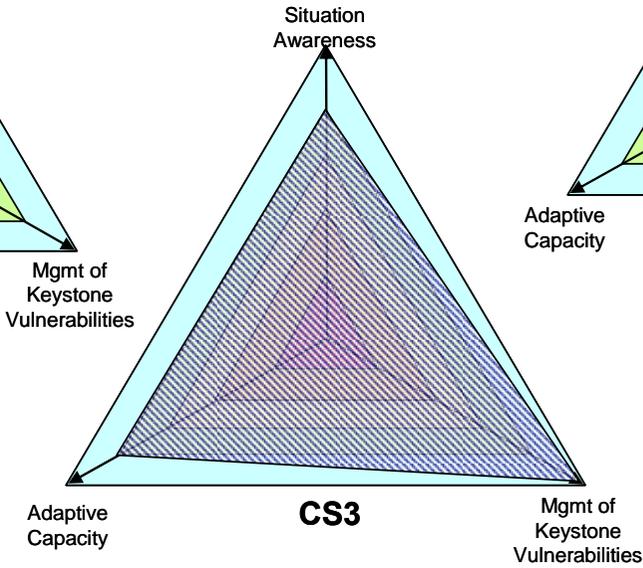
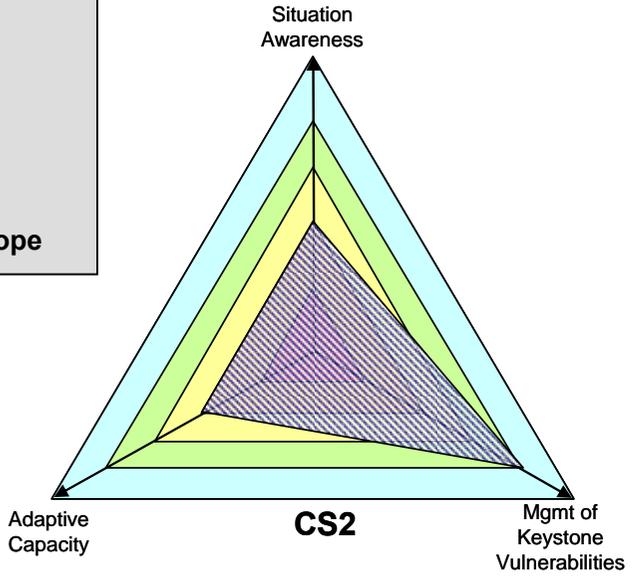
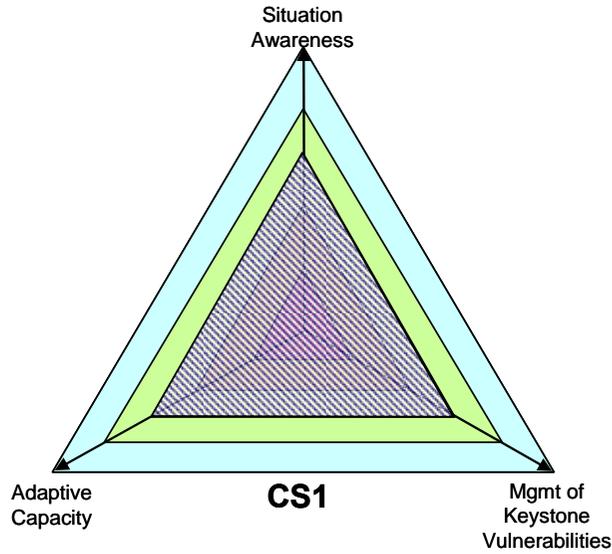
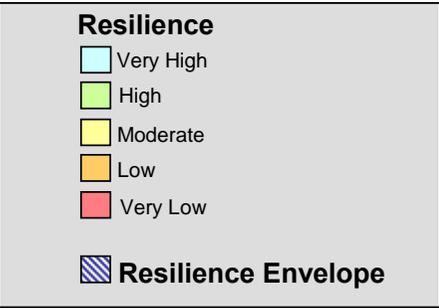
Table 8 presents the relative rankings for each resilience indicator for each of the case-study organisations and the composite rankings of situation awareness, management of keystone vulnerabilities and adaptive capacity for each organisation.

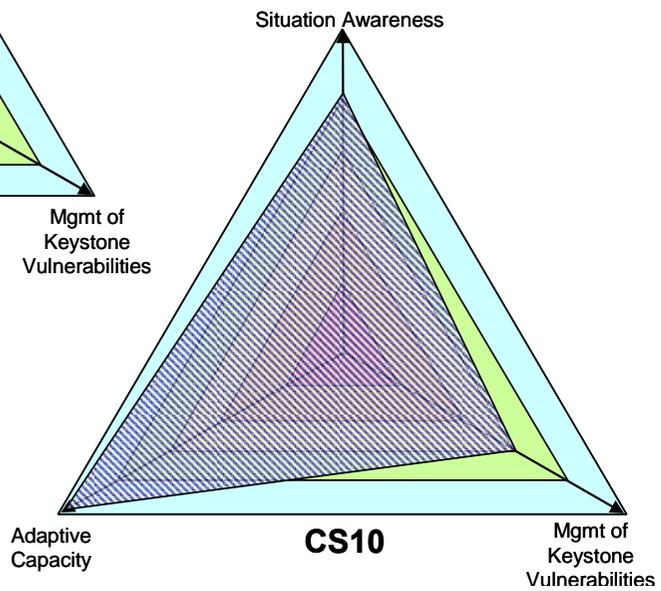
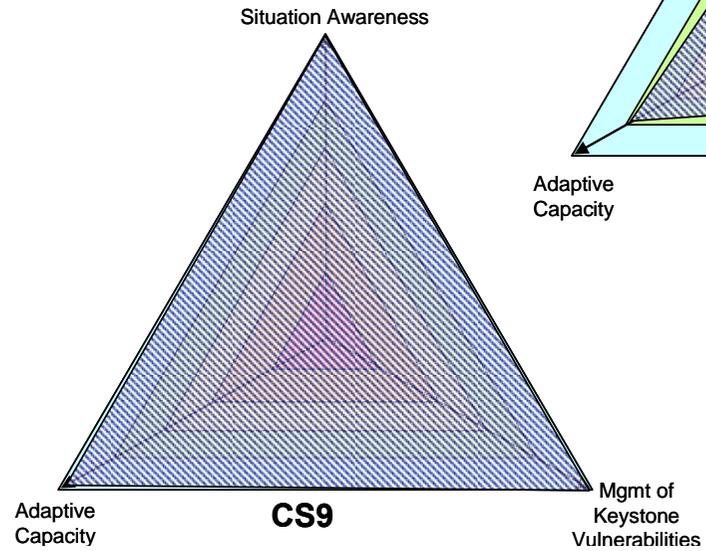
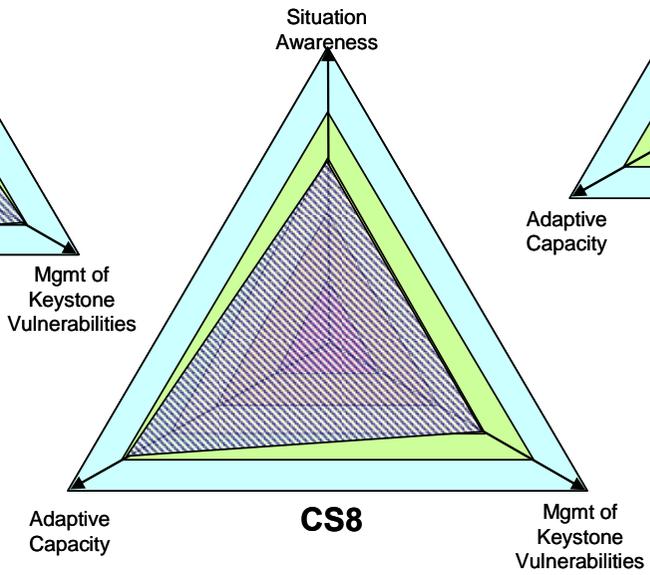
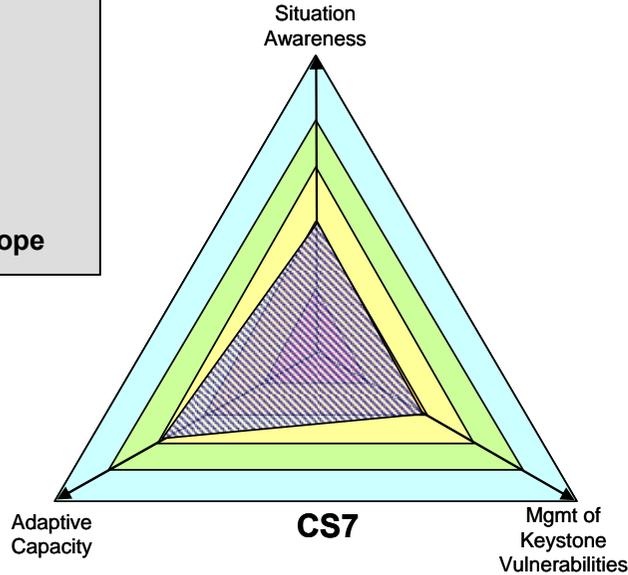
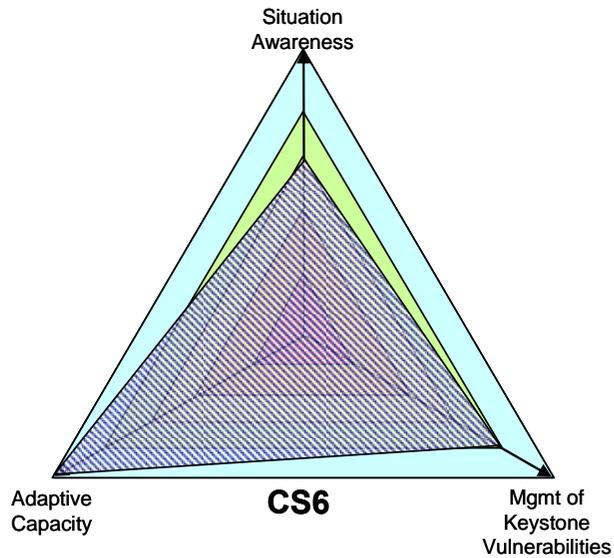
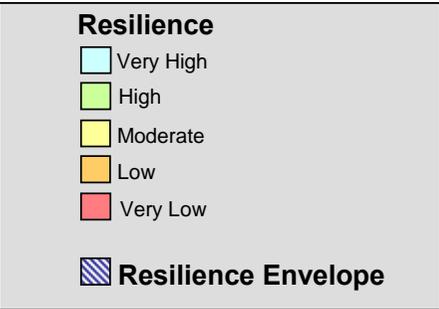
The degree of situation awareness, management of keystone vulnerabilities or adaptive capacity is assessed on a qualitative basis by assessing the performance of an organisation relative to the resilience indicators. Each organisation was scaled according to their performance in each indicator in relation to the other organisations in the study. Therefore, there is at least one organisation with a very high ranking and one with a very low ranking for each resilience indicator. All other organisations are compared to these two end points and given a relative ranking.

The resilience profiles show the relative rankings for each attribute of resilience, and the envelope of resilience represents the relative overall resilience of each organisation comparative to the others in the study.

		CASE-STUDY ORGANISATIONS										
		Indicator	CS1	CS2	CS3	CS4	CS5	CS6	CS7	CS8	CS9	CS10
Situation Awareness	Roles and Responsibilities	SA ₁	Mod	Low	Mod	Mod	Very low	Mod	Very low	Low	Very High	Very High
	Understanding of Hazards and Consequences	SA ₂	Very low	Low	V.High	High	Mod	Mod	Low	Low	V.High	Mod
	Connectivity Awareness	SA ₃	High	Low	High	Mod	V.Low	Low	Low	V.High	High	V.High
	Insurance	SA ₄	Low	Mod	Low	V.High	Mod	Mod	Low	V.Low	High	Mod
	Recovery Priorities	SA ₅	Mod	V.Low	V.High	High	V.Low	Mod	Mod	High	V.High	Low
	SUMMARY	SA_{COMP}	Mod	Low	High	High	Low	Mod	Low	Mod	Mod	V.High
Management of Keystone Vulnerabilities	Risk mgmt and Planning Exercises	KV ₁	High	Mod	High	V.High	Mod	High	V.Low	V.Low	V.High	Low
	Internal Resources	KV ₂	V.Low	High	V.High	V.High	V.Low	Mod	V.Low	Low	V.High	Low
	External Resources	KV ₃	Mod	V.High	High	High	Low	High	Mod	Low	V.High	Mod
	Connectivity	KV ₄	Mod	High	High	Mod	Low	High	Low	Mod	High	High
		KV ₅	V.Low	High	V.High	V.High	V.Low	V.High	Mod	High	High	Mod
	SUMMARY	KV_{COMP}	Mod	High	V.High	V.High	Mod	High	Low	Mod	V.High	Mod
Adaptive Capacity	Silo Mentality Management	AC ₁	Low	V.Low	Mod	Mod	V.Low	V.High	Mod	Mod	Mod	V.High
	Communications/relationships	AC ₂	V.Low	Mod	High	Low	Low	V.High	Low	V.High	V.High	V.High
	Strategic Vision	AC ₃	V.High	Low	Mod	Mod	V.Low	V.High	Mod	High	High	Mod
	Information and knowledge	AC ₄	Mod	Mod	High	Mod	V.Low	V.High	Low	Mod	V.High	V.High
	Leadership and management	AC ₅	High	Mod	High	Mod	V.Low	V.High	Mod	High	V.High	V.High
	SUMMARY	AC_{COMP}	Mod	Low	High	Mod	Low	V.High	Mod	High	V.High	V.High
OVERALL RESILIENCE			Mod	Mod	V.High	High	Low	High	Mod	High	V.High	High

Table 8. A summary of the relative resilience indicator results for each of the case-study organisations with composite results for situation awareness, management of keystone vulnerabilities and adaptive capacity for each.





Appendix B. Literature Review

B.1 Resilience: The Historical Context

Traditionally, resilience is viewed as the qualities that enable the individual, community or organisation to cope with, adapt to and recover from a disaster event (Buckle et al, 2000; Horne, 1997; Mallak, 1998; Pelling and Uitto, 2001; Riolli and Savicki, 2003). Although the term resilience has its roots in science as the ability of materials to return to their original form following deformation (Sheffi, 2006a) it is also used to describe the capacity of a system to absorb change (generally conceptualised in the form of sudden shocks) and still retain its essential functionality (Walker et al, 2006). One of the most influential contributions to defining the term resilience is attributed to Holling in 1973 and is associated with the stability of ecological systems. In the ecological literature there is a distinction between engineering resilience and ecological resilience, each representing different attributes of a system's stability (Gunderson et al, 2002). Engineering resilience refers to systems that exist close to a single state of equilibrium (Holling, 1996) and is defined by both the distance the system moves from this steady state and the time taken for the system to return to its original steady state following a disturbance (Gunderson et al 2002). Ecological resilience describes the system that has no single stable state but instead may have a number of possible domains or behaviours (Walker et al, 1981; Gunderson et al, 2002). Resilience in these types of systems is a measure of the size or magnitude of disturbance that the system can absorb before it restructures itself and moves into another state of behaviour (Gunderson et al, 2002). A third concept to appear in the literature regarding the resilience of systems is that of adaptive capacity; the ability of a system to change the variables that define the states of equilibrium (Gunderson, 2002; Luers and Lobel, 2003; Gunderson et al, 1996; Mallak, 1998).

Evolution of the original concept of resilience has occurred through its application in numerous scientific disciplines. Resilience has been discussed in relation to; climate change and linked to vulnerability (Timmerman, 1981); in terms of proactive and reactive resilience of society as a whole (Dovers and Handmer, 1992); as it relates to both ecological and social systems (Adger, 2000); and natural hazards (Blaikie et al, 1994) to name but a few. Several excellent reviews of the literature are available by Klein et al (2003), Folke, (2006) and Hollnagel et al (2006) and the reader is directed towards these for a detailed discussion. However, as pointed out by Klein et al (2003), resilience remains a theoretical concept and methods for achieving improved resilience at an operational level still challenge both the academic and the practitioner. Resilience applies not only to a systems ability to change or remain stable within a given context. Resilience, critically, also relates to the appropriateness of that change or stability for the given situation and potential future contexts (McDonald, 2006).

B.2 Organisations as Complex Adaptive Systems

One way forward is to consider resilience in the context of a systems approach; more specifically in relation to complex adaptive systems. A general systems analysis approach has been suggested by a number of authors as a way to assess and measure resilience at an organisational scale (Horne, 1997; Riolli and Saviki, 2003, Dalziell and McManus, 2004, Starr et al, 2004).

Recent work into the interconnectedness of organisations has allowed researchers to identify the critical links and hubs of their relationships with other organisations and their participating

communities. This recognition has led to a greatly increased understanding and appreciation of their vulnerabilities; economically, politically, socially and environmentally. The advent of the information age, and the increasing reliance on computerised networks and communications has reduced the size of the world for organisations while at the same time dramatically increasing the potential for abuse of the systems. Much of the risk that organisations face is tied up in their intrinsic interconnectedness; the organisational network. The key to successful adaptation in this new, changing environment, according to Barabasi (2003) is to move from a tree-based organisational structure, to a web or network organisation that effectively utilises many inter- and intra-organisational links. It is the realisation that no organisation can or does work alone that is crucial to the successful navigation of a crisis event.

One of the most important outcomes of this networked economy is the potential for small changes at one scale to become significant, even devastating, at another. While broken links generally affect only the immediate organisations involved, the failure of some links will lead to a ripple effect throughout the entire system (Comfort, 1999; Barabasi, 2003; WBCSD, 2004). Examples are numerous and include, among others, the 1997 East Asia economic crisis and the 1996 Power blackout in the USA and Canada. Perrow (1984) discusses systemic failures or ‘accidents’; the result of standard or regular errors that compound in unanticipated ways and result in consequences that are unexpected.

One of the challenges for organisations is not to over prioritise those events they can foresee at the expense of building the capacity to cope with those they cannot. In many instances, the issue of ‘risk transference’ significantly alters the perception of risk away from the high consequence, low probability events (Figure 3), (Etkin, 1999; Mileti, 1999; Tobin and Montz, 1997). Similarly, those events that have not been experienced in living memory, or even historically, are much less likely to be considered as worthwhile for realistic risk assessments (Etkin, 1999; Slovic, 1986).

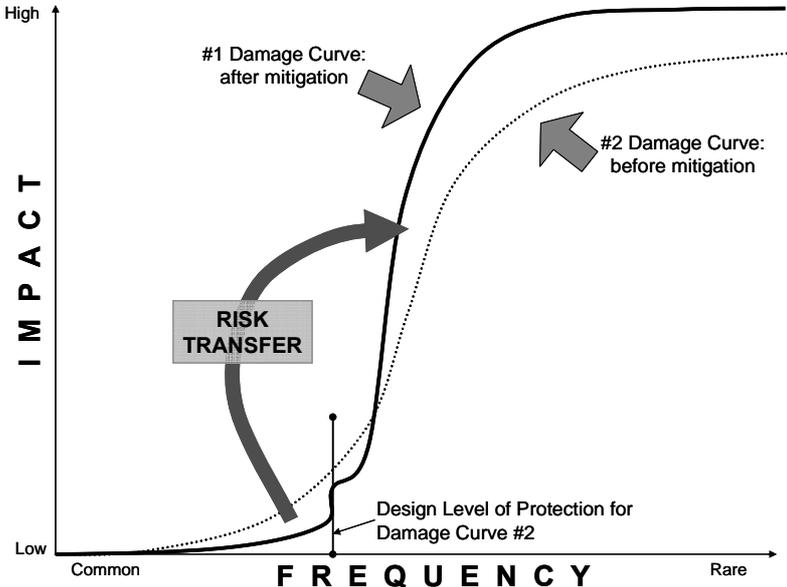


Figure 3. Risk Transference (after Etkin, 1999).

However, when development or mitigation strategies fail to correctly access the risk of rare high-consequence events, risk is transferred from the more common hazards to extreme events that exceed design criteria. Long-term vulnerability can thereby be increased. Risk

transference, therefore, may be a significant obstacle to successful management of extreme events for organisations. The consequences of smaller scale events are reduced to such a successful degree that organisations can no longer cope with the larger scale events that come along. Potentially this could lead to large scale catastrophe (Holling et al, 1998).

B.3 The New Zealand Context

In New Zealand there is an increasing emphasis on creating more resilient communities. The changed focus from post-crisis response to pre-crisis planning originated in the early-mid 1990's in New Zealand and reflects a global trend (Britton and Clark, 2000; Buckle et al, 2000; Keanini, 2003; Luers et al, 2003; McEntire, 2001; Pelling and Uitto, 2001; Weichselgartner, 2001). Significant and widespread economic restructuring in the 1980's in New Zealand highlighted the need to alter the way emergency management was addressed. This resulted in legislative changes and the establishment of the Ministry of Emergency Management in 1999 (subsequently renamed Ministry of Civil Defence & Emergency Management). The purpose of these changes was to ensure that broad risk management techniques become embedded in government, business and the community, thereby increasing overall resilience and continuity (Britton and Clark, 2000). The current legislation in New Zealand for Civil Defence and Emergency Management (CDEM Act, 2002) reflects a need for greater levels of responsibility from organisations with a front-line response during and following a crisis (for example lifeline utility providers, emergency services such as police, fire and health organisations, and emergency co-ordination agencies). However, it is becoming more apparent that a wide range of organisations also need to increase their resilience because of the vital role that they play in community resilience and recovery (Dalziell, 2005). In addition, the move to more comprehensive emergency management in New Zealand has resulted in an 'all-hazards' approach. While the traditional focus of emergency management has been on natural hazards, the current legislation requires the adoption of a risk management approach which addresses all hazards including emerging hazards such as pandemic and terrorism. A new National Civil Defence Emergency Management Plan and Guide were released in July 2006 (MCDEM, 2006).

As New Zealand entered the 1980's, economically it was facing huge national debt and a change of government in 1984 saw the introduction of an extensive program of restructuring the economy. This restructuring, operating over two decades, led to the corporatisation of organisations in New Zealand and has had both positive and negative impacts. As highlighted by Brunson and Dalziell (2005) the restructuring focused on both private and public sectors, demanding 'economic accountability and independence'. This has produced smaller and more independent enterprises and business units resulting in greater economic efficiency in the short term. However, this has reduced the capacity of organisations to engage in longer term management strategies that improve resilience (Brunson and Dalziell, 2005).

Resilience may also be linked to an organisation's key performance indicators (KPI's). The progress of organisational KPI's can be mapped over time following a disturbance to determine the system's vulnerability (Section B.5 and adaptive capacity (Section B.6), and ultimately its resilience. Additionally, situation awareness (Section B.4) may be viewed as an overarching attribute of resilience that applies to both the pre-crisis and the post-crisis phases (Figure 1, after Dalziell and McManus, 2004). The ability of an organisation to engage in pre-crisis planning will have a marked impact on the degree of change in KPIs. An

organisation, therefore, needs to consider its planning strategies across the 4R's. The 4R's, Reduction, Readiness, Response and Recovery, represent time-based clusters for emergency management activities and are co-ordinated into a pattern of pre- and post-crisis action. Emergency management in New Zealand uses the 4R's to emphasize the need to plan in the pre-crisis phase to reduce the impact of an event as well as in the traditional post-crisis response and recovery phases (Britton, 1998). Furthermore, planning across the 4R's emphasises the importance of linking resilience strategies for crisis situations to day-to-day pre-event operations.

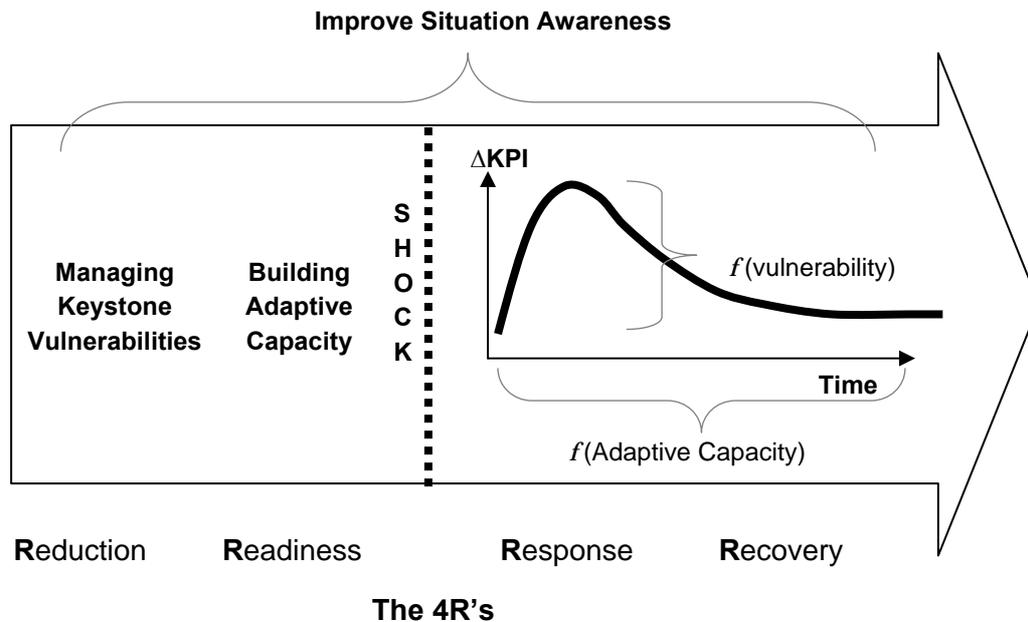


Figure 4. Diagram showing the use of key performance indicators (KPIs) as a measure of system resilience, where resilience is a function of the area under the curve defined by system vulnerability and system adaptive capacity.

B.4 Situation Awareness

It is critical that organisations understand that they do not work alone if they are to successfully navigate a crisis. They must recognise themselves as parts of a wider network, and indeed as networks themselves. As a result there is an increasing need for decision makers, and organisations generally, to have common and shared situation awareness. Originally coined in relation to military pilots the modern concept of situation awareness is traditionally attributed to Endsley (1995) and originally described the situation awareness of an individual or agent within a system; situation awareness is:

‘the perception of the elements within a volume of time and space, the comprehension of their meaning, and the projection of their status into the near future’.

However, as recognition of teamwork increased, so did the necessity to look at situation awareness from a different, more complex perspective. Even those decisions ultimately made by one individual are often based on information from a much wider team. Furthermore, the sum of the individual knowledge or awareness does not represent the overall situation awareness of the system (Salas et al, 1995). While team or shared situation

awareness is rapidly becoming a significant field of research there is no agreed upon definition (Salmon et al, 2006). The terminology is diverse.

Events such as the 9/11 terrorist attacks in the USA, Hurricane Katrina in 2005 and the Boxing Day Tsunami in 2004 have highlighted how limited situation awareness has contributed to major deficiencies in the emergency response (Bahora et al, 2003, Titan Systems Corporation, 2002; Ntuen, 2006; Runyan, 2006). Researchers and practitioners are therefore becoming increasingly concerned with developing improved situation awareness among teams. Specifically this is in relation to the response and recovery for individual organisations as well as from a multi-organisational approach, particularly in inherently dynamic and complex situations.

A fundamental approach to increasing an organisation's situation awareness is by encouraging some experience of pseudo-crisis situations through the use of scenario exercises. Coates (2006) suggests that organisations have a 'severely limited psychological capacity' to look at incidents in other corporations and apply the lessons learned to themselves. Therefore, scenario exercises offer significant value for the networked organisation, specifically if they involve participants from across a number of internal divisions and/or external interconnected organisations. The benefits include:

- increased awareness of value systems and the development of shared mental models (Starr et al, 2004);
- appreciation of a team environment and integration of diverse information (Coutu, 2002; Flin, 1996; Paton, 1996; Paton and Jackson, 2002; Quanjel et al, 1998, Salas et al 1999);
- the identification of solutions that may not have been overtly apparent (Starr et al, 2004);
- the opportunity to learn from emergency experiences and apply that knowledge in novel situations (Paton and Jackson, 2002);
- the fostering and encouragement of self efficacy (Jex and Bliese, 1999), and;
- improving the persistence of individuals and groups to achieve predefined goals in an emergency situation (Klimoski and Brickner, 1987; Paton and Jackson, 2002).

Improving situation awareness about crises also involves learning about the types of emergency situations that may occur. Many organisations have engaged in some sort of risk identification process but few take this process one step further and combine risks of similar nature or expected response. In an emergency often the same types of issues will be faced and actions will be common across crisis types (Pearson and Mitroff, 1993). Furthermore, while there is debate on the validity and usefulness of emergency plans (Seaman and Williams, 2005), for those organisations that do create emergency plans, these must be tested, practiced and exercised to be useful in a real emergency (Coates, 2006; Coutu, 2002). It is also vital that organisations do not just focus on those events that they can foresee or those that they have already experienced. Sheffi (2006a) suggests that organisations prepare for the unknown by increasing resilience; not only by creating redundancy but also through overall flexibility and agility.

B.5 Management of Keystone Vulnerabilities

The term vulnerability is one which has many different definitions and applications depending on the objectives of the researchers/practitioners and the situation within which it is applied. As such there is considerable confusion over the use of the term vulnerability and assessing and modelling vulnerability in the real world. Good summaries are given by Klein et al (2003), Villagrán De León (2006) and Füssel (2005) and highlight some of the difficulties associated with determining what vulnerability is as well as how to measure and assess vulnerability to provide meaningful results. The reader is directed to these summaries for a detailed account of how vulnerability has evolved as a term since the 1970's.

A number of studies of organisational vulnerability have highlighted some of the strongest influences on post crisis survival, particularly for small businesses. The degree of structural damage to the physical location of an organisation and its degree of disaster preparedness has been shown to have some influence on business survival rates (Alesch and Holly, 1998; Alesch et al, 2001; Chang and Falit-Baiamonte, 2002; Tierney, 1997; Webb et al, 2000). However, much stronger indicators of organisational failure following a crisis (see (Durkin, 1984; Tierney, 1997; Alesch and Holly, 1998; Alesch et al, 2001; Tierney, 1997; Webb et al, 2000; Chang, 2001a; Chang, 2001b; Chang and Falit-Baiamonte, 2002) include:

- interruptions to infrastructure,
- experiencing financial difficulties prior to an event;
- operational difficulties, problems with interdependencies, and
- problems with the supply chain.

Additionally, Paton (1999) identified that, in an organisational context, the vulnerability of key groups that contribute to an organisation must also be considered from a business continuity perspective.

The scale at which vulnerability is assessed is critical and the global and interconnected nature of organisations is important to consider. Wisner (2005) observes that vulnerability manifests itself very differently at a household level compared to a national level even for the same event. This is also true of organisations where what is highly vulnerable to a small firm of 1-2 employees may be vastly different to what is vulnerable to a multi-national organisation. Hence, the assessment of vulnerability should be conducted separately at different scales (Villagrán De León, 2006). Watts and Bolhe (1993) suggest that vulnerability is not a static entity, but rather it is a dynamic and complex condition that cannot and should not be reduced to simplistic terms. From this perspective a more holistic and systemic approach to vulnerability may be more suitable for organisations.

Interdependence between organisations in New Zealand was highlighted by a landmark study in 1991 looking at the performance of lifeline utility organisations in a large scale hypothetical earthquake scenario in Wellington, the nation's capital (CAE, 1991). The interface with co-ordinating organisations such as Civil Defence was illustrated in this study as a critical facet to the successful response and recovery of lifeline utilities and the wider community that they serve. Furthermore, this study identified that individual organisations must create their own emergency planning strategies and be involved with the strategies of those on whom they will depend in a crisis. The Wellington Lifelines study and the others in New Zealand that followed this model clearly showed that interdependence of utilities is

made more vulnerable by our increasingly sophisticated world and our reliance on advanced technology. The vulnerability associated with interdependency is further enhanced by expectations of the general public for both private and public organisations to display more accountability in a crisis situation (WELG, 1994). Therefore, the intrinsic connectivity of organisations, together with the interdependencies that arise as a result, have a significant impact on organisational vulnerability.

Further to the concept of interdependencies in a system and the assessment of their vulnerabilities is the notion of keystone vulnerabilities. The term 'keystone' can be used to denote the presence of integral species in an ecosystem. Typically, a keystone species is one which has an influence on its environment or ecosystem that is disproportionate to its size or abundance (Wikipedia, 2007). The loss of this species can cause a significant shift in the ecosystem; sometimes causing its eventual destruction. Keystone can also have an architectural meaning and is described as either 'the wedge-shaped piece at the highest point of an arch that locks the other pieces in place' or 'something on which associated things depend for support' (The New Penguin English Dictionary, 2000). These keystone vulnerabilities are components in the organisational system, which by their loss or impairment have the potential to cause exceptional effects throughout the system; associated components of the system depend on them for support. This is most often observed in the supply chain of organisations. Numerous examples exist of cascade type failures resulting from the loss of one supplier whose criticality to the entire system was not recognized until it was lost. For example, the Toyota-Aisin crisis (Watts, 2003) that involved the loss of a single factory in Japan that was solely responsible for the production of a critical valve needed for all Toyota vehicles. There are two aspects to identifying keystone vulnerabilities. Firstly is the speed at which a component failure has a negative impact (rapid or insidious) and secondly is the number of component failures required to have a significant negative impact on an organization (discrete or cascading).

B.6 Adaptive Capacity

The literature in relation to adaptive capacity is divided into two rather distinct categories. There is a huge body of research on adaptive capacity as it relates to socio-environmental systems, particularly in relation to climate change research. This work is matched by the volumes of research into organisational adaptive capacity. This discussion focuses on the organisational research domain, but a short introduction on the socio-environmental system approach is warranted. However, this discussion doesn't aim to provide the reader with any great depth in this regard; rather the reader is referred to some of the excellent summaries of this work for more detail (Klein et al, 2003, Brooks, 2003, Gallopin, 2006, Smit and Wandel, 2006).

It is important to realise that adaptive capacity is not a static feature of any system. There are a number of studies (Folke et al, 2002, deVries, 1985) that look at how these components change over time and in response to environmental changes (economic, social, political and institutional) (Smit and Wandel, 2006). Furthermore, researchers have considered the inter-relationships between determinants of adaptive capacity, recognising that strengths or weaknesses in one aspect, for example managerial ability, may influence other determinants such as the reduction of psychological stress among workers (Smit and Wandel, 2006).

The concept of adaptive capacity is at the core of current organisational resilience methodology. Adaptive capacity is defined as the ability of an enterprise to alter its 'strategy, operations, management systems, governance structure and decision-support capabilities' to withstand perturbations and disruptions (Starr et al, 2004). Organisations that focus on their resilience in the face of disruption generally adopt adaptive qualities and proactive responses. Furthermore, they emphasise positive behaviour within the enterprise and within employees and look at disruptions as being opportunities for advancement (Mallak, 1998; Folke et al, 2002).

The study of adaptive capacity in relation to organisational systems has resulted in considerable advances in recent years particularly regarding the cultural capital of an organisation and the effects this may have on its ability to withstand crises. Many organisations have been shown to exhibit favourable workplace cultures that help them to adapt to changes in their operating environment, even when these changes are unforeseen and unexpected. Examples include Nokia, Toyota (Sheffi, 2006a), Dell (Sheffi, 2005), UPS (Coutu, 2002) and Coca-Cola (Seaman and Williams, 2005). While terminology differs regarding what attributes actually make up such effective organisational cultures, there are some widely accepted qualities that organisations can encourage:

- The ability of both leaders and general staff to view crises from a positive and opportunistic perspective is important in the adaptive organisation (for example Borneman, 2005; Hagevik, 1998; Norman et al., 2005; Pearson and Mitroff, 1993; Penrose, 2000; Sheffi, 2005; Starr et al., 2004).
- The quality of leadership and the degree of empowerment through to lower levels in an organisation is increasingly seen as a critical facet of an adaptive organisation's culture (for example Sheffi, 2006a; 2006b; 2005; Kerfoot, 2005; Hagevik, 1998; Norman et al, 2005; Coutu, 2002).
 - Empowerment, for instance, has been identified as a key part of the successful response by the US Coast Guard during Hurricane Katrina and the saving of over 24,000 lives (Sheffi, 2006b).
- Leadership during times of crisis and non-crisis is vital to developing an enhanced adaptive capacity in an organisation.
 - This may be achieved by the development and communication of mutual value systems between the leadership and workforce in an organisation.
 - As identified by Sheffi (2005) *'flexible and fast-responding companies align the employees' interests with the organisations at a fundamental level. Their employees identify deeply with their company and fulfil their personal needs when the company succeeds'*.
- Additionally, employees that are conditioned to expect the unexpected contribute significantly to an organisation with a high adaptive capacity.
 - The ability for an organisation to combine the development and testing of a plan with enhancing the capacity of its staff to cope with the unexpected is a critical balance. No organisation can plan for every possible circumstance and therefore the organisational culture becomes vital.

- *'Culture contributes to resilience by endowing employees with a set of principles regarding the proper response when the unexpected occurs and when the formal organisation's policy does not cover the situation at hand or is too slow to react'* (Sheffi, 2005).

Considerable progress has been made towards developing more resilient organisations in the face of disasters of all descriptions. However, it has been the growing dependence of businesses and other organisations on computer systems, networks and the Internet (Riulli and Savicki, 2003; Horne, 1997) that is beginning to facilitate the application of resilience rather than recovery into the mainstream of organisational management.

There is a fine line between organisational resilience and recovery. An organisation may have a high level of resilience, and hence a lowered vulnerability, but its post-disaster condition may lead to a very different organisational structure than before the disaster event. This is synonymous with the concept of ecological resilience outlined previously and shows that organisations are complex self-organising systems with multiple equilibrium states. Many organisations that focus solely on their post disaster recovery, rather than focus on becoming more resilient, will often try to return to their pre-disaster condition (Tobin 1999). However, recovery rarely addresses the causal problems leading to the disaster situation in the first place, and may in-fact set up the next disaster (Tobin, 1999; Comfort et al, 1999).

The interest in creating an increased adaptive capacity during and immediately following a disaster has led some researchers to propose a set of adaptive features to enhance organizational and societal resilience (Weick, 1993; Kendra and Wachtendorf, 2003; Mallak, 1998). This includes, for example, bricolage, which is the capacity to adapt known information and apply it to the current situation in a creative manner, and virtual role systems, the ability of sub-sets of an organization to take on the role and responsibility of absent members.

Other features include wisdom or the capacity to know the limits of the information at hand, and the ability to seek out additional information, respectful interaction, positive adaptive behaviour and the development of a tolerance for uncertainty (Weick, 1993).

Dalziell and McManus (2004) introduce the concept that systems (specifically organisational systems) can adapt to changes in different ways. Firstly they may use existing responses and apply them to the problems at hand, which may involve up-scaling this response. Secondly, existing responses may be utilised in a new context for a crisis situation. Thirdly, an organisation may develop novel responses and apply them to a problem. The problems may be new and unforeseen or those that the organisation has been able to see coming. Typically organisations enlist either a command and control type structure to deal with crisis or a more organic and innovative approach (Dalziell and McManus, 2004). Recent research is pointing to the increased ability of organisations to respond effectively using a more creative and flexible decision making structure. This appears to be because automation and rigour (more associated with command and control decision making) may actually hinder adaptive capacity by reducing situation awareness (Endsley et al, 2003) and ultimately performance; systems must be more flexible or they risk becoming redundant (Stanton and Baber, 2006).

