Lessons From the West African Ebola Outbreak in Relation to New Zealand's Supply Chain Resilience

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Sponsored by:
Z Energy Limited and Foodstuffs (NZ) Limited

Lessons From the West African Ebola outbreak and
implications for New Zealand's supply chain.
7th May 2015

Our work has been sponsored by Z Energy Limited and Foodstuffs (NZ) Limited who have supported this initiative because they recognise the importance of ensuring New Zealand has resilient supply chains. The intended audience is the New Zealand business community, central government and local government.

This report has also been informed by interviews with experts inside leading New Zealand companies that depend on supply chains for their business. In addition to the sponsors, these include Air New Zealand Limited, Fonterra Co-operative Group Limited, Skope Industries Limited and Vector Limited.

Government officials were informed of the contents of this report. Please note the opinions contained in this report are solely those of the authors.

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Executive Summary

Small, at risk and unprepared?

New Zealand is a small, remote island nation, and our isolation creates both opportunities and threats. Opportunities exist in terms of our ability to export good-quality produce at a cheaper price, due to our lack of pests and diseases. However, isolation brings threats to our supply chain.

Trade is critical for export revenue and for imports of technologies, components and goods, and this trade is reliant on increasingly complex supply chains. Recent events, including the Fukushima earthquake and the Thai floods, have disrupted supply chains and led to increased recognition that supply chains need to be resilient as well as efficient. In other words, organisations and countries need to be prepared.

Being prepared means different things to different people. Generally preparedness is considered in terms of the time citizens or communities are able to survive or thrive in isolation and whether the objective is to return to the status quo (bouncing back) or advance to a better situation (bouncing forward). Supply chain resilience is critical in terms of both survival and moving to a more resilient position over time.

These characteristics, when combined, raise a number of questions:

- Is New Zealand's size and isolation a strength or weakness?
- What risks might New Zealand face going forward?
- How prepared is New Zealand if any of those risks eventuate?
- What risks are unique to New Zealand?
- Are we prepared for the perfect storm of a group of disruptive events?
- How prepared do New Zealanders want to be?
- Who will pay the cost of that preparedness?
- Who is making decisions over the level of preparedness?
- Who is matching our risk profile with our level of preparedness?
- How good is New Zealand at managing types of risk? What do we do well and what do we not? What do we need to work on?
- Who undertakes assessments of past disruptive events (both the preparation and the response)? In particular, how are lessons learned and the knowledge shared with the appropriate authorities?
- What does a resilient New Zealand look like? What are the characteristics we are aiming to build into the framework?
- Given some forms of resilience can be expensive, how should government decide what level of resilience New Zealanders should pay for?
- Who assesses (stress tests) the extent of our supply chain's resilience?

A large number of different organisations can be involved in the supply of one good or 0service, including international organisations. Supply chain resilience refers to the extent that the chain of supply leading to production or consumption remains operational when exposed to operational or disruptive risks. System management to increase supply chain resilience is based on understanding the supply pathways and ensuring that mitigations are identified and in place for each material risk so that the system can continue to perform effectively. Assessment of the vulnerabilities of lifeline utilities is a tool to explore and manage one type of supply chain risk – the risk that certain entities might not be able to provide critical products or service in New Zealand.

This report aims to draw attention to five high-level questions, and based on publicly available information, attempts to answer these questions as a way of identifying possible opportunities to build a more resilient New Zealand. The five questions that are explored in this report are:

1. Why Build a Resilient Supply Chain?
2. What Lessons Can Small Countries Learn From the West African Ebola Epidemic?
3. Looking From the Outside In: How Prepared Is New Zealand?
4. How Do We Anticipate a Supply Chain Event?
5. How Do We Manage Supply Chain Risk?

Ten lessons from the Ebola outbreak

It was just over one year ago – in March 2014 – when the World Health Organization (WHO) first reported an Ebola epidemic emerging in West Africa.[1] Concern about the Ebola epidemic has highlighted event risk again. Event risk comes in many forms including earthquakes, floods, pandemics, financial crises and wars. Epidemics are only one kind of event risk, and the current Ebola event is a specific kind of epidemic. The aim of this paper is to use the Ebola epidemic as a case study to develop a better understanding and awareness of supply chain risks and to offer some ideas about how New Zealand's resilience might be increased.

The main focus of attention is on the medical risks and their management, but there is widespread recognition that a pandemic would have many effects beyond the need for medical responses. A 2015 WHO report sets out the four biggest lessons from the Ebola outbreak in 2014. Based on this report, and our scenario work in Appendix 2, we have identified 10 lessons:

1. Invest in core infrastructure and research.

2. Be vigilant; probe, scan, rehearse, inform and respond in a timely manner.

1 See http://www.who.int/csr/disease/ebola/one-year-report/virus-origin/en

3. Adopt a decentralised and flexible approach; design a unique package of independent but interconnected measures.

4. Engage locally; find out how the community wants to respond.

5. Embrace technology; data builds information and information builds strategic knowledge.

6. Lead from the top, both immediately and over time.

7. Coordinate; supply chain issues deliver complexity but also opportunities in both the short and long term.

8. Review; actively assess progress.

9. Build capacity; prepare response plans for a long-term extended emergency.

10. Govern; possibly separate operations in the field from technical advice/policy.

Six observations on supply chain risk

As part of this process, the authors surveyed a handful of organisations that relied on international supply chains either for export or import. The selected organisations are viewed as leaders in their respective markets and were chosen to represent a cross-section of New Zealand industries. The organisations included Air New Zealand Limited, Skope Industries Limited, Fonterra Co-operative Group Limited, Vector Limited, Z Energy Limited and Foodstuffs (NZ) Limited.

These organisations provided insights to their supply chains and risk management response plans, which were summarised as follows:

1. Councils play a critical role in providing key products and services.

2. Disrupted shipping routes and timing have a large impact.

3. A small number of choke points exist within most large organisations, but a large number of choke points are likely to exist in most small organisations.

4. Reviewing supply chain resilience regularly is good practice.

5. Creating a learning culture improves agility over the long term.

6. Resilience is expensive in the short term but cheap in the long term.

The authors of this paper have not had the time and resources within this project to conduct an in-depth analysis of New Zealand's supply chain vulnerabilities and the way those might be affected by possible events. The approach taken is to highlight supply chain risk, provide some frameworks for understanding and managing that risk and offer some policies and management responses for consideration by government and businesses. Our intention is to increase understanding of the need for supply chain resilience and thereby encourage those responsible to ensure risks are managed effectively.

Overall, we found a relatively low level of awareness and preparedness for supply chain impacts of event risks and not much systematic effort to increase resilience. There is relatively little understanding of what could be done to reduce risk, alongside a sense that many of the risks could only be reduced via actions by others.

Three major recommendations

Our major recommendations are as follows.

1. There needs to be a conscious effort to:

    a) obtain tacit knowledge about New Zealand's supply chain risks;
    b) increase awareness and resilience management capabilities;
    c) make all trigger points transparent;
    d) draw a distinction between strategies, plans and guides;
    e) draw a distinction between preparation and response; and
    f) increase connectedness between central government, local government, businesses and community groups.

2. We need to find more effective instruments/tools to monitor and benchmark progress over time:

    a) an annual report on emergency risk events outlining what events happened over the previous 12 months, describing New Zealand's response to each event and any lessons learned could be a cost-effective instrument.

    b) a supply chain risk matrix that benchmarks risks is a tool that might help identify priorities and develop actions points (see Appendix 8).

3. Map and review existing strategies, preparation plans and response plans (for both central and local government). They need to be mapped in order to determine where documents may overlap (and cause confusion) or where gaps exist. The map then needs to be designed to illustrate how they all fit together so that when a disruptive event occurs, roles and responsibilities are clear to not only officials but also ministers and the general public.

The content of these documents then needs to be reviewed to ensure they have the ability to respond to:

a) a greater variety of events – for example, airborne epidemics that move quickly but usually are less deadly;

b) long-term extended emergencies; and

c) events that have effects beyond the immediate medical effects – for example, second-order impacts from an outbreak outside of New Zealand.

In addition, we have identified specific recommendations for central government, local government and businesses and other non-government organisations. These are listed below and described in more detail in Section 6.

Fourteen specific recommendations

Central government

Recommendation 1
Ensure accountability for overall event risk management – including supply chain resilience and taking account of level-two and level-three effects – is assigned to a single agency or role within government. The responsible agency or role should have access to the authority and resources needed to undertake event risk reduction actions.

Recommendation 2
Develop wider and deeper understanding of event risk for New Zealand.

Recommendation 3
Develop competence in event risk mitigation and responses.

Recommendation 4
Define New Zealand's unique risk profile, event risk appetite and risk management criteria.

Recommendation 5
Rebrand New Zealand's *National Civil Defence Emergency Management Strategy* as New Zealand's *Resilience Strategy* and review annually.

Recommendation 6
Promote resilience understanding and competence within relevant organisations in New Zealand.

Recommendation 7
Develop relevant connections and dialogue with other organisations in New Zealand and overseas.

Recommendation 8
Central government should ensure it has the competencies, capabilities and processes to ensure resilience within its own operations.

Recommendation 9
Establish an independent resilience monitoring and reporting process.

Recommendation 10
Work harder at making the framework less complicated when looking from the outside in.

Local government

Recommendation 11
Include event response resilience considerations in community development efforts.

Recommendation 12
Develop event risk response plans that include preparation for global or overseas events that might affect New Zealand.

Recommendation 13
Develop connections with other local governments to share response plans and develop preparedness.

Businesses and other non-government organisations

Recommendation 14
Four capabilities should be developed by businesses and other non-government organisations: acuity, navigation, agility and resilience.

Recommendation 15
Businesses that supply core infrastructure, and especially those designated as lifeline utilities, should actively pursue relationships with central and local government in order to cushion the impacts of a range of disruptive events.

1.0 Why Build a Resilient Supply Chain?

> *What is resilience? Resilience is the capacity of any entity – an individual, a community, an organization, or a natural system – to prepare for disruptions, to recover from shocks and stresses, and to adapt and grow from a disruptive experience.*
>
> Judith Rodin
> President of the Rockefeller Foundation
> in her introduction to *The Resilience Dividend* (2014)

1.1 Setting the Context

Our ability to respond to and recover from disasters is determined not just by the type of event but also by the nature of the system. However, both the nature of the system and the types of events that may eventuate are changing, which in turn means we need to understand how best to manage risk going forward.

The old-fashioned way of managing risk was simply to identify risks that may affect a community, an organisation, a city or even a country and then manage those risks in a piecemeal and rational manner. The focus was on short-term recovery; hence, civil defence was local and community based.

The nature of the system did not need to be taken into account, as it was largely operating in a consistent manner over a long period of time, and the parts were not interdependent. However, given our increasingly complex and interconnected world, the previous approach is no longer effective.

What we are now generally seeing in the literature is a change of focus from managing a risk to managing a system.[2] Risk can no longer be fully understood in terms of a specific event (e.g. an earthquake or a pandemic) but in terms of an overarching system – what some call systemic risk. Hence, the risk management conversation has moved from an event approach to a resilience approach. Arguably, the first looks from the outside in (how the risk will impact on the system – event-centric), whereas the latter looks from the inside out (how the system will respond to the risk – system-centric). Trying to manage risk in terms of one-off black swan events is not conducive to meeting the needs of society going forward; we need a different paradigm.

2 For example: *Thinking, Fast and Slow* (Daniel Kahneman, 2011), *Seeing What Others Don't: The remarkable ways we gain insights* (Gary Klein, 2014), *The Organized Mind: Thinking straight in the age of information overload* (Daniel J Levitin, 2014), *The Resilience Dividend* (Judith Rodin, 2014), *The Signal and the Noise: The art and science of prediction* (Nate Silver, 2012), *Antifragile: How to live in a world we don't understand* (Nassim Nicholas Taleb, 2012) and *Resilience: Why things bounce back* (Andrew Zolli & Ann Marie Healy, 2012).

1.2 The New Paradigm: A Whole-of-system Approach

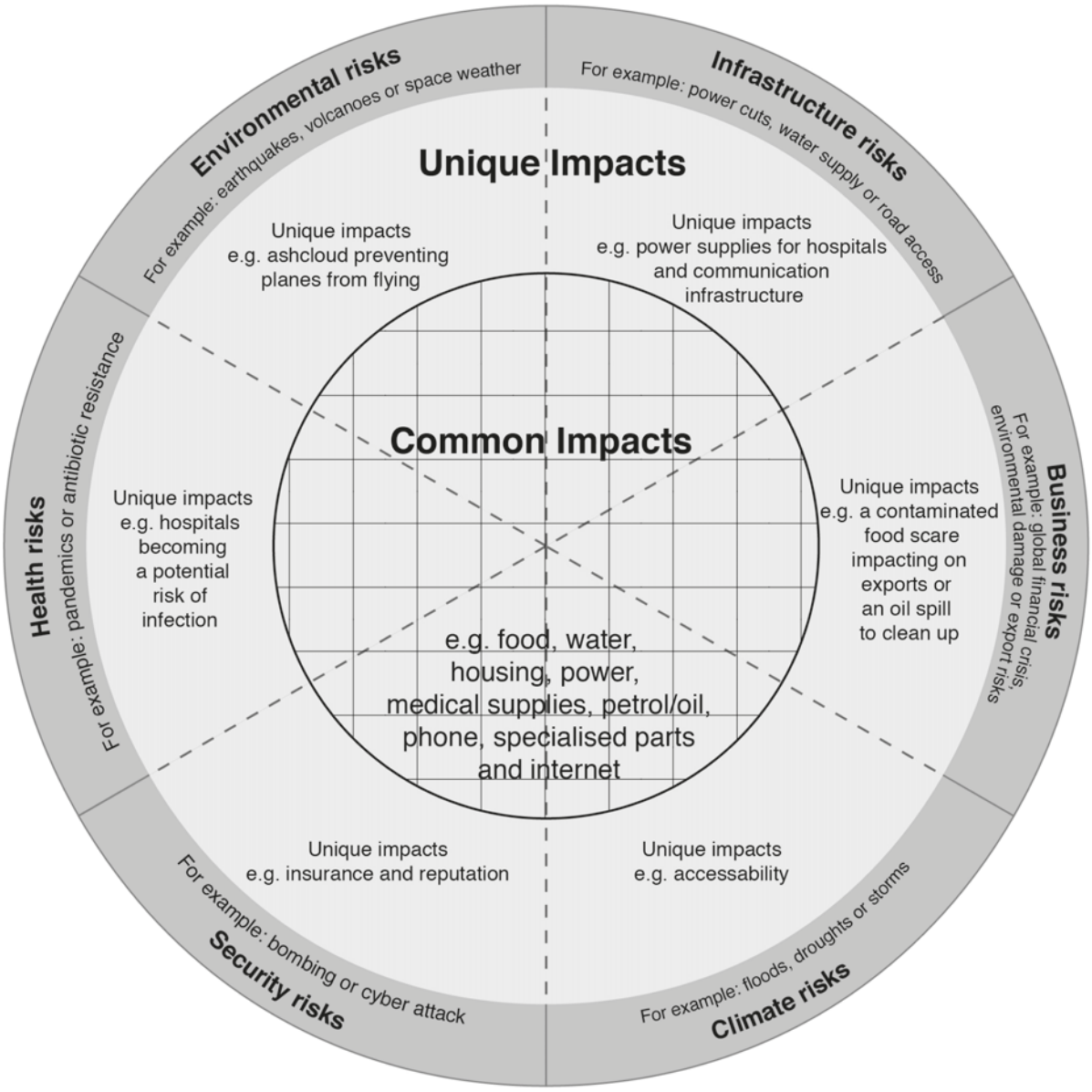
Resilience looks at how a system deals with change; it is system-centric rather than event-centric. A whole-of-system approach can be understood in terms of the types of risk that might enter the system (an input view of risk) versus the types of disruptions that might occur (an outcome view of risk).

An input view of risk does not categorise risk in terms of high or low probability or magnitude, although this is clearly important. It tries to understand possible events in terms of our explicit or tacit knowledge about the risks. For example, risks can be categorised into completely *novel* (such as space weather), *modern* (such as climate change or cybercrime), *infrequent* (such as pandemics), *spasmodic* (such as earthquakes and volcanoes) and *traditional* (such as business and infrastructural risks). The explicit or tacit knowledge about a risk contributes to helping society respond to it when it happens. It is relatively easy to build resilience into a system in order to prepare for spasmodic and traditional disruptive events; however, the reverse is also true. Building resilience into a system that has little or no explicit or tacit knowledge about novel, modern or infrequent disruptive events is understandably difficult. The only way to build in such resilience is to work hard at understanding more about these types of disruptive events and build in a certain degree of redundancy based on the unique characteristics of such events. This paper looks at the Ebola event in terms of learning more about how we might better deal with events where we have little explicit or tacit knowledge.

This brings us to the second view of a whole-of-system approach to managing risk. Although there may be little explicit or tacit knowledge, there are a large number of commonalities that exist. For example, if we compare the Christchurch earthquakes to a pandemic, flood or another event, the initial response is likely to share certain commonalities: the need for short-term housing/hospitals; the need for hot food, water and medicine; the need for infrastructure to work, such as water systems, power and technology; the need to communicate clearly and honestly in a timely manner; and the need to put in place systems to track people's movements and manage unrest. This is the sharp end of risk management – the civil defence response. In New Zealand, this initial response comes under the control of civil defence agencies.

Figure 1 illustrates the idea that there exist a large number of common impacts that can be resolved in a similar way. Resilience can relatively easily be built into a system to manage these short-term local disasters. However, as society becomes more interconnected and complex, dependencies can lie unseen and untested, only to become apparent when a key link in the supply chain becomes broken and alternatives have not been identified. This is when supply chain resilience becomes critical.

Figure 1: Common impacts identify the core infrastructure necessary to cushion the impacts of a range of disruptive events



A third way to view a system is to follow critical flows in the system and work out how they might be disrupted and how those disruptions might best be reduced. This concept allows for identification of multiple risks and shocks, and it stresses and calls for observation and thinking – following the flows in much the same way we follow money flows in order to assess financial risks. Here, the opportunity is to follow the flow of goods and services to assess the supply chain risks.

A fourth way to view a system is to explore a perfect storm – a number of disruptive events that might occur over a short period (e.g. a pandemic and a series of earthquakes or climate change and housing shortages). Resilience is not simply about being able to recover from one disruptive event but also being able to respond to several independent or connected events.

A fifth view is to identify and assess system risks in terms of global risks and New Zealand specific risks. Examples of global risks include the global financial crisis, pandemics or climate change, while specific risks are unique to New Zealand and would include local earthquakes and volcanoes. This distinction is relevant in terms of New Zealand having a clear interest in managing global risks as well as national and local risks. It also illustrates why New Zealand should outsource the risks of unique local events by developing close links with other countries that are also vulnerable to similar risks. For example, Taiwan, Singapore and Japan all sent assistance, including search and rescue teams, to respond to the Christchurch earthquakes.[3]

Lastly, not all disasters are black swan events, and those that initially have the characteristics of black swan events may eventually evolve into long, often less apparent, events that flow through a system causing unseen havoc for a few (e.g. droughts for farmers) or unforeseen opportunities for many (e.g. tourists attracted to Christchurch to view the rebuild).

A resilient supply chain is fundamental to delivering core products and services over long periods in times of stress. A resilient system is much more than natural disaster management or epidemic management. It requires an understanding of where the system is weak and how we might strengthen it; it is about the ability to not just bounce back but to bounce forward.

1.3 How to Build Resilience Into a System

Resilience is firstly about understanding the system in order to then strengthen it. Rodin, in her book *The Resilience Dividend* (2015), suggests there are five main characteristics that exist, to a greater or lesser degree, in different manifestations, and in all resilient entities, whether they are an individual, a community or a country. Resilient entities actively work hard to be *aware* of their external environment and internal capabilities and resources, to develop *diverse* sources of capability and redundancy, to embrace an *integrated* culture and share ideas, to *self-regulate* in times of stress (and by doing so fail safely) and to be *adaptive,* adjusting quickly to changes in circumstances.

In this age of complexity, breaking down how resilience might be achieved in a logical manner is a useful endeavour. There are at least nine actions one can implement and embed into a system to help build and maintain resilience. Figure 2 (page 12) illustrates the process of the nine possible action points.

3 See http://tvnz.co.nz/national-news/christchurch-quake-wednesday-feb-23-4038727

1. **Probe: explore scenarios**
   Instead of reacting to an event, respond to a system.

2. **Scan: watch emerging events as they unfold**
   Instead of relying on one set of eyes, use many.

3. **Rehearse: trial possible disruptions**
   Instead of thinking about events, test out what happens in practice.

4. **Inform: produce and communicate timely and accurate information**
   Instead of focusing on what the public 'needs to know', be clear about what the public 'does not need to know'. Open and timely information is critical for building public trust. Knowledge gaps between parties feed uncertainty, which is the breeding ground for fear – and fear, without timely and accurate information, leads to behaviours that are not conducive to managing disruptive events.

5. **Respond: work with the community and act swiftly**
   Instead of being reactive, be proactive and apply the precautionary approach.

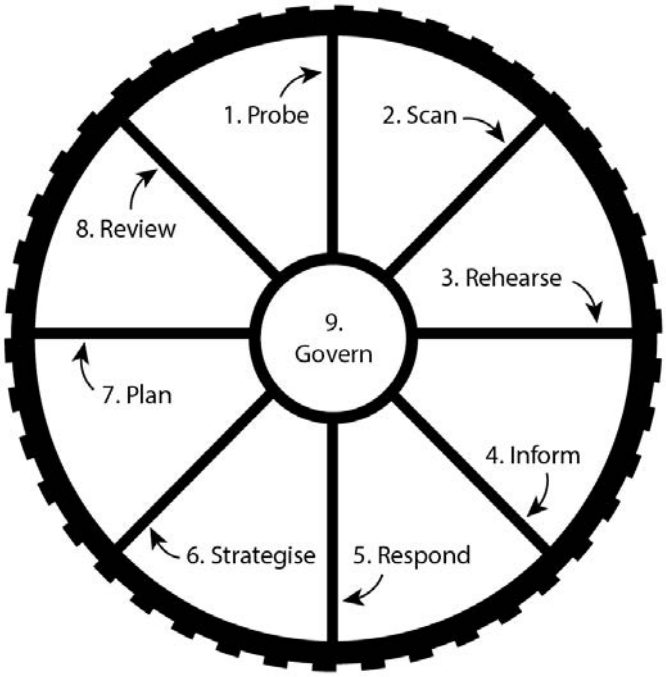
6. **Strategise: develop and communicate a strategic response**
   Instead of reacting to the event, react in accordance to the desired outcome.

7. **Plan: prepare and implement a tentative operational plan – then monitor and adjust**
   Instead of sticking to the plan, plan to be agile.

8. **Review: actively review and assess progress**
   Instead of making assumptions, learn from our mistakes/successes and those of others.

9. **Govern: design the structure to empower good strategy**
   Instead of reacting, be proactive and open.

Figure 2: Building resilience into a system



1.4 Resilience Is Not a Goal but a Means to a Goal

Resilience is not a goal in the true sense of the word; there is no end destination. Rather it is a state of being that must be continuously worked towards. Zolli and Healy, authors of *Resilience: Why things bounce back*, stated that 'resilience must continuously be refreshed and recommitted to' (2012: 276).

Understanding resilience in terms of building and maintaining a system that enables a range of goals to be achieved, such as economic stability, healthy citizens and good environmental outcomes, is a useful context for exploring supply chain resilience in New Zealand.

The decision for government/investors/stakeholders is whether New Zealand's supply chain should be engineered to cover redundancy for stressful times, delivering short-term pain for long-term gain (e.g. storing spare assets/parts/food or investing in more durable long-lasting assets) or whether it should be focused on efficiency and effectiveness (investing in just-in-time systems and quick temporary fixes). A good analogy is biking: do decision-makers want a road bike or a mountain bike? A road bike will get you further in a shorter period of time, but only if the road is tar-sealed and the weather is dry. A resilient system is one that is able to travel on most terrains in most conditions. The question is how resilient we want New Zealand's supply system to be, and to answer that question, we need to understand more about how humans behave in response to disruptive medium-term events. To understand how disruptive events might impact on logistics and human behaviour, the next section looks at lessons from the recent Ebola epidemic in West Africa.

2.0 What Lessons Can Small Countries Learn From the West African Ebola Epidemic?

Our world is getting more vulnerable to big epidemics, because of population expansion, huge mobility and more intense contact between animals and people. My concern is that when [the Ebola outbreak] is over we will just forget about it. We need to be better prepared and we need to invest in vaccines and treatment. It's like a fire brigade – you don't start to set up a fire brigade when some house is on fire.

Professor Peter Piot, Director of the London School of Hygiene & Tropical Medicine and co-discoverer of the Ebola virus in 1976.[4]

2.1 Setting the Context

This section looks at what small countries can learn by considering the events that unfolded following the Ebola outbreak in West Africa. This does not entail focusing on how New Zealand was affected and reacted during the Ebola outbreak; rather, this section aims to identify lessons that we can learn from the experiences of others – building tacit knowledge about how the world, nation states and communities responded to a recent disruptive event. Importantly, the Ebola outbreak in West Africa has a number of characteristics that does not necessarily make it an ideal case study for exploring a human pandemic in New Zealand but the outbreak is both recent and topical. For example, in contrast with many West African countries, New Zealand has a well-resourced health care system.

The World Health Organisation recently produced a report on the lessons learned from the first 12 months of the Ebola epidemic: *One year into the Ebola epidemic*.[5] The remainder of this section quotes heavily from this report, as it is a detailed and honest account of events as they unfolded, highlighting what can be learned to date. The key lessons from reading the WHO report are summarised at the end of this section.

Under the chapter heading 'The warning the world did not heed', it discusses key events before the outbreak. In 2010 a WHO review committee was convened to evaluate the response to the 2009 H1N1 influenza pandemic and assess global preparedness. They found that 'the world is ill-prepared to respond to a severe influenza pandemic or to any similarly global and threatening public health emergency'. The committee believed the WHO systems 'were designed to respond to a geographically focal, short-term emergency rather than a global, sustained, long-term event'.

4 See http://www.bbc.com/news/business-30907630
5 See http://www.who.int/csr/disease/ebola/one-year-report/introduction/en/

The review committee noted that in addition to the implementation of core public health capacities, there was an urgent need to improve global preparedness through research, reliance on a multisectoral approach, better health care delivery systems, economic development in low- and middle-income countries and an improved health status. The 2015 WHO report noted that these recommendations were not fully implemented, noting a further review in November 2014 found only 64 of WHO's 194 member states had the essential surveillance, laboratory, data management and other capacities in place to fulfil their obligations under the International Health Regulations (IHR).[6]

The January 2015 WHO report concluded: 'As a result, WHO went into battle against this virus with no army of reinforcements to support a sustained response, no war chest to fund a surge, and weapons that date back to the Middle Ages.'

2.2 How It All Began

The Ebola outbreak in West Africa was first reported on 21 March 2014 and has rapidly become the deadliest since the disease was first discovered in 1976. Some evidence suggests that foreign mining and timber operations in the area led to wild bat species living in closer proximity to humans. The child first infected was seen playing under a tree infested with bats, which are thought to be the natural reservoir.[7]

Understanding Ebola's trajectory provides important insights for understanding other epidemics in the future. Ebola spreads slowly and allows us to watch events unfold.

The authors are not experts in epidemics or pandemics. Our focus is not the event itself but the effects. We are using the Ebola experience as a case study to learn more about second- and third-level effects so New Zealand can identify opportunities to become more resilient in the future.

To provide context, Figure 3 and Figure 4 outline the spread of Ebola at the time of publication, but it is important to remember that WHO accepts these figures are underestimates.[8]

6 'Since 15 June 2007, the world has been implementing the International Health Regulations (2005). This legally binding agreement significantly contributes to global public health security by providing a new framework for the coordination of the management of events that may constitute a public health emergency of international concern, and will improve the capacity of all countries to detect, assess, notify and respond to public health threats.' See http://www.who.int/ihr/about/en/

7 See http://www.who.int/csr/disease/ebola/one-year-report/virus-origin/en/

8 See http://www.independent.co.uk/news/world/africa/ebola-outbreak-death-toll-passes-3000-as-who-warns-numbers-are-vastly-underestimated-9759314.html

Figure 3: Cumulative Ebola cases and deaths reported by WHO between September 2014 and April 2015

Source: World Health Organisation, 2014; 2015[9]

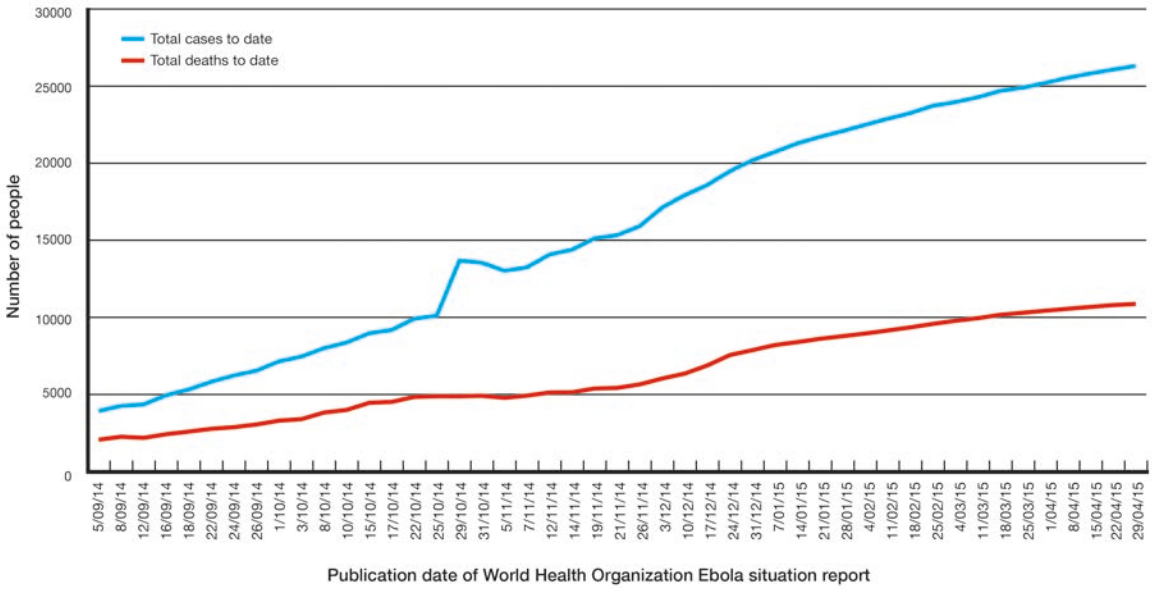
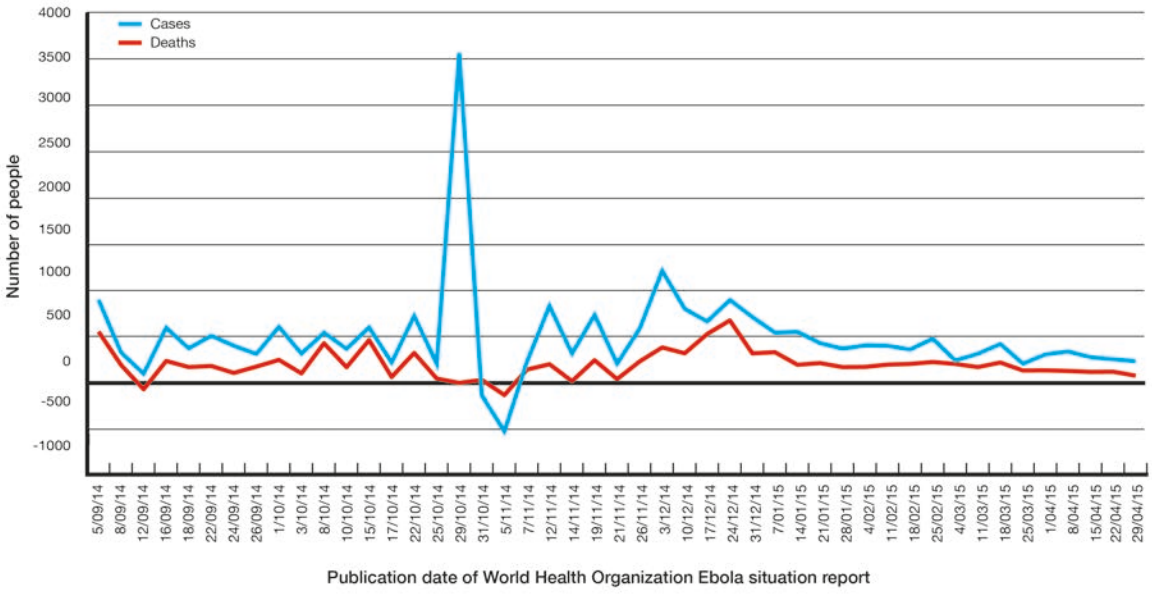


Figure 4: Number of new Ebola cases and deaths in each WHO report between September 2014 and April 2015

Source: World Health Organisation, 2014; 2015[10]



Note: The first reported case of Ebola was on 21 March 2014. The data in Figure 3 and Figure 4 includes cases and deaths in all nations affected by the West African Ebola outbreak from September 2014. The numbers

9 See http://apps.who.int/ebola/en/current-situation/ebola-situation-report
10 See http://apps.who.int/ebola/en/current-situation/ebola-situation-report

given in the WHO reports are the sum of confirmed, probable and suspected cases and deaths. These figures are estimates and subject to inaccuracy, as indicated by the negative values in Figure 4. For example, the late October 2014 peak results from a more comprehensive assessment of patient databases. The additional 3,792 cases have occurred throughout the epidemic period, not only since October.

Between March and September 2014 reporting was irregular. Between September and November 2014, situation reports were published regularly but at varying intervals (between two and seven days), hence both these figures should be read with this limitation in mind. From 26 November 2014 the situation reports have been published every seven days.

Essential medicines and health products are a key focus, and new information is becoming available all the time. Knowledge about how to treat Ebola has progressed, with increasing evidence that early oral rehydration salts (ORS) are effective.[11] As at 14 March 2015, WHO has divided emerging products into vaccines, therapies and diagnostics.

Vaccines for Ebola are being developed and tested, but the urgency creates additional issues. To elaborate, in November 2014, WHO noted that 'recent intense media coverage of experimental medicines and vaccines is creating some unrealistic expectations, especially in an emotional climate of intense fear. The public needs to understand that these medical products are under investigation. They have not yet been tested in humans and are not approved by regulatory authorities, beyond use for compassionate care'.[12] This could be the fastest vaccine roll-out in history.[13] Vaccine trials for Ebola are still underway in West Africa, and researchers are still awaiting data on their effectiveness.[14]

The most likely therapy is antivirals. Clinical trials are likely to take place in West Africa shortly. In addition, whole blood of Ebola survivors and convalescent plasma are being tested for efficacy as a potential therapy by the blood transfusion services.[15]

There is also concern over the length of time it takes to confirm diagnosis in suspected and probable cases of Ebola in West Africa. Turnaround ranges most often from nine hours to four days. A number of companies are working on ways to improve timeliness.[16]

Ebola is unlikely to create a global pandemic due to two of its characteristics:

(i) it is difficult to catch (it is not airborne); and
(ii) transmission happens only once a person is clearly unwell.

This means transmission is slow (the basic reproduction rate is 1.7; see Appendix 1). Appendix 2 explores four scenarios, developed by the authors in late 2014. These scenarios were used to help scope this project and build tacit knowledge about supply chain risk.

11 See http://www.npr.org/blogs/goatsandsoda/2014/10/23/358108367/ill-gag-drink-to-that-oral-rehydration-key-for-Ebola-patients and http://www.who.int/csr/disease/ebola/messages/en/
12 See http://apps.who.int/iris/bitstream/10665/137590/1/WHO_EVD_HIS_EMP_14.1_eng.pdf?ua=1
13 See http://www.who.int/medicines/ebola-treatment/emp_ebola_vaccines/en/
14 See http://time.com/3742986/ebola-deaths-10000/
15 See http://www.who.int/medicines/ebola-treatment/emp_ebola_therapies/en/
16 See http://www.who.int/medicines/ebola-treatment/emp_ebola_diagnostics/en/

2.3 Where We Are at the Start of 2015

The *Statement on the 4th meeting of the IHR Emergency Committee* regarding the 2014 Ebola outbreak in West Africa, dated 21 January 2015, reaffirmed the following:

- The event continues to constitute a public health emergency of international concern. The Committee reviewed the temporary recommendations previously issued and stated that all previous temporary recommendations should remain in effect.
- There is a need to avoid unnecessary interference with international travel and trade, as specified in Article 2 of the IHR 2005. 'The Committee noted that more than 40 countries have implemented additional measures, such as quarantine of returning travellers and refusal of entry. Such measures are impeding the recruitment and return of international responders. They also have harmful effects on local populations by increasing stigma and isolation and by disrupting livelihoods and economies.'[17]

The WHO report also refers to a major study published in *Science* on 29 August 2014 that the virus' genome is changing 'fairly quickly' in fixed ways. The report concluded by stating 'continued progression of this epidemic could afford an opportunity for viral adaptation, underscoring the need for rapid containment'.

On 25 February 2015 Dr Peter Walsh, a researcher in emergent disease dynamics at the University of Cambridge, said that there is no compelling evidence of changes that would make the virus more likely to become endemic. Some major evolutionary changes would be required to make it more transmissible – not just tweaking around the edges but big changes in the way it behaves.

We are still a long way from it becoming endemic. With an acute outbreak this large, we expect the attenuation to take quite some time. Although it is, in theory, possible that Ebola will become endemic, a far more likely outcome is that the epidemic will eventually burn out, probably by the end of this year. The greatest risk factor for it becoming endemic is the international community taking its eye off the ball. If we follow through with existing and planned efforts, the chances of endemic establishment are low. Second, even without major interventions such as treatment centres, people naturally become more educated about the virus and avoid high risk behaviours. This takes a while to kick in, but it already has in much of the outbreak zone and should continue to spread. This is why more should have been spent on public education. It is much more cost effective than expensive treatment facilities.[18]

In addition to the ongoing epidemic, concerns exist over the welfare of Ebola orphans (the WHO report estimates 30,000) and the possibility that a post-Ebola syndrome may exist.

17 See http://www.who.int/mediacentre/news/statements/2015/ebola-4th-ihr-meeting/en/
18 See http://www.theguardian.com/world/2015/feb/25/ebola-endemic-west-africa-scientists-warn

2.4 Lessons From the WHO Report on Ebola

The January 2015 WHO report, *One year into the Ebola epidemic*, identified two causes and the four biggest lessons from 2014.

The first cause was:

A lethal, tenacious and unforgiving virus. The second was the fear and misunderstanding that fuelled high-risk behaviours. As long as these high-risk beliefs and behaviours continue, the virus will have an endless source of opportunities to exploit, blunting the power of control measures and deepening its grip. Like the populations in the three countries, the virus will remain constantly on the move. Getting to zero means fencing the virus into a shrinking number of places where all transmission chains are known and aggressively attacked until they break. It also means working within the existing context of cultural beliefs and practices and not against them. As culture always wins, it needs to be embraced, not aggravated, as WHO aimed to do with its protocol on safe and dignified burials.

Several experts noted: 'When technical interventions cross purposes with entrenched cultural practices, culture always wins. Control efforts must work within the culture, not against it.'

The report also discussed factors such as high mobility, making tracing more difficult and transmission more likely, particularly where patients moved frequently to find medical help.

Using the concepts outlined in Section 1, the four lessons can be summarised as follows. The text and examples in the following pages are largely taken directly from the 2015 WHO report.[19]

Lesson 1: Invest in core infrastructure and research

Countries with weak health systems and few basic public health infrastructures in place cannot withstand sudden shocks, whether these come from a changing climate or a runaway virus. Failure to invest in these fundamental infrastructures leaves countries with no backbone to stand up under the weight of the shocks that this century is delivering with unprecedented frequency.

19 See http://www.who.int/csr/disease/ebola/one-year-report/introduction/en/

A whole-of-system observation

What began as a health crisis snowballed into a humanitarian, social, economic and security crisis. In a world of radically increased interdependence, the consequences were felt globally.

Examples

- Under the weight of Ebola, health systems in Guinea, Liberia and Sierra Leone collapsed. People stopped receiving – or stopped seeking – health care for other diseases, such as malaria, which causes more deaths per year than Ebola. In turn, the severity of the disease, compounded by fear within and beyond the affected countries, caused schools, markets, businesses, airlines, shipping routes and borders to close. Tourism shut down, further deepening the blow to struggling economies.

- Scientists and the pharmaceutical industry have geared up to develop, test, license and introduce the first Ebola vaccines, therapies and point-of-care diagnostic tests. These groups are attempting to compress work that normally takes two to four years into a matter of months.

  Nigeria had a first-rate virology laboratory, affiliated with the Lagos University Teaching Hospital, that was staffed and equipped to promptly diagnose a case of Ebola virus disease. This was an important factor in managing the outbreak.

- The outbreaks demonstrated the dangers of using growth in GDP as the sole measure of a nation's socio-economic progress, as it conceals vast social inequalities and hides the vulnerability to national security created by large numbers of desperately poor populations. The economies in all three countries were on the upswing following years of civil war and unrest, yet they crumbled under the severe shock delivered by Ebola.

- Step up ongoing research. Research aimed at introducing new medical products needs to continue at its current accelerated pace. Executives in the research-and-development-based pharmaceutical industry have expressed their view that all candidate vaccines must be pursued 'until they fail'. They have further agreed that the world must never again be taken by surprise and left to confront a lethal disease with no modern control tools in hand.

- Researchers have identified at least 22 African countries that have the ecological conditions and social behaviours that put them at risk of future outbreaks of Ebola virus disease.

- One overarching question hangs in the air. The virus has demonstrated its tenacity time and time again. Will national and international control efforts show an equally tenacious staying power?

Lesson 2: Be vigilant; probe, scan, rehearse, inform and respond in a timely manner

Preparedness made a real difference, including a high level of vigilance for imported cases and a readiness to treat the first confirmed case as a national emergency.

A whole-of-system observation

Constant vigilance underlies a whole-of-system approach. As noted in Section 1, the key is to probe, scan, rehearse, inform and respond in a timely manner.

Examples

- Countries like Nigeria, Senegal and Mali that had good surveillance and laboratory support in place and took swift action were able to defeat the virus before it gained a foothold.

- Delays in receiving test results are especially detrimental to outbreak control.

- Clinicians in equatorial Africa have good reasons to suspect Ebola when a 'mysterious' disease occurs, and this favours early detection. Laboratory capacity is in place, and staff know where to send patient samples for rapid and reliable diagnosis. Health systems are familiar with Ebola and much better prepared.

- West African countries, which had never experienced an Ebola outbreak, were poorly prepared for this unfamiliar and unexpected disease at every level, from early detection of the first cases to orchestrating an appropriate response. Clinicians had never managed cases. No laboratory had ever diagnosed a patient specimen. No government had ever witnessed the social and economic upheaval that can accompany an outbreak of this disease. Populations could not understand what hit them or why. Ebola was thus an old disease in a new context that favoured rapid and initially invisible spread. As a result of these and other factors, the Ebola virus has behaved differently in West Africa than in equatorial Africa, challenging a number of previous assumptions.

- Ongoing intensive surveillance is needed as early optimism was unfounded.

- On 6 August, Liberian President Sirleaf declared a three-month state of emergency and announced a string of new regulations, which included the closing of markets, curfews and restrictions on the movement of patients and their contacts – to be enforced by the country's military. In her view, such restrictions were justified, as the disease threatened to undermine the nation's 'economic and social fabric'.

Lesson 3: Adopt a decentralised and flexible approach; design a unique package of independent but interconnected measures

No single control intervention is, all by itself, sufficiently powerful to bring an Ebola epidemic of this size and complexity under control.

A whole-of-system observation
All control measures must work together seamlessly and in unison. If one measure is weak, others will suffer. This was not an epidemic with three different national patterns, but likely hundreds of distinct patterns with their own transmission dynamics, playing out within individual districts and sub-districts.

Examples

- Aggressive contact tracing will not stop transmission if contacts are left in the community for several days while test results are awaited. Good treatment may encourage more patients to seek medical care but will not stop community-wide transmission in the absence of rapid case detection and safe burials. In turn, the powers of rapid case detection and rapid diagnostic confirmation are diminished in the absence of facilities for prompt isolation. As long as transmission occurs in the community, medical staff following strict protocols for infection prevention and control in clinics will be only partially protected.

- In one of the most encouraging investigations in all three countries during 2014, WHO was able to find a direct link between implementation of the full package of control interventions, including community engagement, acceptance and ownership of the response, and the decline and then end of new cases in Lofa, a North Liberian county. Those findings were all the more impressive given Lofa's proximity to Guinea, where transmission was still ongoing and intense.

Lesson 4: Engage locally; find out how the community wants to respond

Contact tracing, early reporting of symptoms, adherence to recommended protective measures and safe burials are critically dependent on a cooperative community. Having sufficient facilities and staff in place is not enough. In several areas, communities continued to hide patients in homes and bury bodies secretly, even when sufficient treatment beds and burial teams were available. Experience also showed that quarantines will be violated or dissolve into violence if affected communities are given no incentives to comply.

A whole-of-system observation
Community engagement is the one factor that underlies the success of all other control measures.

Examples

- People and their ancestors had been living in the same ecological environment for centuries, hunting the same wild animals in the same forest areas, and had never before seen a disease like Ebola. Equally unfamiliar were the response measures, like disinfecting houses, setting up barriers and fever checks, and the invasion by foreigners dressed in what looked like spacesuits, who took people to hospitals or barricaded tent-like wards from which few returned.

- A second source of community resistance arose from the inability of ambulance and burial teams to respond quickly to calls for help, with bodies sometimes left in the community for as long as eight days. The communities will comply with official advice if it benefits them. They are far less likely to comply if the result, like uncollected bodies, causes visible harm.

- In the face of early and persistent denial that Ebola was real, health messages issued to the public repeatedly emphasised that the disease was extremely serious and deadly and had no vaccine, treatment or cure. While intended to promote protective behaviours, these messages had the opposite effect: this may have led to the practice of hiding patients in homes.

- Some people believed that foreign teams were causing deaths in order to harvest organs. Fear spreads faster than a virus.

- Intensification of technical interventions, like increased laboratory capacity, more treatment beds and a larger number of contact tracing and burial teams, will not bend the curve in the absence of community engagement and ownership.

- Low fences let patients interact with loved ones from a safe distance.

- Isolation in reverse. Residents of villages near Kenema witnessed how quickly the virus could sweep through crowded households. A WHO field coordinator learned that what people wanted was a place where uninfected members of a household could go to ‘self-isolate’. They wanted a low-risk environment to stay in while waiting for the results of diagnostic tests. The idea of providing a tent, offering sufficient space to keep a safe distance from others, was born. Communities know what they need. If that need is met with acceptable measures, they will be used.

Although not referenced directly in the four biggest lessons in the WHO report, a number of other observations are apparent. These are listed as lessons 5–10.

Lesson 5: Embrace technology; data builds information and information builds strategic knowledge

Countries that embraced technology to manage fear and obtain knowledge managed the crisis more effectively. For example, Mali was well rehearsed in the emergency measures that needed to be taken swiftly. Hundreds of contacts were identified and placed under daily surveillance. Isolation facilities and an Ebola-designated treatment centre were constructed. In response to public fears and misperceptions, an innovative telephone hotline was established and began receiving around 6,000 calls per day. All calls were meticulously recorded and analysed each day, with information on the caller's precise area of work or residence, occupation and main concerns. Calls were then mined to uncover where public messages about the disease needed to be adjusted. Some callers reported suspected cases. All such reports were investigated.

Lesson 6: Lead from the top; both immediately and over time

The report acknowledged the role of top-down leadership, noting that the President of the Democratic Republic of Congo personally supervised the response to the country's seventh Ebola outbreak. 'Health officials knew what to do to contain the outbreak, despite a weak health system and a severe shortage of healthcare staff. The Minister of Health immediately travelled to Boende, together with the head of the WHO country office, to assess the situation, discuss control measures with local health officials, and demonstrate high-level of leadership and concern to the affected population.'

The report also discussed the importance of collaboration where experts worked together across silos and between institutions. For example, epidemiologists worked shoulder-to-shoulder with staff from the Senegal Ministry of Health, Médecins Sans Frontières (MSF) and the Centers for Disease Control and Prevention (CDC) to undertake urgent and thorough contact tracing in Senegal.

Lesson 7: Coordinate; supply chain issues deliver complexity but also opportunities in both the short and long term

Most importantly, the report emphasises the need to disrupt chains of transmission while maintaining supply chains of core goods and services and creating new supply chains of vaccines, protection equipment, epidemiologists and medically trained staff. All three are in reality supply chain issues. The challenge is to manage all three simultaneously. The opportunity is to leave communities stronger than before, bounding forward not just back. This could be seen in terms of strengthening health care infrastructure through building a stronger cohort of trained health professionals, improving hospitals, setting up better monitoring systems and sharing latest technological and medical outcomes.
The report does not directly discuss the economic impacts, other than to indicate they are significant. For example, they note that Nigeria, Senegal and Mali 'had witnessed the tenacity of the virus, and the social and economic devastation it caused, and were on high

alert to respond to an imported case as a national emergency'. Arguably it was beyond the purpose of the WHO 2015 report to explore the economic impact in more detail, but there has been much discussion in the press. For example, Sierra Leone President Koroma stated: 'We were implementing policies that were making our country one of the fastest growing economies in the world when Ebola struck. Ebola is now causing great disruptions to agricultural, mining, manufacturing, construction, tourism, and transportation, and posing a significant threat to human development, state security, and poverty reduction'.[20]

As of 24 February 2015 the World Bank has stated that in Liberia:

- *A substantial percentage of those working pre-crisis remain out of work; however, those in self-employment continue to be the hardest hit by the Ebola crisis, pointing to a lack of working capital and a lack of customers as the main barriers to their operation.*

- *Nearly 85 percent of those surveyed in December and January report having sold assets, sold or slaughtered livestock, borrowed money, sent children to live with relatives, spent savings, or delayed investments in order to manage since the start of the Ebola crisis.*

- *Despite an improved outlook, agriculture remains a concern. Nearly 65 percent of agricultural households surveyed in this round believed that their harvest would be smaller than it had been in the previous year, though this is down from 80 percent in December.*

- *Labor shortages and inability to work in groups due to Ebola infection fears continue to pose a problem for agricultural households; if the fear persists into the new season beginning in April, it could impact the amount of land under cultivation, as the clearing process is more labor intensive than the harvest.*

- *Food insecurity persists nationwide, with nearly three-quarters of households reporting that they were worried at some point in the previous week that they would not have enough to eat; households continue to cite a lack of money as the main constraint to purchasing enough food to feed their families.*[21]

20 Remarks made at the World Bank 'Impact of the Ebola Crisis: A Perspective from the Countries' meeting on 9 October 2014 (see http://live.worldbank.org/impact-of-Ebola-crisis). See also *Transcript of Impact of the Ebola Crisis: A Perspective from the Countries* at http://www.worldbank.org/en/news/speech/2014/10/09/transcript-event-impact-ebola-crisis-perspective-countries

21 See http://www.worldbank.org/en/news/press-release/2015/02/24/households-returning-to-work-liberia-ebola-crisis-wanes. See also the World Bank comment on economic costs on 12 January 2015 on 'Ebola hampering household economics across Liberal and Sierra Leone' at http://www.worldbank.org/en/news/press-release/2015/01/12/ebola-hampering-household-economies-liberia-sierra-leone

Lesson 8: Review; actively assess progress

The World Health Organisation has been impressive. It has systematically and critically assessed every failure and every success, distilling the lessons learned in a thorough and comprehensive manner in order that the world can all be better prepared when disruptive events occur. Not only has it provided a number of lessons learned, it has been an exemplar of what true resilience is about, continually reassessing and adapting the system to meet the inevitability of future disruptive events.

Lesson 9: Build capacity; prepare response plans for a long-term extended emergency

As noted in Section 2.1, in 2010 a WHO review committee noted that WHO systems 'were designed to respond to a geographically focal, short-term emergency, rather than a global, sustained, long-term event'. This seems an important lesson for going forward. Are WHO and nation states in general better prepared for extended emergencies, and if not, what work needs to be done? Building capacity for a long-term extended emergency appears to be about designing a system to be sufficiently connected to enable options to be easily explored but not too connected so that choke points occur. Choke points appear to become more important when dealing with longer time frames.

Lesson 10: Govern; possibly separate operations in the field from technical advice/policy

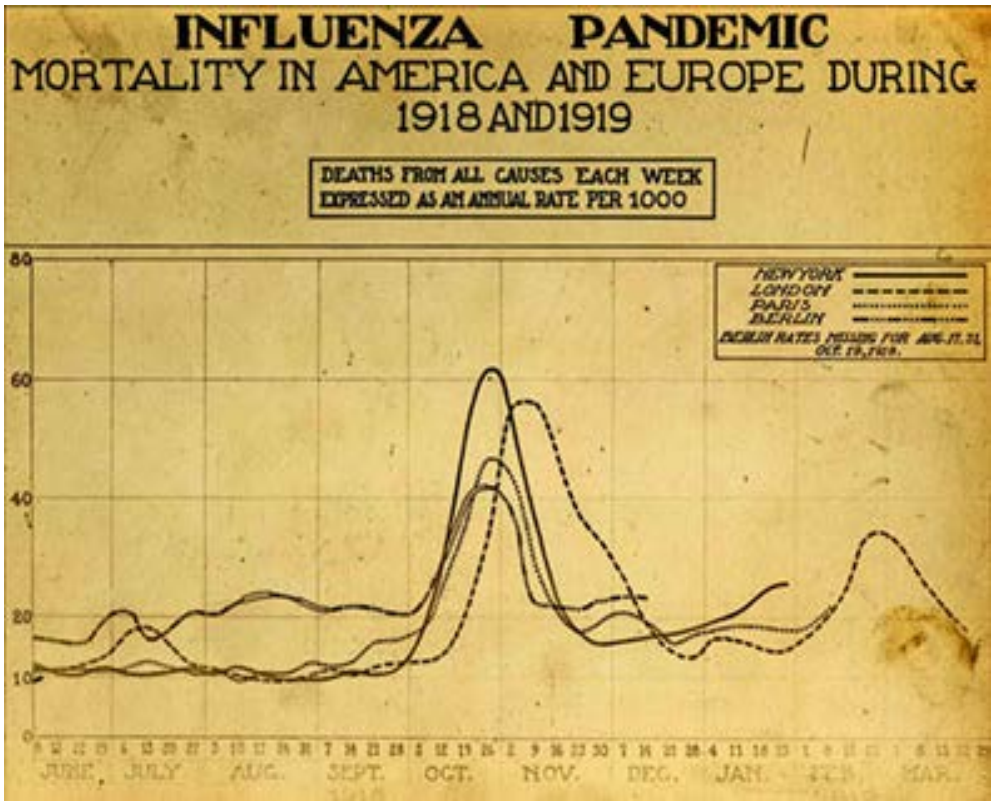
The second-to-last chapter of the WHO report discusses 'the warnings the world did not heed'. The report looks specifically at WHO as an institution and discusses what needs to change.

There remain ongoing discussions on the role of WHO and whether those roles might be better shared across a range of institutions. The reports states, 'In connection with a reform process currently under way at WHO, Executive Board members will consider the extent to which WHO is expected to be operational in the field during extended emergencies, with its staff directly coordinating or supervising the response, or whether the WHO role should be confined to technical guidance and advice. Both functions – providing technical assistance and direct aid – are constitutionally mandated. The Board will also consider administrative and managerial arrangements between WHO headquarters and its six regional offices.'

2.5 The Risk of a Global Pandemic

The most significant airborne pandemic occurred almost one hundred years ago. Figure 5 below shows a timeline for the 1918 and 1919 pandemic.

Figure 5: Spanish Flu mortality from the 1918 and 1919 influenza pandemic
Source: National Museum of Health and Medicine, Armed Forced Institute of Pathology, 2006[22]



In comparison to other viruses, Ebola fits somewhere between HIV and SARS. In contrast to SARS, Ebola and HIV are not airborne. Ebola has a mortality rate of around 60–70 per cent, but early treatment has proved a critical factor. SARS can spread over a shorter time frame than HIV or Ebola but has a lower mortality rate (about 10 per cent). While none of these three viruses has had the characteristics of both rapid infection rates and high mortality, it is widely accepted that an influenza-type pandemic with both of these characteristics is the biggest threat to humanity.

22 See http://journals.plos.org/plosbiology/article?id=10.1371/journal.pbio.0040050

In February 2015 WHO reported[23] that the 'current global influenza situation is characterized by a number of trends that must be closely monitored. These include: an increase in the variety of animal influenza viruses co-circulating and exchanging genetic material, giving rise to novel strains; continuing cases of human H7N9 infections in China; and a recent spurt of human H5N1 cases in Egypt. Changes in the H3N2 seasonal influenza viruses, which have affected the protection conferred by the current vaccine, are also of particular concern.'

While acknowledging 'the world is better prepared for the next pandemic than ever before, WHO states 'it remains highly vulnerable, especially to a pandemic that causes severe disease. Nothing about influenza is predictable, including where the next pandemic might emerge and which virus might be responsible. The world was fortunate that the 2009 pandemic was relatively mild, but such good fortune is no precedent.' The 2009 pandemic (H1N1 'swine flu') contained a unique combination of genes similar to influenza viruses that were identified in and known to circulate in pigs. It is now a regular human flu virus that circulates worldwide.[24]

Figure 6 (overleaf) illustrates the annual likelihood of a hazard occurring and the scale of the consequences for New Zealand. The figure indicates that based on the likelihood and relative consequences, the risk of a human pandemic occurring is the most significant risk facing New Zealand.

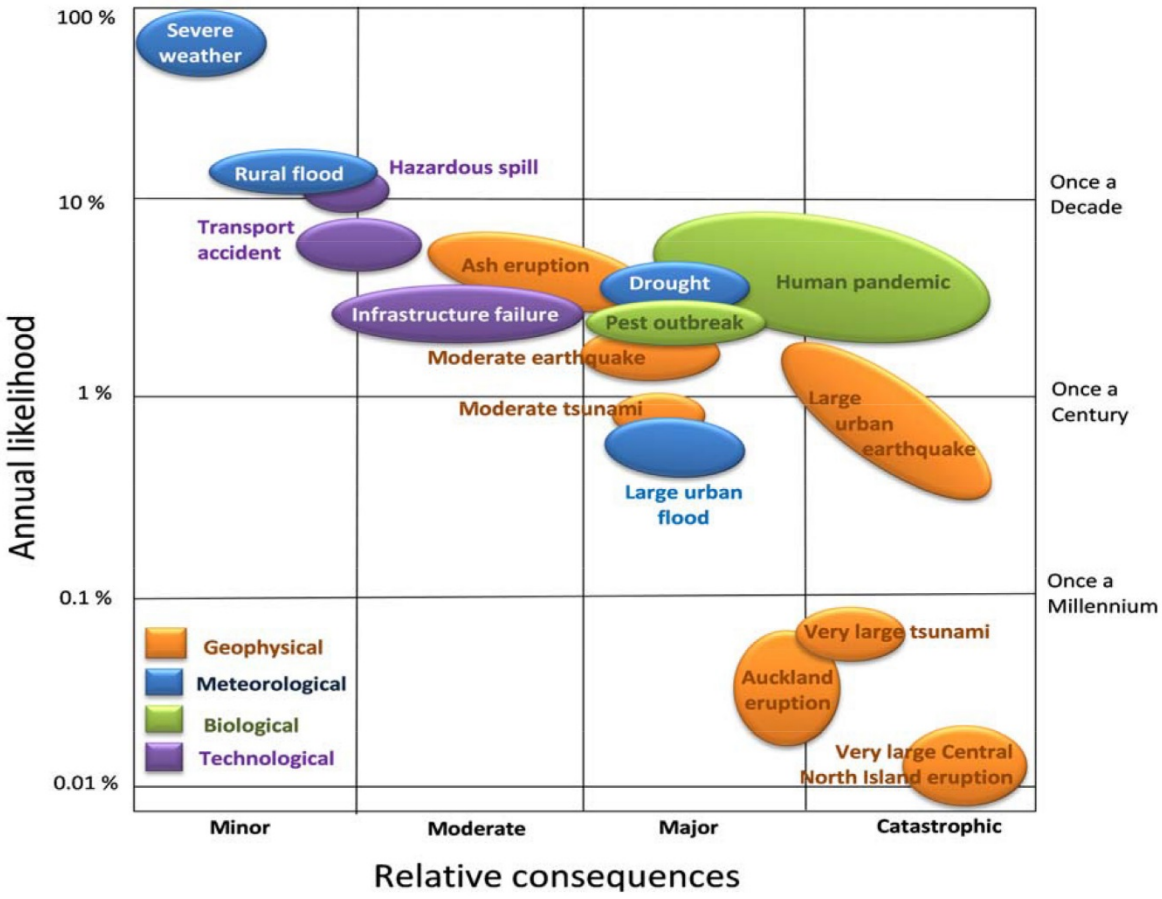
The February WHO report concludes by noting an influenza pandemic 'is the most global of infectious disease events currently known. It is in every country's best interests to prepare for this threat with equally global solidarity.'

While all countries are at risk, the fact that New Zealand is both small and isolated can provide distinct benefits and risks. For example, it would be relatively easy for New Zealand to close its border, but it is unlikely we would have the scale to test patients for novel viruses or produce vaccines in bulk. This is why New Zealand must be both prepared to operate in isolation until global medical supplies have caught up and at the same time be able to tackle a long emergency on our own. But how prepared are we really?

23 See http://www.who.int/influenza/publications/warningsignals201502/en/
24 See http://www.cdc.gov/h1n1flu/information_h1n1_virus_qa.htm

Figure 6: National hazard risks

Source: Department of the Prime Minister and Cabinet & Ministry of Civil Defence and Emergency Management, 2014[25]



25 See http://www.civildefence.govt.nz/assets/Uploads/publications/Final-MCDEM-BIM-2014.pdf

3.0 Looking From the Outside In: How Prepared Is New Zealand?

On the advice of the Director of Civil Defence Emergency Management, and in consultation with the Prime Minister and the Mayor of Christchurch City, at 10.30am I declared a state of national emergency for the Christchurch City under Section 66 of the Civil Defence Emergency Management Act 2002. This was as a result of the magnitude 6.3 earthquake that occurred in Christchurch yesterday at 12:51pm, and the continuing aftershocks.

It is the first time in New Zealand history that a state of national emergency has been declared as a result of a civil defence emergency event. I took this step because I considered the emergency is of such a degree that the required civil defence emergency management will be beyond the capacity of local civil defence emergency people to respond to on their own.

John Carter,
Minister of Civil Defence's statement to Parliament
23 February 2011

3.1 Setting the Context

If a state of emergency were declared in New Zealand – locally or nationally – what would happen next? It is important that New Zealand has in place a framework that not only answers this question but is also able to maintain, adapt and benchmark progress over time.

This section looks at what procedures are in place should a disruptive event occur. This section is broad in approach; it does not directly focus on supply chain risks but explores how the public would be alerted to a disruptive event, what behaviours might evolve and how government might respond once an emergency is declared. It does focus on New Zealand's response to a human pandemic, as this is the most significant risk facing New Zealand (as illustrated in Figure 6 in the previous section).

The reaction to a disruptive event, whether it is from central government, local government, NGOs or businesses, will impact significantly on supply chain risk. Will supermarkets be emptied in hours, will petrol pumps have long queues, will key staff become sick (leaving critical infrastructure dormant) and will key equipment lie stranded on the other side of the Pacific as New Zealand contends with an extended emergency? The answers to these questions will be determined, to a high degree, by answering the question: how prepared is New Zealand?

3.2 A Resilient New Zealand?

A non-resilient New Zealand would not just be a country prone to the physical impact of disruptive events but also a country vulnerable to the human impact of such events. As noted in the preceding section, socialising potential disruptive events before they eventuate and ensuring the community is part of the solution are key aspects of building a resilient country. Fear proved to be a key determinant of people's behaviour during the Ebola outbreak; therefore, a confident, informed and connected community is more likely to deliver a resilient society than an uninformed unconnected one, as the community will contribute positively in an emergency and play an active role in the recovery.

Given that human behaviour determines outcomes, preparing and responding to risk should be evaluated in terms of the behaviours we want to see when a disruptive event occurs. Following on from this, understanding and utilising human networks and communication so that people know what is happening, and what is expected in any given situation, is a key component of a system-centric approach to risk management.

Public policy shapes the way the country is run. Within the public policy system are three components (institutions, instruments and information systems), and each component works together with the others to deliver public good outcomes. This section provides an overview of each of the components, followed by a number of observations.

Analysing public policy this way enables weaknesses in the system to be identified and resolved, current linkages strengthened or alternative solutions examined. For example, instead of creating a new institution, a new instrument might focus on requiring institutions, businesses and non-government organisations to work together for a common goal. The new instrument might take the form of legislation, a strategy, a preparation plan, a response plan or a set of guidelines. A more in-depth analysis is necessary and as such forms part of our major recommendations (see the third major recommendation in the Executive Summary).

As outsiders looking in, it was difficult to ascertain and understand the interactions between various institutions that form New Zealand's national crisis management framework. The first step was reviewing the relevant legislation and the Ministry of Civil Defence and Emergency Management (MCDEM) website, and the second step was a wider review in order to understand the broader context.

Of particular interest was how well the system could be understood from publicly available information. A new *National CDEM Plan* and *Guide* will be released shortly, which will provide a more up-to-date explanation of New Zealand's framework for dealing with emergencies. This will no doubt result in an update of the MCDEM website and provide more clarity over the distinction between MCDEM, the wider sector[26] and the CDEM

26 See http://www.civildefence.govt.nz/cdem-sector

framework[27] and also the distinction between states of national emergency and civil defence emergencies of national significance.[28] This report contains an extensive appendix (see Appendix 4) that includes relevant legislation in order to describe the current system more generally and also provide a context for later discussions on supply chain risks and the role of lifeline utilities.

3.3 Relevant Institutions

In terms of institutional structure, there appear to be two modes of operation, a *business-as-usual* structure and a *national crisis* structure.

Figure 7 (overleaf) illustrates how the system operates under a business-as-usual situation. The Officials Committee for Domestic and External Security Coordination – Governance (ODESC[G]) is focused on governance of the sector as a whole.[29] DPMC advise that 'the Security and Intelligence Board (SIB) provides stewardship for those parts of the sector that deal with the more traditional component of national security, with a particular emphasis on New Zealand's core intelligence community. The Readiness and Response Board (RRB) is focused on New Zealand's preparedness to respond to a range of civil contingencies such as natural hazard events, biosecurity outbreaks, pandemic or maritime events. Another new creation is the ODESC Forum, an occasional meeting of officials intended to maintain the tradition of network building and information sharing across the wider national security and resilience sector that has been a mainstay of ODESC since inception. Finally, a new Strategic Risk and Resilience Panel met for the first time in August. This is a panel of 7–10 experts drawn from both inside and outside of government with a brief to: assist ODESC(G) in anticipating and mitigating strategic national security risks; and, provide an advisory and critiquing role in relation to strategic national security risks and how they are addressed by the system as a whole.'

27 See http://www.civildefence.govt.nz/cdem-sector/cdem-framework

28 The current *Guide* is 266 pages long. See Section 3 on page 5 of the *Guide* at http://www.civildefence.govt.nz/cdem-sector/cdem-framework/guide-to-the-national-civil-defence-emergency-management-plan

29 The background on the ODESC is noteworthy. It 'was established in March 1987 at the direction of Cabinet in order to have a mechanism in government to undertake strategic planning on national security issues. Its roles initially were concentrated on counter-terrorism policy, intelligence assessments, and civil defence matters. It was tasked with assessing levels of risk to national security, advising government on the resources required to manage those risks, and setting up arrangements for coordinating operational responses if necessary. ODESC's architecture was reorganised in October 2013 to ensure it remained responsive to more modern concepts of national security. This broader, "all hazards" approach to national security has, over time, widened ODESC's mandate to incorporate threats posed by natural hazards, biosecurity risks and pandemics alongside more traditional threats posed by state actors, trans-national criminals or terrorists.'

Figure 7: New Zealand's national security coordination system

Source: Department of the Prime Minister and Cabinet & Ministry of Civil Defence and Emergency Management, 2014[30]

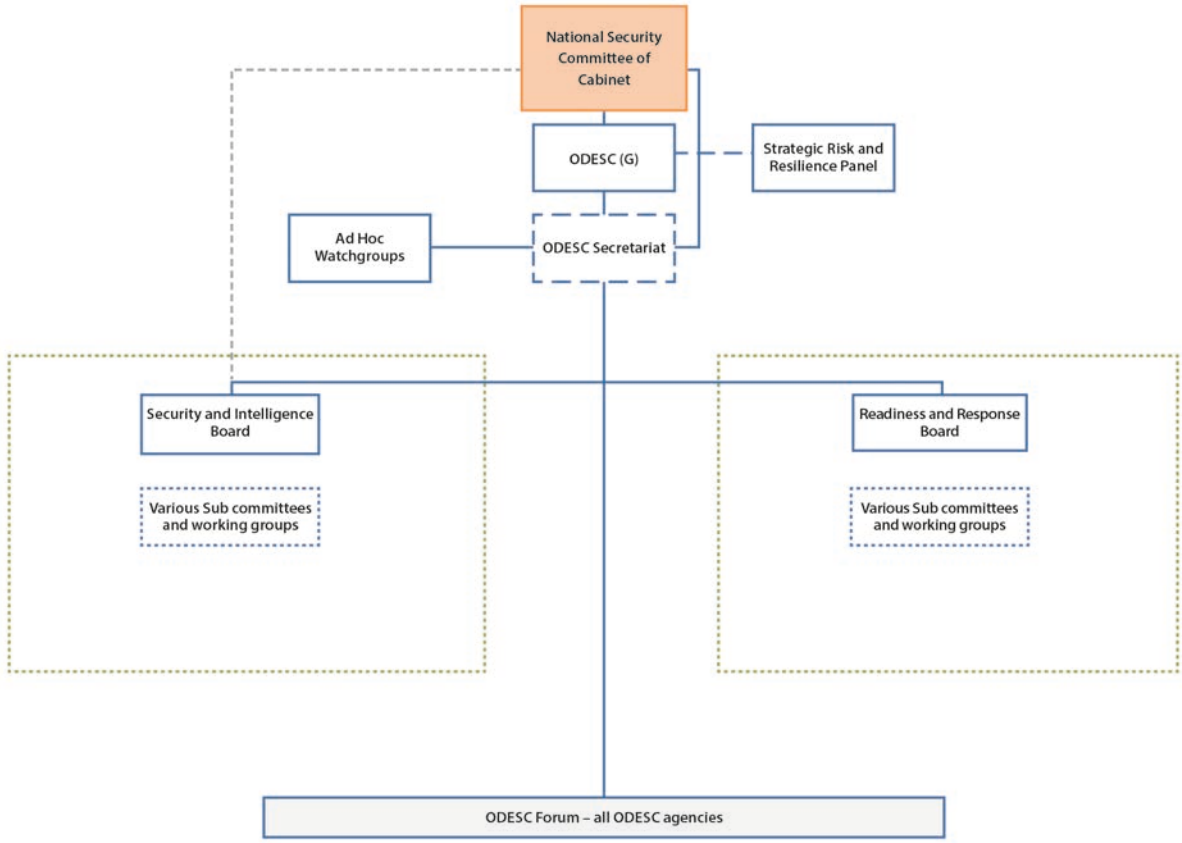


Figure 8 illustrates how the system operates under a national crisis; illustrating the key role of the Ministry of Civil Defence and Emergency Management (MCDEM) when MCDEM is the national lead agency at an operational level. Appendix 5 outlines the key organisational risks identified by MCDEM management in 2014. This shows a desire to operate in an open and transparent manner and is included in this report to illustrate good practice. This was an honest and no doubt effective appraisal that has made New Zealand more resilient.

In addition to MCDEM, there are many other institutions directly involved in building resilience. As part of the preparation for an emergency, a number of additional organisations are required to prepare their own plans. For example, there are 16 nationwide local CDEM groups (see Figure 9 and Figure 10 in Section 3.4) and a number of lifeline utilities, each of which are required to prepare plans under the Act (see Appendix 4).

When an emergency is of national significance, a national emergency can be declared over all or part of New Zealand. Once a national emergency has been declared, the director of civil defence emergency management, or another delegated person, will become the national controller and will be responsible for coordinating the response to the

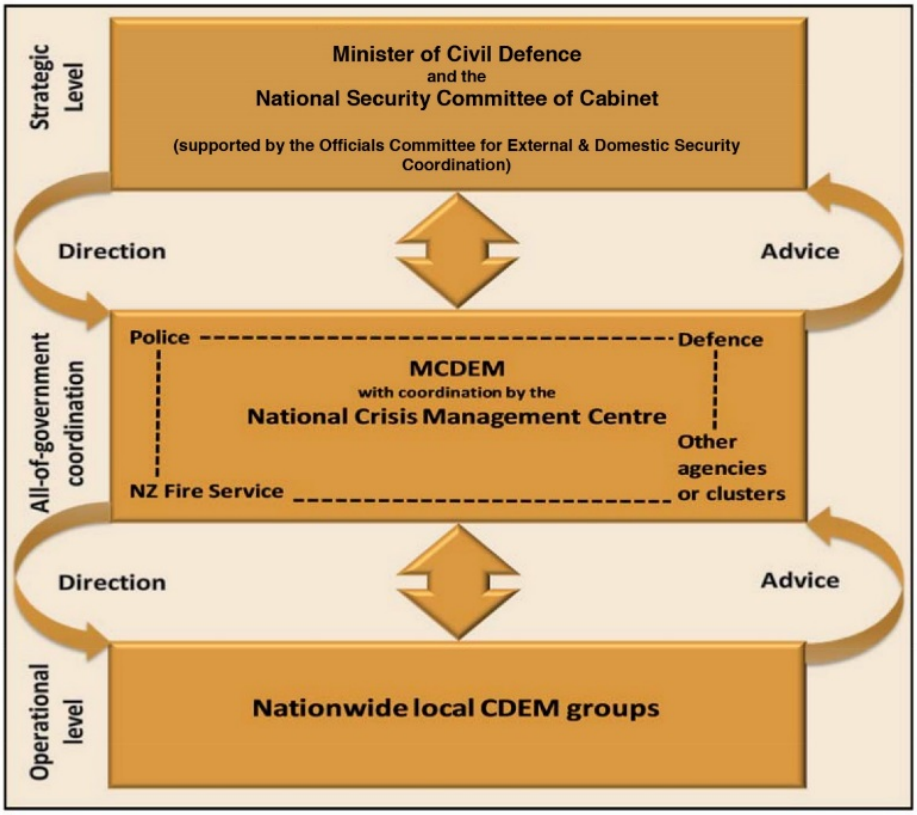
30 See http://www.civildefence.govt.nz/assets/Uploads/publications/Final-MCDEM-BIM-2014.pdf

emergency.[31] However, the type of emergency will determine which agency has a lead role in the response; for example, biosecurity emergency responses are led by the Ministry for Primary Industries, counter-terrorism emergency responses are led by the New Zealand Police and a pandemic response would be led by the Ministry of Health. The National Crisis Management Centre (NCMC), which has been established by government, is the central facility for use when MCDEM is the lead agency for civil defence emergency responses.[32] See Appendix 6 for more information on the range of risks and the tentative lead agencies. Under the Civil Defence Emergency Management Plan Order 2005, the CDEM director has the responsibility to coordinate, direct and control the use of emergency resources during a civil defence emergency. The director also has the responsibility to control the nationwide local CDEM groups, brief the responsible minister (currently the minister of civil defence), recommend required policies to Cabinet and establish emergency processes (see Appendix 4 for more detail).

Figure 8: New Zealand's national crisis management model in an emergency for which MCDEM is the national lead agency at an operational level

Source: Department of the Prime Minister and Cabinet & Ministry of Civil Defence and Emergency Management, 2014[33]

Note: New Zealand's arrangements for dealing with national security issues have evolved through the system of Domestic and External Security Coordination (DESC).



31 See page 6 at http://www.civildefence.govt.nz/assets/Uploads/publications/cdem-act-2002-introduction-brochure.pdf

32 See Section 20 on page 2 of the Guide at http://www.civildefence.govt.nz/cdem-sector/cdem-framework/guide-to-the-national-civil-defence-emergency-management-plan

33 See http://www.civildefence.govt.nz/assets/Uploads/publications/Final-MCDEM-BIM-2014.pdf

Recent developments in the structure are significant. In April 2014 MCDEM was transferred from the Department of Internal Affairs (DIA) to DPMC. At the time, the Minister of Civil Defence and Emergency Management explained:

The transfer will strengthen co-ordination across the national security and intelligence sector and provide closer alignment of civil defence emergency management with national security directions. It will enhance the ability for MCDEM to take a greater role working with other departments in whole-of-government planning and resiliency issues. It will strengthen the capacity to plan and manage, across government, large-scale emergencies such as the Canterbury earthquakes.[34]

A further development was that the Cabinet Committee on Domestic and External Security (DES) was replaced by the National Security Committee (NSC). The loss of the DES creates some confusion, as New Zealand still operates an Officials Committee for Domestic and External Security Coordination (ODESC). The new structure is set out in Figure 7. The terms of reference of NSC are two-fold: (i) to have oversight of the national intelligence and security sector and to consider policy and legislative proposals relating to the sector; and (ii) to coordinate and direct national responses to major crises or circumstances affecting national security (either domestic or international).[35]

The current framework is made up of a range of different institutions (e.g. local CDEM groups, lifeline utilities and a national crisis management centre), committees, boards, legal instruments and mechanisms, numerous acronyms, and a number of diverse and often competing roles – many of which change significantly depending on whether New Zealand is dealing with *business as usual* or a *national crisis* situation.

To summarise, the structure of the current institutional framework has both strengths and weaknesses. The approach could be described as flexible and responsive, arguably making the system more resilient and agile. The legislation allows for large discretion in parts to maintain optionality in practice. It enables the MCDEM response to be designed specifically for the nature of the event. However, such flexibility poorly communicated may also create a weakness.

Drawing the distinction between a complex system and a complicated system is useful. A national crisis situation cannot help but be complex, but it does not need to be complicated. Having in place a flexible evolving framework to manage a diverse range of risks (many of which are interconnected) is logical, but if that framework is not clear, it adds another layer of risk to the system. Hence the solution is to ensure the framework is up-to-date, straightforward and consistent across all key documents and that operational practice mirrors the intent of the legislation.

34 See http://www.national.org.nz/news/news/media-releases/detail/2013/11/18/mcdem-shift-will-strengthen-emergency-management-and-resilience
35 See http://www.dpmc.govt.nz/cabinet/committees/nsc

As with any complex system, the goal is to simplify rather than complicate. This is particularly important considering effective management of many national disruptive events is likely to be dependent on New Zealanders being informed and on civilians acting for the greater public good. Improve our resilience – communicating clearly who will do what, when and why – will require not just an 'all-of-government coordination' but a 'whole-of-society' approach.

3.4 Relevant Instruments

The key instrument at the centre of the framework is the Civil Defence Emergency Management (CDEM) Act 2002, from which stems the *National CDEM Strategy* and the *National CDEM Plan* (see Appendix 4).

The vision of the *National CDEM Strategy* is 'resilient New Zealand communities understanding and managing their hazards'. The document sets out principles and national-level goals[36] and objectives that collectively define what we as New Zealanders want to achieve through our CDEM arrangements. The *CDEM Strategy* was first published in 2004 (for the period 2003 to 2006)[37] following the introduction of the Civil Defence Emergency Management Act in 2002. It was revised in 2008; however, the vision and the goals have not changed since the 2004 document was published.

In 2013 the Minister of Civil Defence reported to Cabinet on the progress made in implementing the *CDEM Strategy*. The report noted: 'Overall, since 2008, good progress has been made in building New Zealand's resilience to hazards and risks, and capability to manage civil defence emergencies. The biggest challenge for "business as usual" (both locally and nationally) remains prioritising effort for best gains given the range of hazard risks.'

Under the *CDEM Strategy*, the minister of civil defence must report to Cabinet every three years on progress towards achieving a 'resilient New Zealand'. The current website indicates that the next review is due in 2016 and a new strategy is likely in 2018.[38]

Appendix 4 describes key legislation. Figure 9 (overleaf) illustrates the various policy instruments in existence as at 2008; there appears to be no recent illustration that showcases how the institutions and instruments interconnect to deliver an integrated and comprehensive approach to emergency management.

36 The strategy contains four goals:
- Increasing community awareness, understanding, preparedness and participation in civil defence emergency management.
- Reducing the risks from hazards to New Zealand.
- Enhancing New Zealand's capability to manage civil defence emergencies.
- Enhancing New Zealand's capability to recover from civil defence emergencies.

See http://civildefence.govt.nz/cdem-sector/cdem-framework/national-civil-defence-emergency-management-strategy/

37 See http://www.mcguinnessinstitute.org/Site/Projects/NSDS_national_strategy/Government_Strategies/emergency_management.aspx

38 See http://www.civildefence.govt.nz/cdem-sector/cdem-framework/national-civil-defence-emergency-management-strategy/

Figure 9: The civil defence emergency management framework
Source: Department of Internal Affairs, 2008[39]

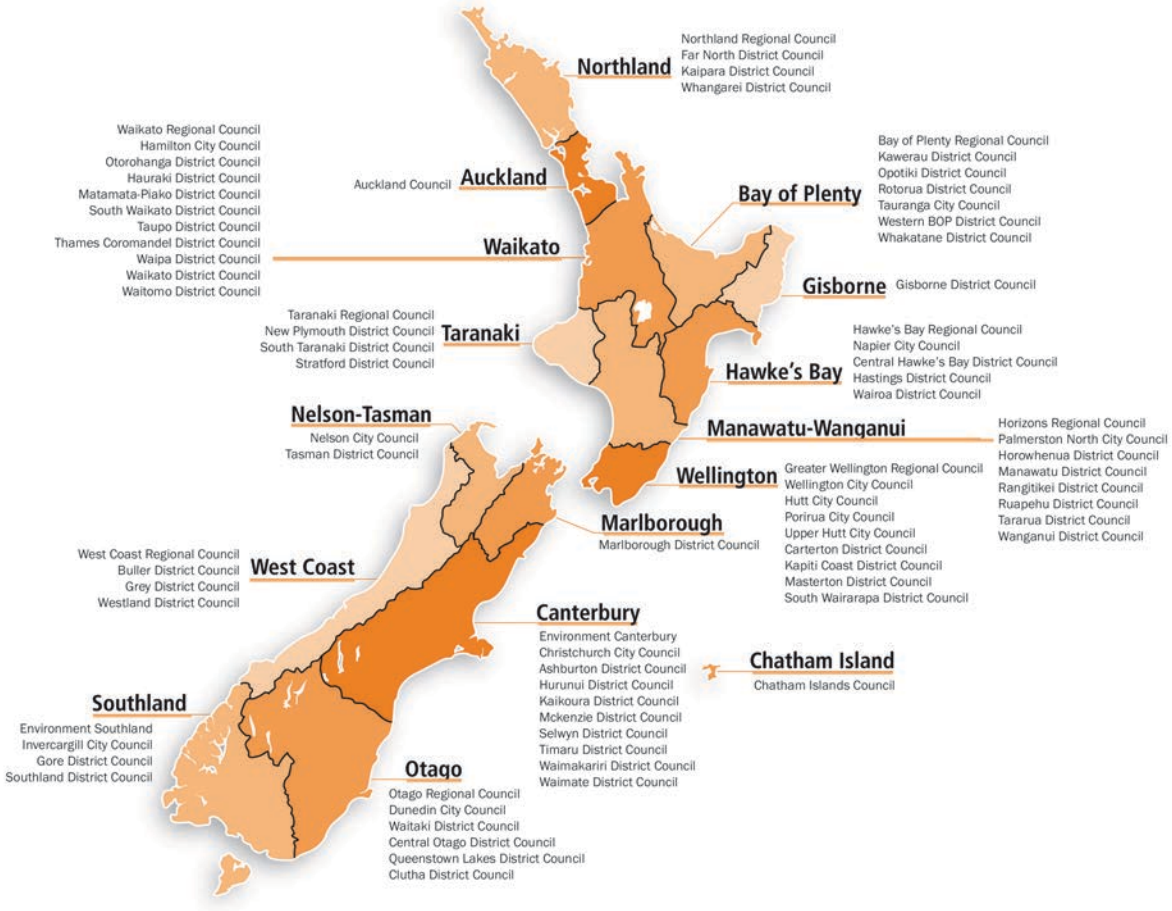
Note: LTCCP stands for long-term council community plan.

In addition to the elements outlined in Figure 9, other policy instruments included in the framework but not illustrated above are the CDEM regulations made under the CDEM Act 2002, the other directors' guidelines on various aspects of CDEM (the 2009 *Guide to the CDEM Plan* is included above) and other legislation relevant to CDEM.[40]

At the micro level, local CDEM groups (required by the CDEM Act 2002) represent the cooperation and coordination of local authorities with emergency services and other agencies to implement the *CDEM Strategy* vision at the local level. There are 16 local CDEM groups formed across New Zealand; these are committees of elected councillors from each council within regional boundaries (see Figure 10). As required under legislation,[41] each group must develop, approve, implement and monitor a civil defence emergency management group plan and review that plan at least every five years.[42] These plans are currently being reviewed, with a national summary report scheduled for late 2015.[43]

39 See http://www.civildefence.govt.nz/assets/Uploads/publications/national-CDEM-strategy-2008.pdf
40 See http://www.civildefence.govt.nz/cdem-sector/cdem-framework/civil-defence-emergency-management-act-2002/#framework
41 See http://www.legislation.govt.nz/act/public/2002/0033/latest/whole.html#DLM150704
42 Each of the 16 CDEM group reports can be found at the bottom of the webpage at http://www.civildefence.govt.nz/cdem-sector/cdem-framework/cdem-groups/
43 See http://www.civildefence.govt.nz/assets/Uploads/publications/Final-MCDEM-BIM-2014.pdf

Figure 10: Illustration of the local CDEM groups and their associated councils
Source: Ministry of Civil Defence and Emergency Management, September 2013[44]



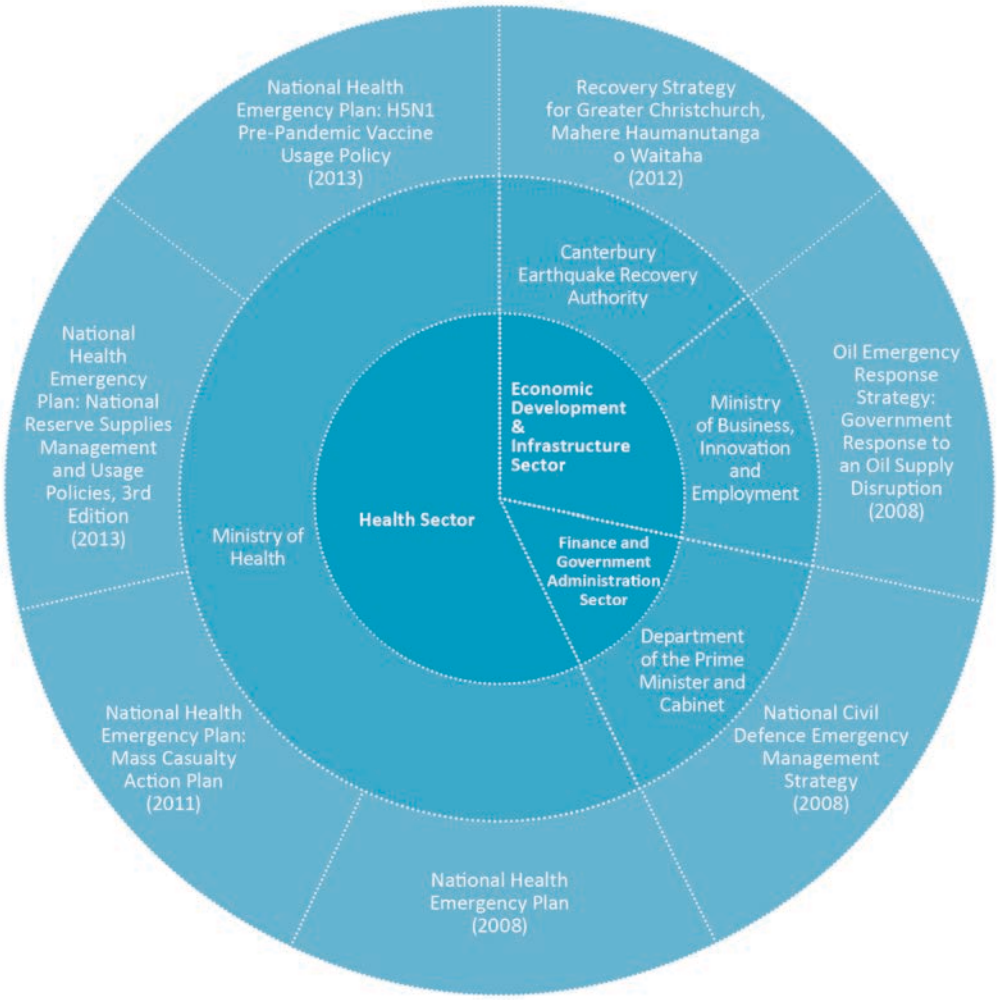
There are many strategies that together are meant to deliver New Zealand resilience, but it is difficult to assess the quality of the framework given the large number of strategies and plans, the small amount of information about how those strategies and plans work together with institutions to achieve the overarching goal (see appendices 3 and 4), and the lack of reports that rigorously review New Zealand's preparedness by independent parties. For example, the *CDEM Strategy* does not specify the other strategies or plans that it 'relies on' or 'connects to' when a disruptive event occurs.

Figure 11 (overleaf) outlines our tentative understanding of the relationships between institutions, strategies and plans, but it does not include biosecurity emergencies (which are led by the Ministry for Primary Industries [MPI]), as these documents were not found in the public domain; nor does it include counter-terrorism emergencies (which are led by the New Zealand Police), as the New Zealand Police is not a government department. In contrast, the Ministry of Health has placed its strategies and plans in the public domain and these are readily accessible and therefore included in Figure 11. Importantly, this figure aims to illustrate the important relationship between strategies and plans, rather than be a complete and comprehensive list.

44 See http://www.civildefence.govt.nz/assets/Uploads/cdem-groups-and-councils-september-2013.pdf

Figure 11: Government department strategies (GDSs) by department and by sector (tentative)

Source: McGuinness Institute, 2015[45]



Note: Only government departments were analysed for The GDS Index 2015. The term 'government departments' refers to the 29 'departments of the public service' currently listed in Schedule 1 of the State Sector Act 1988.46 Because of this, Figure 11 only contains strategies which were published by a government department and were in operation as at 30 June 2014. Core emergency strategies which are published by non-government departments (for example the New Zealand Police) have been excluded from this strategy wheel.

In 2014 the McGuinness Institute set out to identify and obtain copies of all government department strategy documents published in New Zealand from 1 July 1994 to 30 June 2014 through the Official Information Act 1982 (OIA requests). This resulted in 290 strategies; 136 of these were still in operation as at 30 June 2014.

45 The profile and a PDF copy of the strategy can be found at *Profiles* on *The GDS Index 2015* website at http://gdsindexnz.org/profiles
46 See *The Government Department Strategies Index 2015: Methodology* at http://gdsindexnz.org/methodology

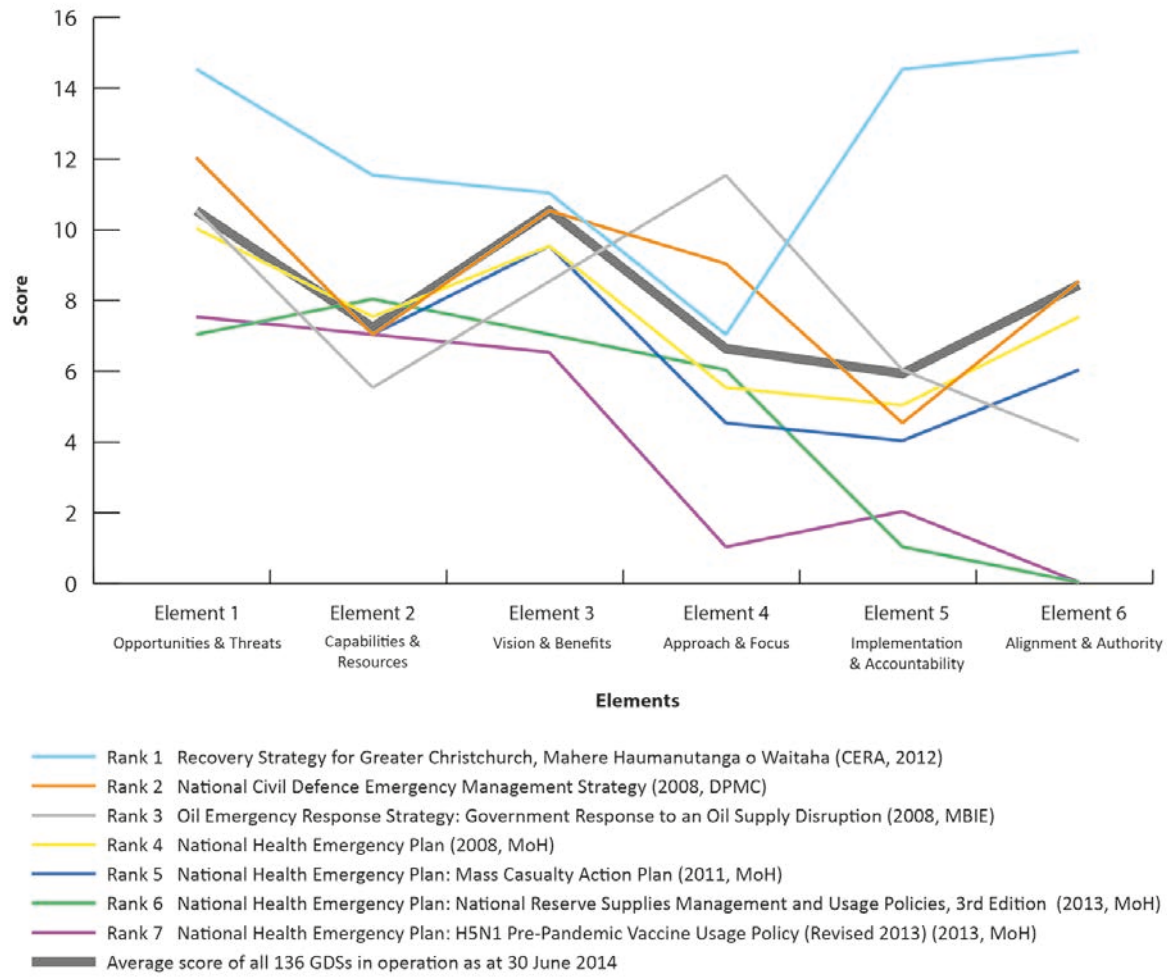
In 2015 further research was undertaken to assess each of the strategies in operation against six elements that were considered to make a good strategy document:

Element 1: opportunities and threats
Element 2: capabilities and resources
Element 3: vision and benefits
Element 4: approach and focus
Element 5: implementation and accountability
Element 6: alignment and authority.

From the 136 strategies in operation, seven relate specifically to emergency management. Figure 12 (overleaf) illustrates how the seven compare against the national average score for all 136 GDS documents. Appendix 3 features the radar chart scoring each strategy document against each of the six elements. Although four include the word 'plan' in the title, they were considered strategies as per the McGuinness Institute's definition (see Appendix 3).

Figure 12 shows that our emergency management strategy documents are consistently poor at reporting on the quality of the department's capabilities and resources (with the exception of CERA's), and that this in turn might explain why departments are poor at clarifying how the strategy will be implemented and by whom. Put simply, we may be good at identifying the problem/opportunity (Element 1) and preparing a vision (Element 3), but we are poor at reporting on our capabilities and resources (Element 2), the options/ways forward (Element 4), the means (Element 5) and, for some strategy documents, how the strategy aligns and secures a mandate for action (Element 6).

Figure 12: Emergency and response GDSs, scores by element
Source: McGuinness Institute, 2015[47]



To summarise, the CDEM 2002 legislation is logical and comprehensive; in particular, it recognises the importance of lifeline utilities (which are an important aspect of supply chain risk),[48] sets the context of risk management over time through recognising the 'four Rs' (reduction, readiness, response and recovery) and establishes an approach to engage local communities (see Appendix 3). As noted above, there are likely to be a large number of strategies and plans (some of which may not be in the public domain). Ensuring these key documents – such a strategies, plans and guides – are accessible, up-to-date, timely, comprehensive, accurate, meaningful and reviewable will be a challenge.

The framework is designed to be flexible and responsive to an emergency, so there is a risk that key documents are not given adequate attention. For example, with a lead agency approach there is not the impetus for institutions to work together on identifying emerging risks, assessing weaknesses and building capacity. Further, the approach is arguably designed to *respond* to short-term emergencies, rather than *reduction, readiness and recovery* (which is the focus of managing supply chain risk in an extended emergency).

47 The profile and a PDF copy of the strategy can be found at *Profiles* on *The GDS Index 2015* website at http://gdsindexnz.org/profiles
48 See http://www.legislation.govt.nz/act/public/2002/0033/latest/DLM150765.html?search=sw_096be8ed80d230d0_lifeline+utilities_25_se&p=1

Most importantly, there appears to be no public document that describes New Zealand's unique risk profile in detail[49] or, more specifically, explores and develops resilience in terms of New Zealand's supply chain risk. It was also unclear to what extent the lifeline utilities were aware of their responsibilities and had, as suggested in the 2002 legislation, prepared a plan for functioning during and after an emergency.

3.5 Relevant Information Systems

Section 1.3 highlights nine ways resilience can be built into a system. The first two, *probe* and *scan*, focus on information collection, and the fourth, *inform*, is about producing and communicating timely and accurate information. It is not immediately apparent how information for CDEM is gathered and communicated, other than through the 16 local CDEM groups.

To summarise, resilience is not a destination but a way of operating that needs continuous information, assessment and independent review. The collection of data and tacit knowledge, both in terms of international experience (such as the Ebola outbreak) and New Zealand's own local experiences, is paramount for building resilience. Local communities will be an important source of knowledge and innovative ideas on how the community would like to respond to the disruptive event. An in-depth analysis of the strengths and weaknesses of the current information system was beyond the purposes of this report; however, given the important role MCDEM plays in building resilience in New Zealand, an independent review of the current information requirements in terms of operations and capabilities is likely to bring benefits.

3.6 Observations

New Zealand is probably more prepared than most countries. However, making a country resilient is not easy, as it depends on matching the institutions, instruments and information systems against a country's unique risk profile. The list of observations below is not meant to be a comprehensive analysis or set of recommendations but rather an outline of observations for discussion and further consideration.

1. New Zealand needs to be prepared for two eventualities:

    - surviving in isolation as the rest of the world deals with a disruptive event (e.g. New Zealand rides out the storm); and
    - dealing with a disruptive event on our own (e.g. a global pandemic where New Zealand cannot rely on help from overseas).

49 This gap has been identified by Wise Response, which is a broad coalition of interested parties that are calling for Parliament to comprehensively assess imminent risks to New Zealand and to draw up plans to deal with them. See http://wiseresponse.org.nz

2. Emergency management requires a non-partisan approach:

- independent leadership is provided by a senior public servant who is in the public domain (e.g. the CDEM director);
- roles and responsibilities between Cabinet and the public servant are clear;
- public expectations are realistic and capabilities are well understood; and
- emergency funds are accessible and ideally under the control of the CDEM director.

3. A pandemic requires 'three chains' to be managed simultaneously:

- maintaining existing supply chains; while
- disrupting the chain of transmission; and
- putting in place a new supply chain for vaccines, medical equipment, staff, etc.

4. The strategy framework is relatively old (the document was published in 2008), and such a key document deserves regular updating. For example, it should be updated to include DPMC's and MPI's responsibilities (rather than DIA's and Biosecurity New Zealand's) and the role of the National Security Committee (NSC), which has succeeded the previous cabinet committee on Domestic and External Security (DES). Further, there are an increased number of risks that were not apparent in 2008, and revisiting the *CDEM Strategy* would provide a good opportunity to identify and explore these. Ideally the CDEM *Strategy* should be updated at the same time as the upcoming 2015 CDEM *Plan* and the CDEM *Guide*. Also the importance of the *Guide* in the public arena is not easily apparent; it is arguably the key 'how to' resource for anyone who wishes to understand how the system operates in practice. The framework would benefit from providing more clarity over the linkages and distinctions between the CDEM *Strategy*, the CDEM *Plan* and the CDEM *Guide*.

5. There appears a lack of detail as to how the policy documents work together, how often they are reviewed as a whole (bottom-down, top-down and sideways) and whether those reviews are undertaken by people outside of the process.

6. Other than through the 16 local CDEM groups, there was little clarity as to how non-government institutions can provide feedback on CDEM instruments.

7. There may be value in reviewing the strategy in terms of preparing for a long-term extended emergency, as the 2008 CDEM *Strategy* seems focused on the short-term emergency. See Lesson 9 in Section 2.

8. Our current legislative framework allows the director significant discretion to quickly implement action in the way that they feel is most appropriate to the situation. An emerging trend is for these key roles to have immediate access to significant funds, rather than requiring untimely procedural hurdles. New Zealand does have a CDEM

Resilience Fund; however, the size of this may be worth reconsidering.[50] The need for such a contingency fund to deal with increases in *surge capacity*, as experienced by WHO in the wake of its initial Ebola response, is an important insight. A 2011 WHO committee, after the 2009–2010 influenza pandemic, had recommended that the emergency fund should contain $100 million. Director-General Dr Margaret Chan recently told reporters that the figure was 'a good starting point'.[51] New Zealand may like to reconsider the size of our current fund.

9. In terms of lessons learned from the Ebola outbreak outlined in the previous section, there are six additional observations:

a) A clear distinction must be made between internal communications for risk notifications and the public warning notifications. The *Guide to the National CDEM Plan* states that there are different types of warning notifications used to advise agencies, authorities and the public of events. These warning notifications are issued in the form of national warning systems. They are intended to allow the public to prepare or act in a potential or actual emergency and are issued when hazards are imminent and a quick response is required.[52] This differs from internal communications for risk notifications, which are used to communicate potential risks and hazards within the lead agency responsible for the particular type of risk or emergency. For example, MoH has a 'Pandemic influenza alert status' with various codes (white, yellow, red and green). These codes are used to inform those within the health sector of the different stages of the health response to an influenza pandemic.[53] The Director of Public Health Dr Darren Hunt made a more specific announcement that it was not possible to quantify the Ebola risk exactly, 'but the MoH assessment is that the risk to New Zealand from Ebola remains very low'.[54] The *Briefing to the Incoming Minister of Civil Defence* noted there is 'a need for an enhanced, common emergency alerting capability that can be used by all agencies'.[55] The ability to effectively communicate risk is not just critically important for the public in general but also for those managing supply chain risks.

b) There was a concern New Zealand may not be good at bringing lessons from the past into the present. Are there other areas where New Zealand is infrastructurally weak? Who is responsible for this list, and how can businesses, non-government organisations and the wider public have assurance that the right decisions are being made?

50 See http://www.civildefence.govt.nz/cdem-sector/cdem-resilience-fund
51 See http://uk.mobile.reuters.com/article/idUKKBN0KY0KA20150125?irpc=932
52 See http://www.civildefence.govt.nz/assets/Uploads/publications/the-guide-v1.3-section-19-national-cdem-warning-june-2014.pdf
53 See http://www.health.govt.nz/our-work/emergency-management/pandemic-planning-and-response/pandemic-influenza-alert-status
54 See http://www.stuff.co.nz/national/10603196/New-Zealand-officials-ready-for-Ebola
55 See http://www.civildefence.govt.nz/assets/Uploads/publications/Final-MCDEM-BIM-2014.pdf

c) Testing for highly infectious diseases like Ebola requires a physical containment level 4 (PC4) laboratory. New Zealand is equipped with multiple PC3 laboratories; however, the closest PC4 is in Melbourne at the Victoria Infectious Disease Reference Laboratory. Blood samples sent there must be cleared by customs.[56] During the 2009 swine flu pandemic, samples had to be sent to this laboratory for testing, and this process can take up to 48 hours from blood samples being taken before results are known (this turnaround time is longer than in many Third World countries).[57] In light of this, it seems prudent for New Zealand to invest in our own PC4 laboratory.

d) In light of the reviews WHO is currently undertaking concerning their response to the Ebola outbreak (see the discussion in Section 2, Lesson 10), questions arise regarding New Zealand's balance between operations and technical guidance. Can we be sure that the right experts are being asked to provide advice, and is that advice being listened to? Have we the right balance between operations and technical guidance to meet the diverse range of potential disruptive events?

e) New Zealand has both an opportunity and a responsibility to support smaller nations in the Pacific region when disruptive events occur. It may be appropriate for New Zealand to lead or contribute to the development of a Pacific region strategy to deal with certain types of disruptive events where a lack of resources (e.g. medical services) and isolation are major risk factors.

f) Concerns have been well articulated in the *Ministry of Civil Defence & Emergency Management Business Plan: 1 July 2014–30 June 2015*, which is in effect the operational and capacity planning aspect of the strategy. The *MCDEM Business Plan* is a good example of a robust and transparent review process. It also highlights concerns that need to be addressed (see Appendix 5 for an excerpt of the plan's key risks and budget for the MCDEM). The plan was published in September 2014 and the nature, level and likelihood of the risks are a concern. The business of CDEM must have the necessary capability to pull together the committee to respond to a disruptive event. If the business capability does not exist in the CDEM team at DPMC, all the good intentions will not eventuate.

56 See http://www.nzherald.co.nz/nz/news/article.cfm?c_id=1&objectid=11416969
57 See http://www.who.int/medicines/ebola-treatment/emp_ebola_diagnostics/en/

10. New Zealand's legislation is logical and comprehensive (see Appendix 4), but the definitions contained in the CDEM Act 2002 may not cater for a system-centric approach to risk management (as discussed in Section 1). In law, *risk* means the likelihood and consequences of a hazard and *hazard* means something that may cause, or contribute substantially to the cause of, an emergency. Supply chain risk is not necessarily a hazard, but it is definitely a risk.

11. There is no annual report on how this wider sector operates. This might be an ideal instrument to communicate risk management in New Zealand. It could include a list of risks that have occurred over the last 12 months, outlining what actions were taken and what lessons were learned. An annual public report on progress towards a 'resilient New Zealand' may increase public engagement and deliver better long-term outcomes than the existing reporting system. Currently, the minister of civil defence is required to report on the *CDEM Strategy*'s progress to Cabinet every three years. The last review was in 2013 and was relatively light. Given Cabinet's key role in an emergency, it seems a more rigorous analysis is warranted. How much progress has been made towards the 'resilient New Zealand' vision is an important question that must be answered in the review and the subsequent report to Cabinet. Given the increased complexity and risks in the world, it seems prudent to also review the four goals set within the strategy to ensure they are still appropriate.

12. As a general high-level observation, there exists a natural tension between government *empowering* its citizens through decentralising powers and responsibilities to local communities and *abandoning* them to fend for themselves. As discussed, against the background of the Ebola outbreak in the previous section, ensuring institutional roles and responsibilities are clear in times of stress is a difficult and challenging task; it is clearly one of balance. This raises the question as to whether we have struck the right balance in New Zealand.

13. It is unclear what a 'resilient New Zealand' would look and feel like. Further, it was unclear to what extent trade-offs have been made in developing this vision. For example, if New Zealand invested more time and energy into this area, what additional level of resilience would be provided? This raises a number of questions; for example, would citizens/businesses be happy to pay a little more to have more resilience? A more comprehensive list of questions is contained in the executive summary of this report.

Following this overview, Section 4 looks more specifically at how New Zealand might anticipate supply chain events.

4.0 How Do We Anticipate a Supply Chain Event?

I had one case of a lawyer contacting me to ask whether he could land a helicopter on top of one of the city's broken buildings so he could sneak in and recover a computer server. I said no, but that's how desperate people were.

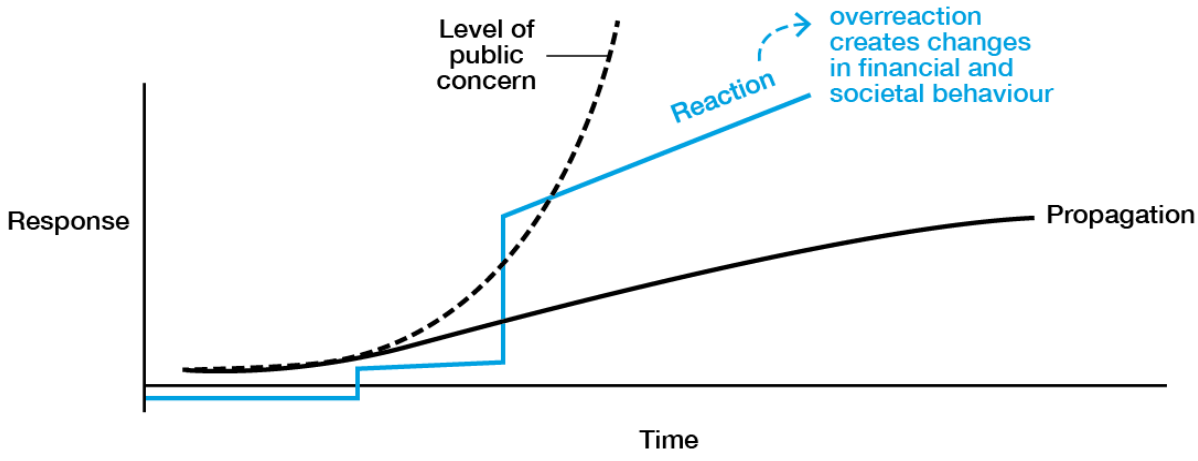
Peter Townsend, CEO of the Canterbury Employers' Chamber of Commerce[58]

4.1 Setting the Context

One of the difficulties in building a resilient supply chain rests on the fact that disruptive events are often tough to imagine – let alone anticipate.

Each kind of event risk has its own characteristics, and each event is unique. Our decision to focus on Ebola provides the benefit of a specific and current example. The analysis approach used for Ebola will not necessarily be applicable to all events. Epidemics evolve over time like wars and financial crises. In contrast, floods and earthquakes usually start suddenly. As a starting point it is useful to understand the processes that may be triggered by an event, as illustrated in Figure 13.

Figure 13: Impact of behaviour in response to an event



The figure illustrates how a delayed response can lead to a vigorous reaction as an epidemic grows and creates concern. The black line illustrates the natural journey of the disruption in terms of what one would expect (the propagation), the dotted black line shows changes in public concern and the solid blue line conveys the strength of the actual response. The response may have adverse effects, because it may be more than what is required to protect against the epidemic, due to the need to reassure the public, or because it may include unhelpful actions taken by government, businesses or the public.

58 See http://www.nzherald.co.nz/business/news/article.cfm?c_id=3&objectid=10793995

4.2 Exploring Possible Events in Terms of Level-one, Level-two and Level-three Effects

Risk management requires anticipation of possible situations and development of responses to increase resilience. It is difficult to imagine how an Ebola outbreak might affect New Zealand without thinking through how the event might play out and what the second-level and third-level effects might be.

For the purposes of this paper, level-one effects include all those that directly relate to either a patient with Ebola or a person potentially at risk of contracting Ebola. Examples include effects on medicines, vaccines, body bags, nursing staff and building hospitals.

Level-two effects relate to effects that are generated as a direct response to a level-one effect and tend to be micro in nature. Examples include effects on border control, food supply, other sick people (i.e. normal hospital operations) and managing fear.

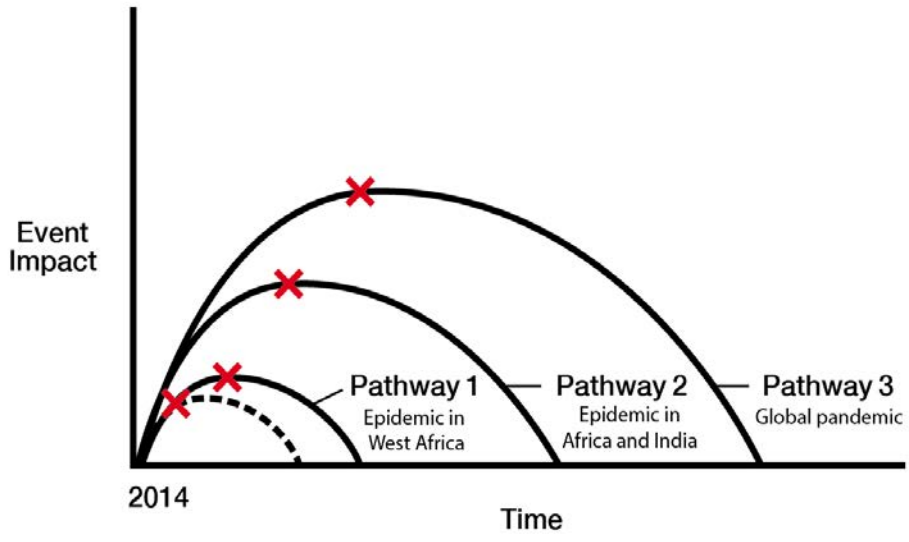
Level-three effects are in response to second-level effects and tend to be more macro in nature. Examples include effects on farmers, imports and exports, insurance and financial transactions, and also unexpected supply chain interruptions.

4.3 Using Scenarios to Understand Possible Effects Over Time

Figure 14 below shows three possible pathways for the current Ebola outbreak, corresponding to different forms that the epidemic might take.

Figure 14: Possible pathways

Note: The red crosses refer to specific scenarios that are referenced in Appendix 2.



In the first pathway, Ebola is contained within West Africa. It continues to grow into early 2015 and then is controlled and declines. There are few direct or indirect effects on New Zealand.

The second pathway has Ebola becoming a pandemic, spreading more widely in Africa and India, and then being contained. The epidemic lasts much longer and has more second-level and third-level effects. These effects have impacts on New Zealand.

The third pathway is a global pandemic that has a direct impact on New Zealand. In this pathway New Zealand has to manage the direct consequences of the disease as well as the second-level and third-level effects.

The actual likelihoods of these pathways are not our primary concern; instead the focus is on how the pathways might lead to consequences that should be anticipated by risk managers.

One approach to highlight effects is to imagine one pathway at one point in time and describe the effects at that time. The three pathways, shown in Figure 14, are described in more detail in Appendix 2. Scenarios do not reflect the probability an event might happen, but rather they explore the magnitude of what might happen if one or a set of events occur.

Scenarios are also valuable tools to start conversations that imagine what might be possible and to explore possible responses. This is explored further in Section 5.2 in regard to the Christchurch earthquakes.

The probability of the second-level and third-level effects seems very small, but they are included to provide insight into how a pandemic may impact New Zealand in the future. Hence, the purpose of these descriptions is to provide a context for imagining the resulting second-level and third-level effects which might in turn affect New Zealand. See Appendix 2 for the scenarios and a list of key observations.

4.4 Exploring Second-level and Third-level Effects

The anticipation of effects on New Zealand depends on understanding how the Ebola situation might unfold as well as the impacts of a pandemic and the requirements for a response. To illustrate the thinking process, the Pathway 2 example is used.

Pathway 2 would arise if the Ebola epidemic became established in several countries beyond West Africa – for example, in India and China. Efforts to contain the epidemic would continue, preventing wider transmission, but travel might be made more difficult by quarantines designed to prevent further spread. Quarantines might be introduced in part to respond to public concerns and also because medical response teams would be stretched in areas where outbreaks had occurred.

Despite high mortality from Ebola, only a small minority of regions with the epidemic are being directly affected by Ebola. However, many more people are affected by the responses to the Ebola outbreak. In the three most affected countries, economic growth would decline sharply due to deferred investment, reduced revenues and higher expenses.

The behavioural response to Ebola has effects via several mechanisms. For example, in the countries directly affected, many farmers in rural areas abandoned their farms, fleeing in fear of the disease. Fluctuating food prices in response to local shortages disrupt regional trade, causing price spikes and exacerbating the effects of the food shortages on local populations.

More-widespread outbreaks would create more fear. For example, during the SARS outbreak trans-Pacific air travel in some areas dropped by around 40 per cent temporarily as people changed their priorities to avoid exposure to risk.[59] Travel and tourism businesses would be hard hit, but the pattern would be driven by both the geography of the pandemic and the actual response of people to the outbreak. Their reaction will be affected by the level of preparedness and the effectiveness of responses by governments.

In developed countries the analogue of people fleeing their farms might be abandoning their homes and jobs to relocate away from disease risk or to secure resources for their families. The consequences could be local interruptions of critical infrastructure as key staff fail to turn up and production shortfalls.

Production shortfalls might have widespread effects because of the large number of components in many international supply chains. Modern technological equipment relies on materials sourced from a wide range of countries, delivered via supply chains that are optimised for efficiency in order to be cost-competitive. These characteristics make supply chains vulnerable to interruption if availability of components is affected by an event.

Supply chain vulnerabilities were highlighted in 2011 by the Thai floods and Fukushima earthquake when interruption of availability caused ripple effects in supply chains that lasted for several months. This is explored in the subsequent section of this report.

Sources of potential interruption are not always well understood. For example, New Zealand's agricultural industry is dependent on supplies of rock phosphate from Morocco. Without phosphate, agricultural productivity would be much lower than it is today, which has obvious economic consequences. Morocco is the world's third-largest producer of phosphate and by far the world's largest phosphate exporter. The two largest producers are China and the USA, and neither of these countries exports its product.[60]

59 See http://hbr.org/2006/05/preparing-for-a-pandemic-2
60 See http://www.resourceinvestor.com/2011/06/03/feeding-the-worlds-hunger-for-phosphorus

Morocco is not far north of West Africa, and there are important migration paths from West Africa through Morocco. Early in the Ebola outbreak the country moved to restrict travel for a regional sports event, consistent with Ebola risk reduction strategies to limit concentrations of large numbers of people.

Similarly, New Zealand uses hybrid cereal seeds sourced internationally, and without those seeds cereal production would reduce. Although farmers in New Zealand could produce seeds, crops grown from those seeds would not breed 'true', therefore significantly reducing the quality of production.[61]

Shocks to the New Zealand economy – from declines in market demand, interruption or restriction of trade and travel flows, and lack of supply – could combine with financial shocks from international markets to have serious effects on the New Zealand economy and potentially on the availability of vital imported resources. See Appendix 7 for basic trade statistics over time.

In the past, when economies were less integrated, supply chain interruptions had smaller and more local effects than they could have in today's highly complex and integrated economies. Even a few decades ago, many households had vegetable gardens, and fabrication facilities were smaller and more local. The combination of high economic interdependence, lack of local production of important goods and lack of self-sufficiency skills makes modern societies more vulnerable to event risks.

There is an argument that, alongside increased vulnerability, event risk itself is increasing. Climate change is shifting global weather patterns, and global warming is expected to increase vulnerability to existing and novel pathogens. Social and political unrest along with financial vulnerabilities and shocks are additional sources of potential event risks.

Prevention of serious events, such as via a robust international response to the Ebola outbreak, can reduce the risk of serious disruption, but New Zealand should not rely only on prevention. It would be prudent to also take steps to increase supply chain resilience to reduce vulnerability.

61 See http://www.i-sis.org.uk/hybridSeed.php

5.0 How Do We Manage Supply Chain Risks

In so many of the stories we've explored about resilience, we see a great confluence of factors coming together – the right systems and structures, the right technologies and information, the right kinds of community empowerment, and the right values and habits of mind.

Andrew Zolli and Ann Marie Healy,
Authors of *Resilience: Why things bounce back* (2012: 275)

5.1 Setting the Context

The world is very connected, and trying to understand how to manage supply chain risk is perhaps best understood in terms of exploring what supply chain failure looks and feels like.

The flooding in Thailand in 2011 provides an illustration of why organisations should start to think more broadly about their supply chains. Many global manufacturers had specialised plants operating in Thailand. Some of these factories manufactured critical parts for finished goods that were assembled elsewhere.

While some companies had built resilience into their facilities, they could not control the resilience of their suppliers. As a result, when flooding occurred, some organisations were in the predicament that, while their own facilities were largely operational, their suppliers were closed down. This meant that global production halted, as there were no alternatives that could quickly be substituted.

Figure 15: Impacts on the supply chain of the 2011 Thai floods

(Further details about the Thailand example can be read in Haraguchi and Lall's paper, 'Flood Risk and Impacts: A case study of Thailand's floods in 2011 and research questions for supply chain decision making', in the International Journal of Disaster Risk Reduction, Oct 2014.)

Following on a similar theme, it is worth considering the electricity grid in the USA and its implications for international trade. In March 2014 the *Wall Street Journal* cited a report by the federal agency Federal Energy Regulatory Commission (FERC) that stated that although the USA has 55,000 substations, if nine of them fail or are knocked out, the entire USA would lose power for weeks.

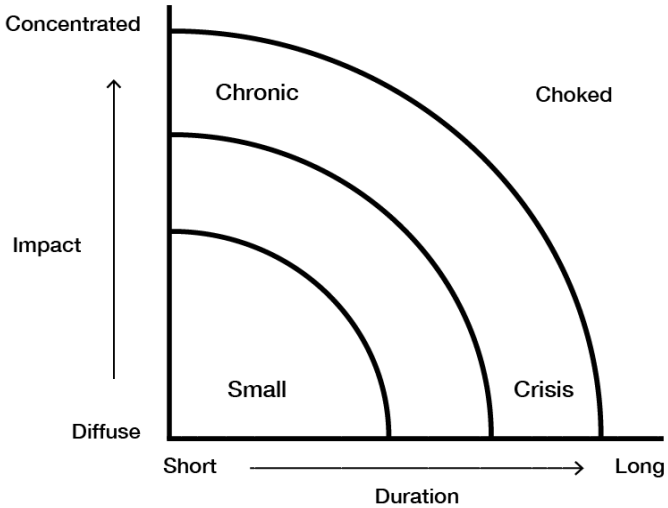
Such a failure would have massive implications for world trade, as many cloud computing servers would fail, and even offshore redundancy for the servers themselves would not mitigate widespread chaos, as staff based in the USA would have no means of communicating with offshore facilities. The increasing use of cloud computing services would mean that any organisations – no matter where they were located – that relied on a cloud-based service (e.g. Amazon file services) would likely suffer significant disruption for a number of weeks.

Figure 16: Hypothetical example of the impact of disruption of the USA power grid

Figure 17 offers a typology of event-driven supply chain risk. If the event is concentrated in its impact, it may prevent production, for example lack of availability of a critical input or infrastructure. If the interruption is for a short period, there will be an acute production crisis that will soon be resolved when supply is resumed. If the interruption is for a long time, the supply interruption will become much more serious, especially if the product is essential or important.

If the interruption is diffused, i.e. affecting a variety of inputs, a short interruption is likely to cause only short-term effects, and those effects are likely to be widespread within the industry and economy. Therefore, competitive consequences are likely to be small. However, long-term diffuse supply interruptions are likely to be costly to manage and will have a negative effect on economic efficiency and growth.

Figure 17: The relationship between the impact of a disruption and its duration



5.2 New Zealand Example: Preparing for Event Risk – A Case Study From the Canterbury DHB

In 2007 the then CEO of the Canterbury District Health Board (DHB) commissioned a piece of work to examine how the health system might function in 2020 and how the organisation would adapt to changing conditions. The work had many facets, but one of these involved the development of scenarios that envisaged a different picture of the health system. The scenarios held that the health system in Canterbury faced pressure on three fronts:

1. Increased demand on services from an ageing population.
2. Decreased workforce (from an ageing population).
3. Decreased infrastructure (from a cash-constrained government).

In 2011 the conditions that underpinned these scenarios were brought to life in less than 60 seconds from an unexpectedly destructive force: an earthquake. Almost immediately all three of the above conditions were experienced as people left the city (decreasing the workforce), demand for services changed and infrastructure was compromised.

However, the health system did not fail under the stress but coped well in the circumstances. This is because the scenarios had established conversations within the Canterbury health system about how services would function given the three constraints above. This level of preparation was reflected in the response to the earthquake. For example, the Canterbury DHB had a better success rate meeting its elective surgery target in March 2011 (just weeks after the earthquake) than other DHBs around the country.

Although the scenarios were prepared with gradual, long-term changes in mind and never anticipated an earthquake, they started conversations and triggered actions that better prepared people for the unexpected. This is the value of scenario thinking.

5.3 Anticipating Supply Chain Risks in New Zealand Today

To gain a better understanding of the specific supply risks that might face New Zealand businesses, we conducted interviews with a select group of leading companies and examined New Zealand trade statistics. The interviews were designed to identify some critical inputs that might be threatened and to understand how well prepared some leading companies are to respond to event risk that might threaten supply. The trade statistics analysis in Appendix 7 provides a mechanism to review New Zealand's imports and imagine how supply disruption might impact the country and its businesses.

The aim of this process was to survey a handful of organisations that relied on international supply chains for either export or import. The selected organisations are viewed as leaders in their respective markets and were chosen to represent a cross-section of New Zealand industries. The organisations included Air New Zealand Limited, Skope Industries Limited,

Fonterra Co-operative Group Limited, Vector Limited, Z Energy Limited and Foodstuffs (NZ) Limited.

These organisations provided insights to their supply chains and risk management response plans. Some of the material that was shared was commercially sensitive, and with this in mind the information provided was summarised to highlight the important themes that emerged. Also included are relevant points that could be applied to any organisation.

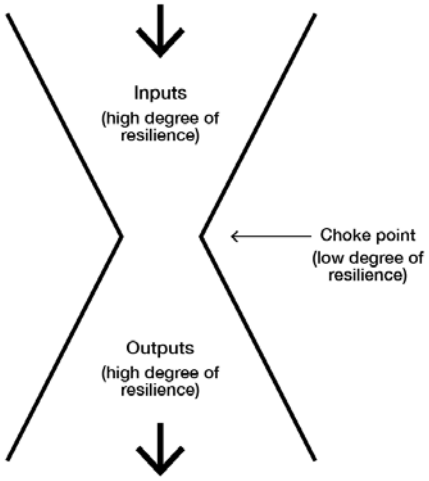
1. **Councils play a critical role in providing key products and services.**
   While organisations can develop a degree of resilience by understanding their supply chains, there is generally little they can do to guarantee the availability of water, fuel and electricity. These generally fall under the remit of central government, as they are seen as essential not just to commerce but also to the fabric of society.

   However, the essential nature of these supplies means that there is also a high degree of resilience embedded into the supply chain. For example, in the current geopolitical climate the supply chain for oil (and associated products) is robust both locally and globally. However, it is impossible to guarantee the continued functioning of any supply chain and, in this regard, one expert noted that the oil industry is now reliant on 'things going well' and has underinvested in storage**.**

2. **Disrupted shipping routes and timing have a large impact.**
   Both importers and exporters rely on international shipping, and any disruption to this industry would create havoc for New Zealand. For example, a pandemic could dramatically slow down international shipping, perhaps by requiring quarantine periods for crews in overseas ports. An example of this was provided by one of the businesses interviewed. The organisation had a cargo destined for a port in West Africa in late 2014, and ships with this type of cargo usually enter and leave port within three days. The Ebola outbreak meant that this ship was placed in quarantine resulting in a turnaround time of three weeks. If this were to happen for an entire region, the flow-on effects would have a significant impact on the ability to ship goods to and from New Zealand, as the global shipping industry would be thrown into scheduling chaos.

3. **A small number of choke points exist within most large organisations, but a large number of choke points are likely to exist in most small organisations.**
   One of the themes that emerged for several organisations is that internal 'choke points' are likely to be prime sources of disruption. To illustrate, while an organisation can cross-train staff, it is problematic to implement this with highly specialised roles. The result is that an organisation can become reliant on a handful of staff to carry out extremely technical jobs, and if these people were absent the entire business would halt.

Figure 18: Choke points



4. **Reviewing supply chain resilience regularly is good practice.**
It is good practice to view the understanding of the supply chain as a strategic advantage. One organisation had taken this view at an executive team level recently, and over the last year it had not only looked at its supply chains but also the supply chains of its suppliers.

5. **Creating a learning culture improves agility over the long term.**
Businesses should also run regular disaster recovery exercises and learn from recent examples such as the Christchurch earthquakes. Reportedly, in the food industry it is standard practice to have alternative suppliers ready to substitute ingredients at short notice, but this level of readiness was not observed in some of the non-food organisations interviewed.

   Organisations that have agility built into their business response plans are better able to take advantage of changing conditions for better or worse. Examples would include changing a product specification if a critical component cannot be sourced.

6. **Resilience is expensive in the short term but cheap in the long term.**
Supply chain optimisation is almost diametrically opposed to increasing resilience; the more efficient a supply chain becomes, the more likely it becomes that a single disruption will shut down the entire chain. For example, increasing centralisation optimises a supply chain in one aspect while at the same time decreases the ability to respond to event risk. This is because centralisation removes alternative options, favouring a focus on efficiency.

Note that the interviews for this research were carried out with organisations that are considered to be some of the best performers in their sectors. It is expected that the level of supply chain expertise and risk management would be lower when dealing with second- and third-tier organisations and small businesses.

This has significant implications in a small economy like New Zealand's, where only one per cent of our enterprises employ more than 50 people.[62] In these small companies the quality of risk management is likely to be low when compared to the organisations interviewed for this research.

5.4 Lessons Learned

1. Supply chain risks exist in New Zealand, and there is low awareness of the risks in some places (but recognised when alerted).

2. Some firms with systemic responses in place have vulnerabilities due to gaps in anticipation of risks.

3. Dependence on international infrastructure exists.

4. Concentrated skills risk exists.

5. Events may have unique characteristics that determine level-one risks, but there are many shared level-two and level-three risks.

62 See http://www.med.govt.nz/business/business-growth-internationalisation/pdf-docs-library/small-and-medium-sized-enterprises/2013-stats-factsheet.pdf

6.0 Conclusions and Recommendations

Nature's laws do not change very much. So long as the store of human knowledge continues to expand, we will slowly come to a better understanding of nature's signals, if never all its secrets.

Nate Silver, author of *The Signal and the Noise: The art and science of prediction* (2012: 447)

6.1 Three Major Recommendations

Overall we found a relatively low level of awareness and preparedness for supply chain impacts of event risks. There was widespread awareness of Ebola and the potential medical risks, along with recognition that there could be level-two and level-three effects but not much systematic effort yet to increase resilience.

When we highlighted the risks for responsible agencies or for businesses, there was recognition of the value of better preparedness but relatively little understanding of what could be done to reduce risk, alongside a sense that many of the risks could only be reduced via actions by others.

Even where supply chain risk preparations were in place, there was a concentration on supplier risk with less emphasis on ensuring ongoing availability of critical infrastructure and essential scarce skills.

A major event could have diffuse and chronic effects on New Zealand businesses, with many impacts from forces outside the control of the businesses. One response might be to conclude that there is nothing that could be done to reduce the impacts of such events. An alternative and better response would be to conclude that the impacts could be reduced, but that would require a coordinated response which might involve central and local governments as well as businesses here in New Zealand and overseas.

What has become clear is that there are many potential sources of event risk and it would not be possible to anticipate accurately what consequences for New Zealand would follow from each possible global-scale event. However, it is possible to understand the kinds of consequences that could affect New Zealand and develop protection against the most likely high-damage risks.

Our major recommendations are as follows:

1. There needs to be a conscious effort to:

    a) obtain tacit knowledge about New Zealand's supply chain risks;
    b) increase awareness and resilience management capabilities;
    c) make all trigger points transparent;
    d) make the crisis management framework less complicated from the outside looking in;
    e) draw a distinction between strategies, plans and guides;
    f) draw a distinction between preparation and response; and
    g) increase connectedness between central government, local government, businesses and community groups.

2. We need to find more effective instruments/tools to monitor and benchmark progress over time:

    a) An annual report on emergency risk events outlining what events happened over the previous 12 months, describing New Zealand's response to each event and any lessons learned, could be a cost-effective instrument.

    b) A supply chain risk matrix that benchmarks risks is a tool that might help identify priorities and develop action points (see Appendix 8).

3. Map and review existing strategies, preparation plans and response plans (for both central and local government). They need to be mapped in order to determine where documents may overlap (and cause confusion) or where gaps exist. The map then needs to be designed to illustrate how they all fit together so that when a disruptive event occurs, roles and responsibilities are clear to not only officials but also ministers and the general public. The content of these documents then needs to be reviewed to ensure they have the ability to respond to:

    a) a greater variety of events – for example, airborne epidemics that move quickly but usually are less deadly;

    b) long-term extended emergencies; and

    c) events that have effects beyond the immediate medical effects – for example, second-level impacts from an outbreak outside of New Zealand.

In addition, we have identified specific recommendations for central government, local government and businesses and other non-government organisations.

6.2 Recommendations for Central Government

Central government is responsible for large-scale event risk management in New Zealand. A case could be made that event risks are increasing and event risk could have serious effects on New Zealand. A false sense of security, hubris and lack of preparedness could combine to make the country more vulnerable than is necessary.

The New Zealand Government takes event risk seriously. The Ministry of Civil Defence and Emergency Management has developed a strategy with four goals that are consistent with the implications of our findings. These goals are:

- to increase community awareness, understanding, preparedness and participation in civil defence emergency management;
- to reduce the risks from hazards to New Zealand;
- to enhance New Zealand's capability to manage civil defence emergencies; and
- to enhance New Zealand's capability to recover from civil defence emergencies.

Reviewing central government's preparedness has not been the primary focus of our research. Instead we have tried to learn lessons from the Ebola outbreak and apply those lessons to the New Zealand context, in particular the nature of supply chain risk. Hence our recommendations for central government do not rely on evidence or assertions about gaps in current preparedness. Rather, they are offered as good practice suggestions for testing current preparedness and contributing to thinking about how New Zealand might become more resilient.

Recommendation 1
Ensure accountability for overall event risk management – including supply chain resiliency and taking account of level-two and level-three effects – is assigned to a single agency or role within government. The responsible agency or role should have access to the authority and resources needed to undertake event risk reduction actions.

Event risk management should not be delegated to a committee. A committee may be a valuable mechanism for understanding event risk and providing advice about how it should be managed, but it cannot easily take action or be held accountable.

Recommendation 2
Develop wider and deeper understanding of event risk for New Zealand.

When we began this project, we found that we had little understanding of supply chain risk and management options, but our understanding developed rapidly as the work progressed. We found that supply chain risk could arise in numerous ways but that there is some commonality among the vulnerabilities, partly because there are a few critical supplies, infrastructures and skills that New Zealand depends on. Food, energy and communications are likely to be among the most important inputs.

Understanding our export and import interdependencies (see Appendix 7) will be one way to obtain tacit knowledge about New Zealand's supply chain risks.

Large-scale damaging events are likely to have effects where one outcome causes another outcome, creating a 'cascade' of effects.

Recommendation 3
Develop competence in event risk mitigation and responses.

Knowing about event risk is not sufficient in itself. It is also important to understand how resilience could be increased by preparations to reduce risks or to increase response effectiveness. However, national-scale event risk management competence is an emerging field. Further, New Zealand's isolation and small scale imply that risk management should be customised to match our special circumstances.

Understanding how other countries are developing event risk management can provide one source of information. Lessons from responses in other circumstances and in other times are likely to be relevant too. For example, plague management during the Middle Ages and responses to the Spanish Flu between 1918 and 1921 provide relevant lessons.

Recommendation 4
Define New Zealand's unique risk profile, event risk appetite and risk management criteria.

Ignoring event risk would be unwise and irresponsible. However, eliminating event risk would be unaffordable and impractical. Any resilience-increasing actions would be taken over time while taking account of the practicalities and costs. That implies a search for the optimal policies. One important goal for government is to ensure a healthy economy. Government has constrained fiscal resources and many competing demands for effort and funds. In normal economic management, that would imply identifying a range of resilience-increasing options that would compete with other spending options based on a benefit–cost ranking. This general approach is known as expected value (EV) maximisation. EV calculations are based on the product of the probability of the event and the cost of the event.

However, when catastrophic outcomes are possible, risk management options are not normally assessed using ordinary EV criteria. The point is well-illustrated by life insurance, where rational citizens make negative EV investments in policies because they are willing to pay more than the EV would imply to remove the risk of an unacceptable outcome.
The decision rule used where catastrophic outcomes are possible is known as 'minimax', which is an abbreviation of 'minimise the maximum loss'. Government's decision processes should recognise that there may be value for New Zealand in paying more than the EV to avoid even a low probability of some avoidable, unacceptable risks.

An additional complication when quantifying resilience-increasing options is quantification of costs. From a government perspective, the fiscal cost may be relatively straightforward to estimate. However, many costs of government-mandated resilience-increasing investments are likely to be borne by businesses, local governments or civil society. These investments may provide private and externality benefits as well as costs, further complicating the task of deciding what to do.

Despite these difficulties, the responsible agency should form a view about what actions should be taken within New Zealand to increase resilience.

Recommendation 5
Rebrand New Zealand's *National Civil Defence Emergency Management Strategy* as *New Zealand's Resilience Strategy* and review annually.

The vision of the *National Civil Defence Emergency Management Strategy* is a resilient New Zealand; see Appendix 3 for more detail. The strategy was revised in 2008 and is unlikely to be revised again until the end of 2018. It is envisaged that it will be published alongside its progress report, incorporating lessons from the Christchurch earthquakes. It was last reviewed in 2013.

It is in effect a resilience strategy for New Zealand. Although this report does not review the current strategy in detail, it does highlight areas for consideration:

- Emergency powers should be clear and concise, outlining who does what and when. Outlining trigger points is critical.

- Businesses need to understand preparations being undertaken by government and the probable responses, ensuring there is some degree of certainty in times of stress. Businesses need to have confidence that essential and important support functions will continue, for example, water, power and petrol. See core infrastructure in Figure 1 in Section 1.

- Supply chain risk is a level-two risk. It is a system risk that can only be understood in terms of the system that exists at a particular point in time. Hence, ongoing monitoring of the system is critical. This type of risk does not easily fit within the Civil Defence Emergency Act 2002.

- The strategy should be focused on both short-term and long-term extended emergency events. Event risk thinking should be connected with broader risk-management efforts focused on longer-term, structural risks.

- Central government must be accountable for resilience management overall, but many of the actions required to increase resilience must be taken by other parties. Those actions might be taken voluntarily by organisations that are willing and able to manage their own risks. Alternatively, those actions may be taken because central government requires them by regulation or funds them directly or indirectly.

- A pandemic or other event might require government to exercise emergency powers, including redirecting supply chains, implying interference with normal property rights and individual freedoms. Central government should consider not only the legislative cover for these kinds of intervention but also how they would be effected in practice. That might imply some joint preparedness work with local governments and potentially also with some non-government organisations and businesses.

- The cost of resilience-increasing investments may be reduced by developing the resilience-management competence of others and by encouraging them to manage their own risks.

- Government might also encourage resilience by influencing other influential organisations. For example, the Institute of Directors in New Zealand might encourage its members to lift efforts to increase resilience, and securities regulations could be more specific in requiring inclusion of resilience efforts in reporting requirements.

New Zealand is a small country without high direct leverage internationally. Therefore, if global supply chains are interrupted, New Zealand might find itself well down the queue of customers clamouring for critical supplies. *Force majeure* interventions by other governments could overrule apparently robust commercial contracts. Therefore, trade policy should include dialogue about privileged supply of critical inputs as well as market access.

In the absence of availability assurance, New Zealand should consider the option of self-sufficiency for some critical inputs. New Zealand already has regulations that require banks to be able to operate critical systems independently from overseas infrastructure. We are also very dependent on software functionality delivered via the Internet, which is in turn dependent on the USA power grid.

It has recently been revealed that at least two countries have the ability to bring down the USA power grid in the event of cyberwar, and the Internet might be interrupted by a ‘space weather’ event. The strategy should consider what steps should be taken to reduce New Zealand’s vulnerability to these kinds of risks.

It is important to ensure that the strategy ensures that resources required to manage an event are available when they are needed. Global pandemic planning included recognition of the need to have financial resources ready for an event. When the Ebola event unfolded, it turned out that the financial resources specified in WHO's planning were not actually available and could not be secured rapidly. In response:

Dr Chan said that although disease outbreaks would continue to deliver shocks, "never again should the world be caught by surprise, unprepared". The reforms announced included a "dedicated contingency fund to support rapid responses to outbreaks and emergencies".[63]

Central government should ensure that businesses understand the value of preparation. The greater the preparedness of businesses, the more effectively events will be managed, and the more businesses are prepared, the less governments will need to do.

Recommendation 6
Promote resilience understanding and competence within relevant organisations in New Zealand.

Resilience depends partly on risk reduction and partly on responding effectively should an event occur. Both would be improved by having appropriate connections and communications between government and other organisations within New Zealand, including local government authorities. Appendix 3 (b) and (c) outlines key documents that should be reviewed to ensure they are up to date with current best practice.

Recommendation 7
Develop relevant connections and dialogue with other organisations in New Zealand and overseas.

The Rockefeller Foundation has developed a programme to create one hundred resilient cities around the world, and Wellington and Christchurch are now in the programme. The size of New Zealand, plus the inclusion of two of our biggest cities, could provide the basis for an interesting conversation with the Rockefeller Foundation to explore the potential for creating a programme to explore how to create a resilient country.

Recommendation 8
Central government should ensure it has the competencies, capabilities and processes to ensure resilience within its own operations.

Capability and resource planning is relatively easy, but plans are not sufficient by themselves. Therefore, resilience-increasing progress should be monitored and reported on to ensure that plans are capable of being converted into actions. Where the stakes are high, it is good practice to have reviewers who are independent of the accountable agency.

63 See http://www.bbc.com/news/health-30974649

Recommendation 9
Establish an independent resilience monitoring and reporting process.

There is a possibility that New Zealand may not have a comprehensive framework in place for collecting data and information on emerging risks or the capability to benchmark, measure, report and review progress towards creating a resilient New Zealand.

Recommendation 10
Work harder at making the framework less complicated when looking from the outside in.

Complicated systems are the enemy of good governance. Section 3 – 'Looking from the outside in: how prepared is New Zealand?' – was difficult to write based on the information available in the public arena. The authors needed considerable assistance to gain a basic understanding of how the governance system worked in practice. There are still areas we do not fully understand, for example how the lifeline utilities work in practice, what organisations are included in the list (in addition to the list in Schedule 1, Part A; see Appendix 4), and whether their plans are up-to-date and have been independently reviewed.

We also do not fully understand how the 16 local CDEM group plans work alongside the LTCCPs (the long-term council community plans). To illustrate how complicated the system is at a local level, there are 20 district health boards, 16 local CDEM groups, 16 regions (these do not match the local CDEM groups exactly[64] and are comprised of 11 regional councils and 5 unitary councils[65]), 12 city councils, and 54 district/local councils (including the Chatham Islands) – all with a role in crisis management. [66]

There are a number of ways to make the framework less complicated but still retain the flexibility to manage complex situations. What follows is a broad list of suggestions to explore how the current framework might be made less complicated. These are considerations rather than specific recommendations, as they would require further research to determine if there is a problem, whether these examples would be cost effective and whether better alternative solutions might exist:

- **Streamline the system (remove unnecessary components in the system).**
  For example, would it be more effective and timely if district health boards, local CDEM groups, regional boundaries and regional councils all shared the same boundaries? Should CDEM plans form part of LTCCPs?

64 The 16 local CDEM groups include the Chatham Islands and combine Nelson and Tasman, but the 16 regions exclude the Chatham Islands and treat Nelson and Tasman separately.
65 Please note that Auckland Council is counted solely as a unitary council, while the other unitary councils (excluding the Chatham Islands Council, which is not counted here) are also counted as district or city councils.
66 See http://www.civildefence.govt.nz/assets/Uploads/cdem-groups-and-councils-september-2013.pdf, http://www.stats.govt.nz/Census/2006CensusHomePage/Boundary.aspx, http://www.health.govt.nz/new-zealand-health-system/key-health-sector-organisations-and-people/district-health-boards/district-health-board-websites and http://www.localcouncils.govt.nz/lgip.nsf/wpg_URL/Profiles-Councils-by-Type-Index

- **Illustrate the framework from the outside looking in.**
  For example, could a decision graph illustrate the decisions central government makes when a crisis is activated? Could a public alert system be standardised to cover all risks, creating one voice to the public?

- **Highlight the key documents and their roles.**
  For example, the Guide is the key 'how to' document; it is the key resource for understanding what happens when a crisis is activated. Therefore, it deserves a higher profile.

- **Specialise.**
  Specialisation of skills is a common way to manage complexity. Are there further ways to improve outcomes using specialisation? For example, the director of civil defence emergency management has a great deal of responsibility and control in a crisis, but is there an opportunity for this position to be further strengthened using specialised support?

- **Develop checklists.**
  A common way to manage complex situations and generate better outcomes for all is to create a checklist. Obvious places in the framework where checklists may be effective are for those preparing local CDEM group plans, lifeline utilities plans and LTCCPs. To a degree, the *Guide* is one large checklist for officials, but could this tool be used more effectively across the framework?

- **Use terminology consistently.**
  Terminology is continuously evolving in the crisis management field and is likely to continue. Definitions and abbreviations can be found in the Guide, but could perhaps be made more accessible by being expanded and updated on the CDEM website. As a general rule, the public service would benefit from drawing a clear distinction between a strategy and a plan, and how they fit altogether; if there is a hierarchy, this needs to be obvious to the reader.

- **Use acronyms and other abbreviations carefully.**
  It is very easy for those governing the system on a daily basis to use acronyms and other abbreviations, but this needs to be considered in terms of being transparent and communicating who is advising the minister, making decisions and directing a crisis when such material is in the public arena.

6.3 Recommendations for Local Government

Local governments have special responsibilities because they need to ensure the continued availability of essential infrastructure and services and the flow of goods to the places they are needed.

An uncontrolled Ebola pandemic affecting many other countries, for example, could cause restrictions on movement, financial market shocks and fear, which would have a variety of effects on local businesses and people.

Profit-motivated local businesses might make preparations to protect the businesses themselves, but they might not make the preparations required to ensure that they contribute the functions they normally perform within the economy and society.

While there would be some value for local governments in understanding how such an event might unfold and affect the community, a more fruitful approach for local governments might be to consider how to ensure ongoing supplies of the essentials needed by local populations.

As a thought experiment, consider a situation where New Zealand was unable to export or import as much food as it does today. Supermarkets would be short of food, and food producers would be unable to export. Businesses might be failing, and people might be taking all kinds of actions to look after themselves. It seems likely that in these circumstances central government would want to redirect food supplies. Local governments would have a role to play too, ensuring the flow of food and other essentials to those who need it, helping to organise local labour reallocation and ensuring that skilled people remain available to sustain essential infrastructure.

Having an uncontrolled Ebola or other epidemic outbreak within New Zealand could introduce these effects as well as the need to contain the disease and mobilise a medical response, placing a great deal of strain on local government resources. A local government needing more resources might find itself with less resources than normal and struggle to continue to operate effectively. Are local governments ready to respond if, in addition to these challenges, fuel supplies or communications were interrupted?

Epidemics were a regular feature of pre-industrial cities. Communities had experience of responding to the disruption and widespread death that they brought. One consequence of medical advances and a long period of peace is that most of our communities lack experience in dealing with crises.

When Hurricane Katrina struck New Orleans and the mobile phone networks failed, there was a widespread temporary breakdown of the social order. Modern Western societies without experience or preparation might not always respond to crises as well as traditional societies did.

Local governments can help by ensuring that communities are resilient, well connected and prepared to respond to an event. The Christchurch earthquakes have produced a lot of effort to ensure buildings are resilient but less investment to increase community resilience. The short-term response of the Christchurch community to the earthquake events was very effective, partly because the initial deaths and injuries were sudden and local. However, in the long term there has been widespread frustration, disaffection and depression. Local government and community resilience and preparedness efforts would not prevent these kinds of effects, but they would reduce them.

Recommendation 11
Include event response resilience considerations in community development efforts.

Natural disaster planning usually assumes an acute, local event. Those response plans might not be applicable for managing the effects of a global or offshore event where it is the second-level and third-level effects that impact New Zealand. Local governments should ensure they have the resources and powers required, and the know-how to deploy them. For example, in an epidemic it might be important to control population movement, labour, food supplies and social interactions. These powers were all important during the Middle Ages for the management of plagues. Central government might provide the legislative or regulatory powers but local governments need to be able to use them effectively.

Recommendation 12
Develop event risk response plans that include preparation for global or overseas events that might affect New Zealand.

Many local governments in New Zealand are quite small and may find it difficult to find the resources to develop event risk preparedness of the type we are highlighting. As discussed in Section 3, there have been 16 local CDEM groups formed across New Zealand as committees of elected councillors from each council within regional boundaries. An understanding of the capability and resources of neighbouring councils will be important when disruptive events occur. Relationships with neighbouring councils may be missed if neighbours have been placed in different CDEM groups.

Recommendation 13
Develop connections with other local governments to share response plans and develop preparedness.

There are arguably benefits in councils connecting with other councils that are not neighbours and not in their CDEM groups. For example, urban councils may have more in common than with their neighbours. Councils that have shared characteristics, such as crops or livestock within their boundaries, may have similar risk profiles and therefore might be able to provide additional support in times of crisis (e.g. transporting livestock to greener pastures in times of drought).

6.4 Recommendations for Businesses and Non-government Organisations

Many businesses already manage risk, including event risk, and they have business continuity strategies and detailed operational plans to respond to disruptions (response plans).

Our interviewers found that leading companies vary in their preparedness, with some having considered not only their own supplier risks but also their suppliers' supplier risks. However, generally these supply-chain-focused risk management efforts are focused on local and business supplier risks and tend to neglect more global event risks and the potential for interruption from sources such as infrastructure failure or lack of critical staff competencies.

Regardless of the effort put into preparing for event risk, it will remain quite likely that the actual event that will threaten a business will be one that has not been specifically prepared for. Nevertheless, preparedness is likely to be valuable by ensuring that the business is ready to respond to unexpected supply interruptions. The resilience-increasing steps taken may benefit the business when responding to a wide range of potential events.

Investing in risk management imposes an immediate and definite cost on a business while providing a possible later return that is difficult to estimate. Risk management is sometimes deferred to allow effort on more immediately valuable opportunities.

Businesses can and should prepare themselves to respond to unexpected event risk by developing their risk management capabilities generally, and by ensuring those capabilities are suited to responding to event risk.

Recommendation 14
Four capabilities should be developed by businesses and other non-government organisations: acuity, navigation, agility and resilience.

1. **Acuity** is the capability to understand potential event risks and to identify when and how those risks might impact the business. Understanding the supply chain and its vulnerabilities helps businesses focus on how event risk might affect them. When a potential risk arises, businesses with highly developed acuity may be able to respond more rapidly, reducing the risk and protecting their competitive positions.

2. **Navigation** is the capability to make good decisions about what to do when an event occurs. Defining the important roles for developing responses and rehearsing event management develops navigation capabilities.

3. **Agility** is the capability to make changes when they are needed. There is little value in having the leadership able to understand the event and how it should be

responded to if the rest of the organisation is not ready, willing and able to execute the responses chosen. In particular, organisations should consider what non-standard actions might be required and whether those who need to take those actions will understand the need and act appropriately when normal lines of authority might be broken.

4. **Resilience** is the capability of the organisation to respond to the shocks caused by events. Stand-by supply lines, reserve stocks, multi-skilling and redundant systems are examples of precautions that can be taken by businesses to increase resilience.

In making their preparations, businesses should consider a wide range of interests: their viability as a business; their responsibilities to their customers, employees, shareholders and other stakeholders; and their responsibilities and potential obligations to their wider communities and country. Section 1.3 highlights nine steps businesses can use to build resilience into a system.

Recommendation 15
Businesses that supply core infrastructure, and especially those designated as lifeline utilities, should actively pursue relationships with central and local government in order to cushion the impacts of a range of disruptive events.

Core infrastructure is fundamental to the economic and social system working in times of stress. Supply chain risk is often hidden and only becomes apparent when the situation becomes urgent. Taking the time to understand the linkages and alternative options available before an event disrupts a system makes sense. Thinking slowly is better than thinking fast. Businesses are a central part of the solution.

About the Authors

Roger Dennis is an independent consultant who specialises in connecting long-term thinking with strategic opportunities. He has worked with large and small organisations around the world to help them understand how to innovate in a fast changing world. For example, Roger was the co-lead of the Shell Technology Futures programme in 2007. This was a two-year project initiated by the Shell Game Changer team in The Hague to understand how technology would impact society over a twenty-year time frame. Roger has worked alongside the foresight teams in the Singapore Prime Minister's office, advised corporations in a range of sectors and spearheaded globally recognised transformation programmes. He is one of the core team of Future Agenda, the world's largest foresight programme. Roger regularly presents at conferences around the world and in April 2015 he discussed the evolution of cities at the Nobel Laureate Symposium in Hong Kong.

Wendy McGuinness is the founder and chief executive of the McGuinness Institute. As a Fellow Chartered Accountant (FCA) specialising in risk management, Wendy has worked in both the public and private sectors. In 2004 she established the Sustainable Future Institute as a way of contributing to New Zealand's long-term future. Since 2012 the Institute has been known as the McGuinness Institute. The Institute is a non-partisan think tank working for the public good, contributing strategic foresight through evidence-based research and policy analysis. The Institute endeavours to undertake research that is independent, innovative and relevant. *Project 2058* anchors the Institute's work programme; the year 2058 was selected to guide the Institute's long-term approach, ensuring a time in the distant future is always front of mind. In 2006 the Institute published *Managing the Business Risk of a Pandemic: Lessons from the past and a checklist for the future* as part of *Project Pandemic Management*. Contributing to *Lessons From the West African Ebola Outbreak in Relation to New Zealand's Supply Chain Resilience* builds on this earlier work.

Rick Boven is the founder of the boutique consulting firm Stakeholder Strategies. Prior to this he led the New Zealand Institute, a non-partisan think tank. Rick has been a strategic management consultant for more than 30 years and was the founding partner of the Boston Consulting Group in New Zealand. A Chartered Fellow of the Institute of Directors, Rick's past directorships include ASB Bank and Sovereign Insurance. Rick has worked with leading companies in Australia, New Zealand and the USA in a wide range of industries including financial services, industrial distribution, energy, telecommunications, information technology and on-line, transport, manufacturing, and agriculture. He has a PhD in Environment Management from the University of Auckland, a Master of Business Administration from the Australian Graduate School of Management, and a Master of Arts (Psychology) from Victoria University of Wellington. Rick has university teaching experience in psychology, social work, research methodology, business strategy and managing change. He has publications in social welfare, mathematical psychology, educational sociology, strategic management, business ethics and economic development.

Appendix 1: BBC Article – Ebola: How Does It Compare?

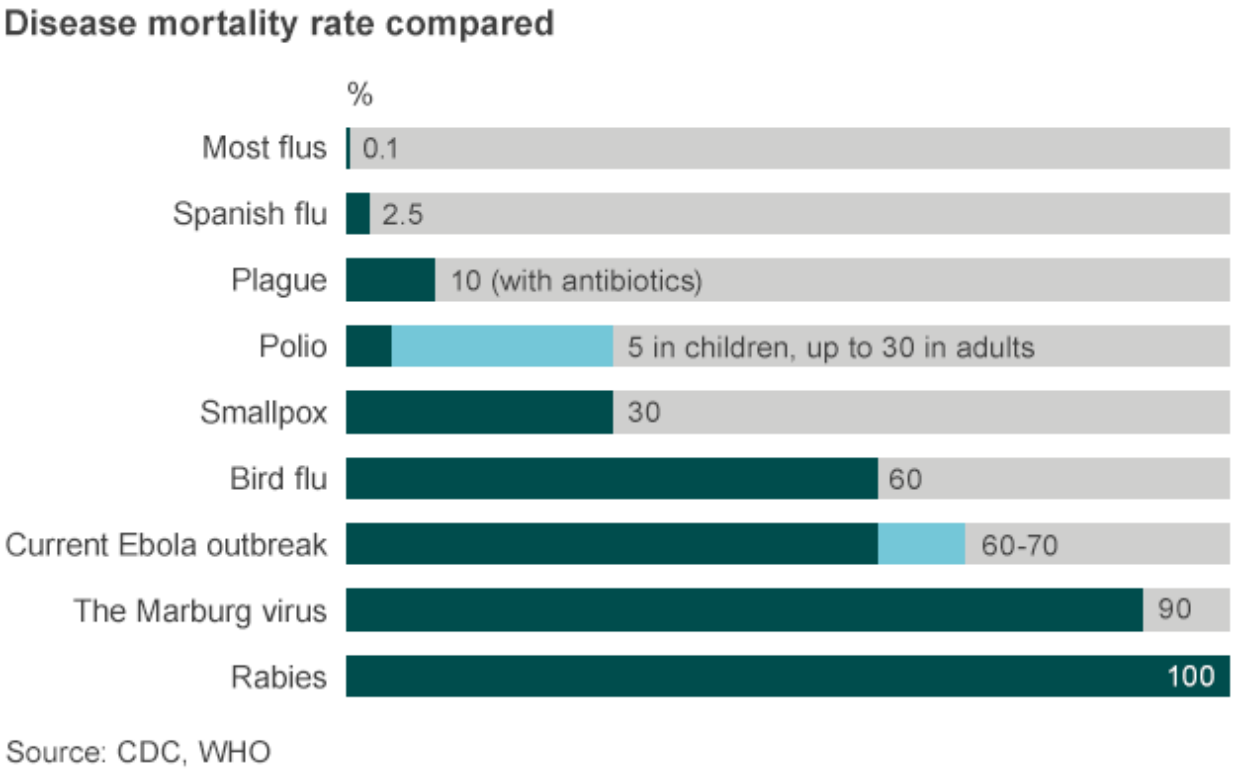
Source: Gallagher, 2014[67]

The world has witnessed the largest-ever epidemic of Ebola claim thousands of lives in West Africa in 2014.

Since the first case, a two-year-old who passed away on 28 December 2013, there have been more than 6,900 deaths. Outbreaks such as Ebola have an ability to spread fear around the world, often through the prism of sensationalist media reporting. So how does Ebola actually compare to previous outbreaks and other diseases? And while the world focuses on Ebola, are we guilty of ignoring much bigger killers?

Deadly killer

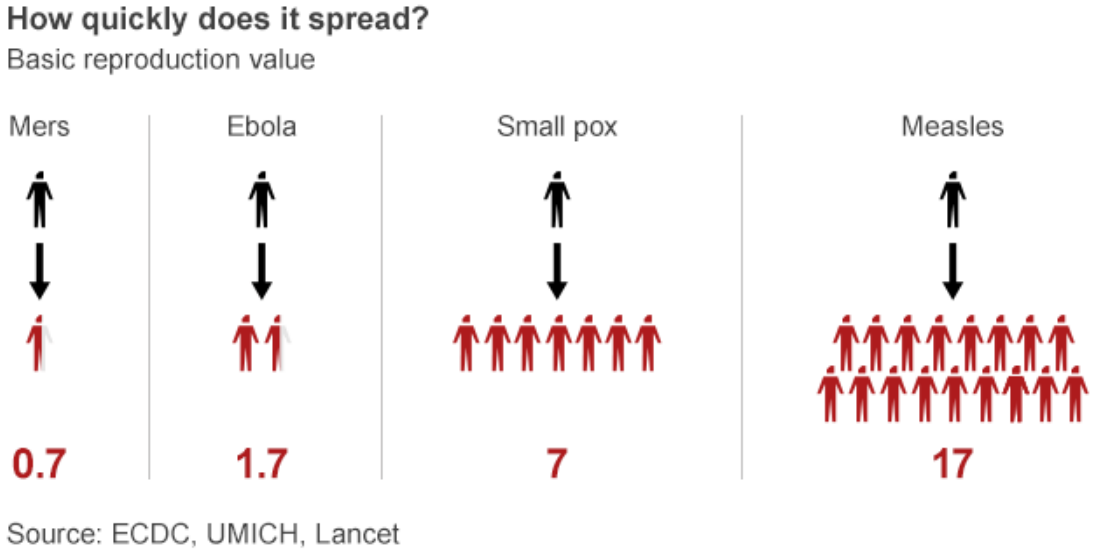
Analysing the death rates from different viruses shows Ebola is certainly one of the most deadly infections ever encountered.



67 See http://www.bbc.com/news/health-29953765

David Mabey, a professor of communicable diseases at the London School of Hygiene and Tropical Medicine, said: "The mortality rate from previous outbreaks is generally over 50% in Africa. Very few other viruses approach that apart from rabies which is 100% and Marburg which is in the same ballpark as Ebola." But just because a virus is deadly does not mean it will cause a large number of deaths. It also has to infect new people.

This outbreak has shown Ebola does not spread as quickly as other infectious diseases.



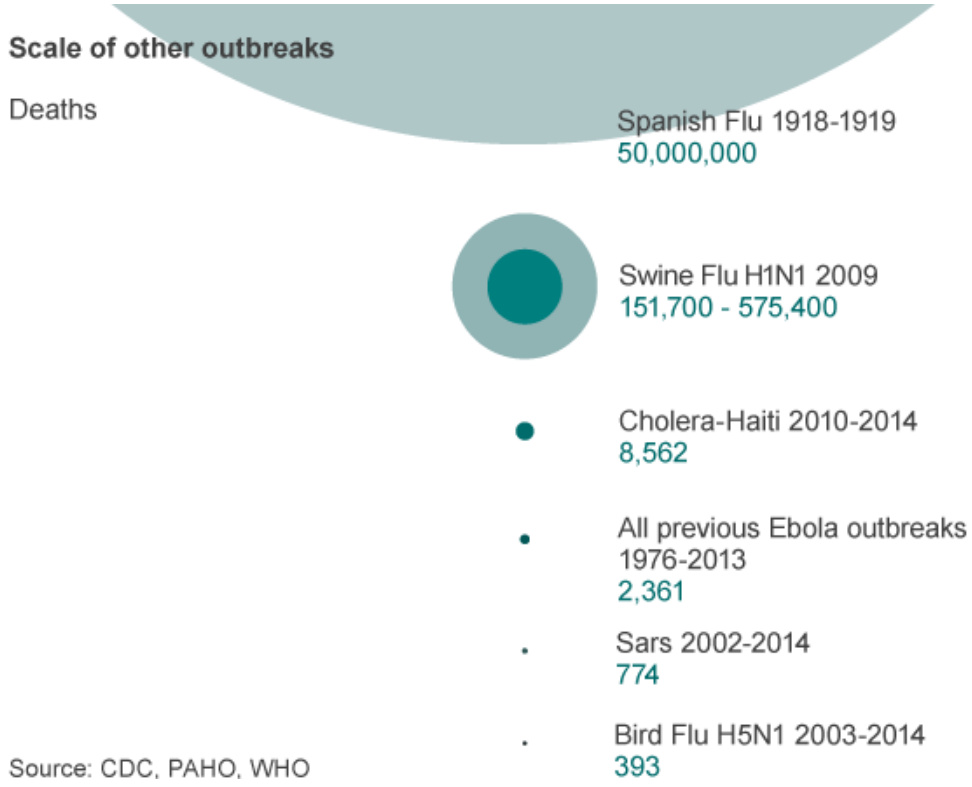
The basic reproduction value represents how many other people an infected person passes their disease onto. The value must be greater than one for a virus to spread, otherwise an outbreak will peter out.

The Mers-coronavirus, which keeps jumping from animals to people in Saudi Arabia, is an example of a virus unable to spread effectively in people. Measles, meanwhile, is rampant and can explode through unprotected communities. The total death toll of a disease depends on the combination of how rapidly a virus spreads and how deadly it is.

"It sounds slightly perverse, but a virus can cause less severe disease, but be a much bigger problem," said Prof Jonathan Ball, a virologist at the University of Nottingham.

SARS to flu

Looking at other headline-grabbing outbreaks, it is those that emerge and then spread with ease that pose global threats. Eleven years ago another deadly virus - Severe acute respiratory syndrome known by its acronym SARS - had the world in a panic. Western countries introduced screening at airports, as they have for Ebola.



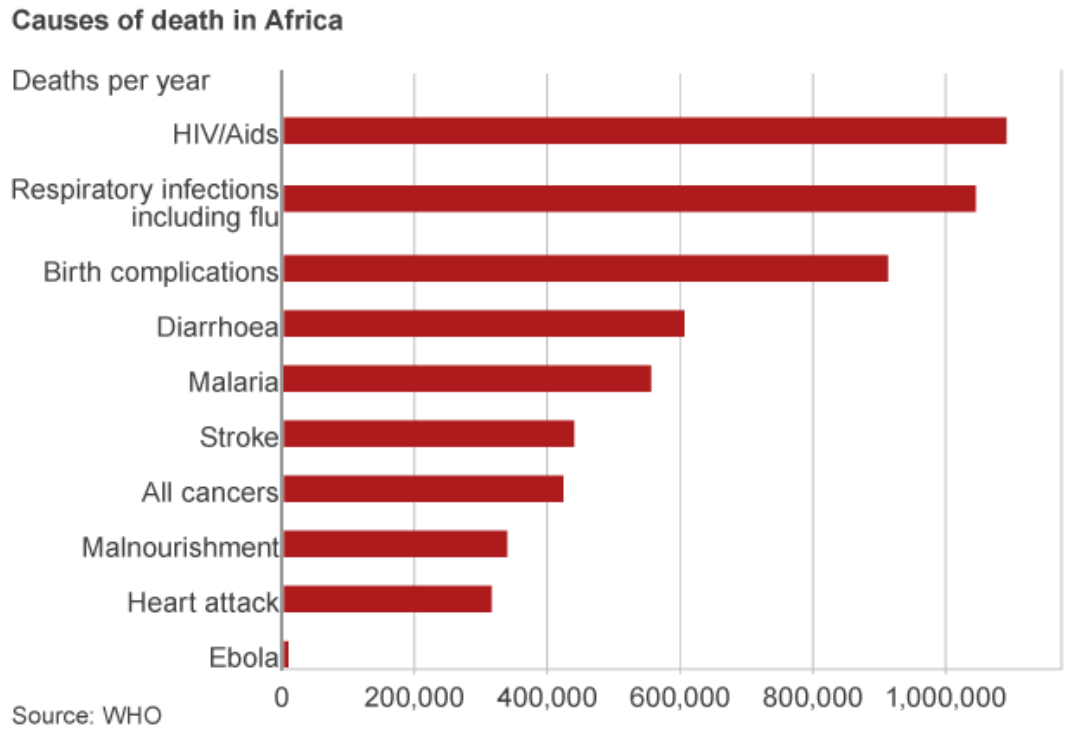
Fewer than 800 people died from SARS out of 8,000 infected. Nearly 7,000 have died in this Ebola outbreak which has infected 18,000 people.

But the big killer in the global epidemics is influenza (flu) viruses. Swine flu infected a fifth of the global population when it rapidly spread around the world in 2009. It killed a tiny percentage of those people, but the global death toll may have been around half a million people.

But Prof Mabey draws an important distinction between flu and Ebola. He told the BBC: "People who die of flu are mostly elderly people with other co-morbidities. That's the really terrifying thing about Ebola you can be a perfectly fit 20 year-old and be dead within 10 days."

The bigger picture

Even at the height of this epidemic, Ebola is far from a major killer in Africa. It takes HIV/Aids just two days to kill as many people as have died in the whole Ebola outbreak so far.



In previous years, Ebola has caused even fewer deaths, which goes some way towards explaining why there is no cure or vaccine as there are bigger targets to aim for.

Huge progress has been made in HIV which is almost a manageable condition with the right drugs. Similarly, malaria is now killing half as many people as in 2001 thanks to improved interventions.

But Prof Ball argues it is right that Ebola is getting so much aid and research attention now. "I think the reality is that we're not giving it disproportionate attention as this is something we know we can stamp out. The effort we expend now is preventing something bigger on a pan-African or even a global scale. This is a problem we can actually sort out, not doing so would be tantamount to stupidity really."

Appendix 2: Four Scenarios

Risk management is often limited by our ability to imagine possible connections and consequences. Nassim Nicholas Taleb, author of the book *The Black Swan* (2007), popularised the term 'failure of imagination' as a way to depict our tendency to be restrained by past experiences and indulge in positive thinking.

Scenarios are simply one method of unleashing our imagination, ultimately providing tacit knowledge that serves to illustrate ways we might strengthen our position in the future. By letting our imagination explore the future, it is possible to (i) highlight general observations, (ii) highlight surprising observations, (iii) identify key questions to explore, (iv) identify weak signals and (v) think about ways to prepare and respond (see pages 80–82). Importantly, scenarios are not judged on whether they come true, but on the quality of discussion that ensues and the extent that discussion delivers better outcomes over time.

The four resulting scenarios

The following four scenarios were written in November 2014 and explore the extent the Ebola epidemic in West Africa will be managed over the following 12 months. As we stand in April 2015, the exercise is factually redundant, in that the epidemic is increasingly looking as though it will be managed in line with Scenario 1. Please keep in mind these scenarios are fiction.

Assumptions

The scenarios are based on the following assumptions:

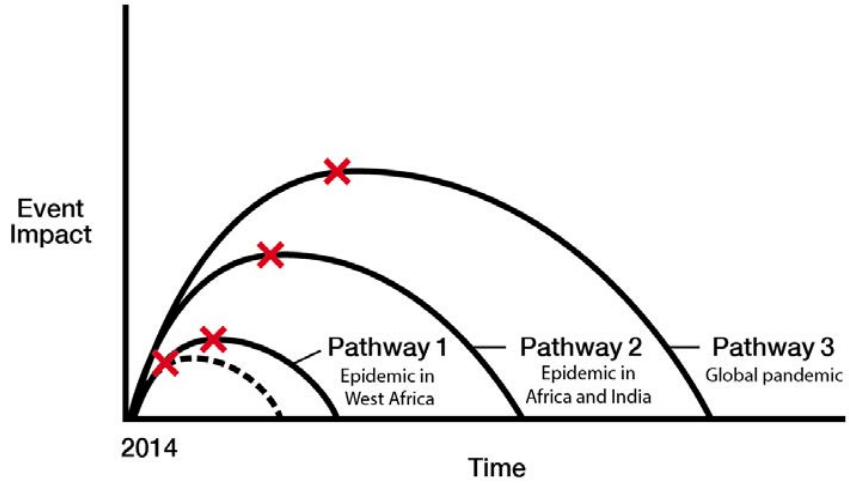
- Airborne transmission of Ebola has not been taken into account with any of the following scenarios, but this would clearly be a game changer.[68]
- A vaccine might take a while to eventuate.[69]
- Scenarios are broken up into a global story followed by a New Zealand story.
- Events will unfold over time. Figure 19 (overleaf) outlines the different time frames used to set the scenarios.

68 See http://healthmap.org/site/diseasedaily/article/pigs-monkeys-Ebola-goes-airborne-112112 and http://edition.cnn.com/2014/09/12/health/ebola-airborne/

69 Vaccine timelines were discussed at the 54th Interscience Conference on Antimicrobial Agents and Chemotherapy (ICAAC) (September 8, 2014). See http://www.medscape.com/viewarticle/831518#vp_1

Figure 19: Possible Pathways

Note: The red crosses refer to the specific scenarios.



Scenario 1: Phew – Ebola under control in Africa

It is now March 2015.

The global story

World leaders let out a collective sigh of relief. The world embraces West Africa, and Médecins Sans Frontières (MSF) is recognised as the hero of the hour. From this disaster, a number of lessons are learned, and most importantly a new appreciation of West Africa and its people is gained.

Children and adults alike can now recite the countries of West Africa, and citizens around the world have gained a much deeper understanding of how interconnected we all are. New hospitals are being built by USA philanthropists to international standards, and staff are accordingly trained – building international relationships and collaboration. Although a major catastrophe has happened, the people of West Africa are no longer hidden and have a voice on the global stage.

The New Zealand story

The Director of Public Health initially believed there was a 'very low risk' of Ebola arriving and spreading in New Zealand, but by the end of October 2014 the Government announced an 'Alert Code White'. This was confirmation of a potential emergency situation that may impact New Zealand. 'Code White' was later downgraded in February 2015.

The Government congratulates MoH and others for their considered response and states it was an excellent test of an important part of New Zealand's resilience system. However, it notes an epidemic that is based in an air transmission would impact more quickly and we need to continue to be vigilant.

Scenario 2: Missed opportunity – Ebola not under control in Africa

It is now April 2015.

The global story

World leaders are seeking to not only control Ebola but also the fear of Ebola. Ebola is now in 15 countries, about half of which have had it introduced by medics or citizens who have travelled to affected countries. The epidemic is now in pockets of Mali, Algeria, Morocco and Tunisia. The southern Spanish border is now patrolled by the Spanish army. Portugal and southern Spain are in the process of managing imported cases of Ebola, but that is proving a challenge, as medical staff are still routinely infected. Médecins Sans Frontières (MSF) continues to warn that prevention is critical and there must be no stopping the fight of Ebola on West African soil, but many countries around the world have stopped providing assistance, as most infected patients are returning doctors and nurses. Borders have been closed to travellers from affected countries. The USA is still providing assistance but will only allow military doctors and nurses to travel to Ebola-affected countries. The rest of the world put all their hopes in a vaccine – but questions are being raised over who gets the vaccine and who pays the price. Ebola has turned into not only a major catastrophe for Africa but also for the rest of the world. Operational disruption of food, medicine, products and services destabilise the global economy. Stock markets fluctuate as new information on our global connectivity and supply chain interdependence become apparent.

The New Zealand story

New Zealand now has its first imported case of Ebola. The Director of Public Health has moved New Zealand to 'Alert Code Yellow', as we now have a case of a new and infectious disease *without* local transmission. 'Code Yellow' acts as a warning that a 'Code Red' (the response phase) may eventuate.

Possible negative responses

New Zealand only considers level-one effects and fails to think through more broadly the opportunities and threats.

Possible positive responses

- New Zealand focuses on contributing to international challenges. Scientists and engineers develop products to help identify, track, treat and bury Ebola patients around the world.
- New Zealand works with other countries around the world to develop new technologies, for example, blood tests to be taken without extracting blood, a tracking system, the manufacture of oral rehydration salts (ORS) and mobile incinerators.
- New Zealand focuses on building resilience in New Zealand. Unlike other countries that are in the process of setting up units in public hospitals, New Zealand:

    a) commandeers a small private hospital in Auckland – this becomes the Ebola hospital for New Zealand.

b) builds a PC4 laboratory in Auckland, designed to test blood for viruses and create vaccines in bulk.

- New Zealand immediately reviews and updates its current strategy to make New Zealand more resilient. For example, the New Zealand Government in 2015:

  (i) purchases gold to increase buying power if either Scenario 3 or 4 came into being;

  (ii) instigates a mandatory three-month supply of critical parts/fuel/products on all strategic government infrastructure;

  (iii) signs maintenance and operational support contracts with comparable industries in Australia to support each other first;

  (iv) works with key businesses to develop risk management strategies and plans; and

  (v) develops the ability to produce vaccines in New Zealand with technical support supplied by overseas partners.

Scenario 3: Anxious times – Ebola not under control in Africa and Europe

It is now January 2016.

The global story

It looked as though the epidemic was under control, but the current Ebola virus mutated, leaving the initial vaccine redundant. This creates a new sense of panic – 'maybe the experts do not know how to manage this virus after all'. There is a rush to produce a new vaccine, but unfortunately the mutation is ongoing. The mutated virus makes people sicker for far longer, making them more infectious before they either get well or die. This change means patients move around the globe longer before symptoms became apparent, making it more difficult to track contacts. There is also a suspicion that carriers might exist, meaning healthy people might unknowingly infect others. These carriers are a health management nightmare. This means even gym equipment or door handles may become infection points. No one can be sure, but uncertainty prevails. Europe and Africa are largely placed in quarantine by the rest of the world. Food and medical supplies are dropped by helicopter, while experts in the USA and Australia work around the clock to find a new vaccine. There are effectively two worlds: the world of Ebola in Europe and Africa and the world without Ebola.

The New Zealand story

Reports are that most Pacific Island nations are now infected, with many hospitals now stretched. Without medical infrastructure, stories of whole villages having Ebola and hospitals turning away patients are in the news. Australia is seeing an increase in asylum seekers from Asia. New Zealanders are returning home in droves. Americans and Australians are arriving in large numbers.

Possible negative responses

- New Zealand is not prepared for this eventuality, and social unrest becomes the norm.
- Medical and food supplies are challenged.
- Banks are no longer in operation, and cash is king – chaos prevails.

Possible positive responses

- New Zealand tries to help the smaller Pacific Island nations where there are one or two imported Ebola cases, collecting them by plane and placing them in the expanded Ebola hospital in Auckland.
- New Zealand closes the border, learns to be self-sufficient and awaits the vaccine.

Scenario 4: Panic – Ebola not under control in the world

It is now 2017.

The global story

Countries struggle to maintain relationships, and tension exists, as medical support and food supply continue to be in demand around the world. A vaccine does exist, but it is in short supply – only 100,000 doses are manufactured per day. With poor transportation infrastructure, it is hard to get these vaccines to the people in need. This means only those that are rich or in the know are able to access vaccines; at this stage this is the USA, UK, Germany, Switzerland and France. Those that have no hope of paying the fee moved a long time ago into country areas away from the chaotic city areas where hospitals have become a dangerous place to visit. Many are effectively waiting out the storm.

However, some countries have begun using the pandemic as an opportunity to reclaim territories, and there are rumours of atrocities occurring while major powers are focused on pandemic management. The gap between the rich countries and the poor escalates, leading to a breakdown in borders where such gaps exist next door to each other. Other borders are left abandoned: Mexicans move into North America; Americans move north into Canada. Asia has moved into the north of Australia. Australians flee to New Zealand. Trade is minimal, and pirates are now roaming the high seas, so the navy has been called in to travel alongside cargo ships. It takes another three years (until 2020) to have everyone vaccinated, but by then borders have changed and the world has returned to the laws of the jungle.

The New Zealand story

New Zealand, because it has managed itself well, looks attractive in terms of resources and healthy citizens. This may tempt countries to travel to New Zealand to gain access to resources and food by force.

Possible negative responses

- Failure to build allegiances leads to a takeover of sorts – it might simply be through resources and trade agreements.

Possible positive responses

- New Zealand and Australia work together to support the Pacific and in doing so help stabilise a new world order.

Observations

Based on these four scenarios, the following observations can be made:

i) General observations

- Understanding the basic reproduction number will be key to assessing impacts of the evolution of this or other novel viruses.
- Understanding the difference between what is 'medically urgent' and 'medically important' is key. 'Medically important' is the ability to track the patient life cycle in terms of what is needed from contamination to release or burial. 'Medically urgent' relates to the immediate actions necessary to manage a contamination, such as the administration of medicines or the development of vaccines.
- The connection between 'medical' and 'non-medical' and how these interact will have important consequences.
- The connection between those wanting to enter or those wanting to leave contaminated zones has important consequences in terms of airports, border control and lockdowns.
- Recovery after a pandemic is economically important – re-establishing trade to its full capacity quickly will be key. Ebola being badly managed has had significant political and economic impacts (e.g. lockdowns, and small farmers not being able to manage farms).

ii) Surprising observations

- Fear of hospitals for those with Ebola. Rumours and myths prevented families from admitting they had a potential patient, as masks and tents were threatening and a large number of patients died in treatment centres. This led to patients staying at home, increasing the level of contamination.

- Fear of hospitals for those with unrelated illnesses. Patients with ongoing health issues failed to continue to go to hospitals, as they became epidemic centres (this meant some patients died, such as those suffering from malaria, due to lack of treatment).
- Cultural practices can be problematic – for example, burial practices.
- WHO was slow to identify Ebola, and when it was identified, WHO was slow to respond. This will have a short-term impact on WHO's reputation.
- Timely medical information: the nature of the virus, how to identify the virus, how to identify a contaminated patient, range of number of days before symptoms showed, nature and timing of symptoms, how to treat the contaminated patient with medicine, how to nurse the contaminated patient, how to reduce contamination, how to bury those that have died and how to treat those that survived (and the extent they were still contagious).

iii) Key questions to explore

- Lockdowns. How cost-effective are lockdowns within a country? When should they be done, and how can the process best be managed?
- Border controls. How cost-effective are border controls within a country? When should they be done, and how can the process best be managed?
- Whether the taking over of private hospitals to care for Ebola patients would be effective. This way you ensure public hospitals are still operating.

iv) What to watch for (weak signals) that might indicate movement to another scenario

- Watch carefully how neighbouring countries respond to an epidemic.
- Watch vaccine solutions – who is doing what and when.
- Watch media and communication. Be ready to respond when misleading information is in the public arena.
- Watch for changes in the nature of the virus, e.g. length of illness or air transmission.

v) Consider how New Zealand might like to prepare and respond

- Divide actions into preparation and response.[70]

Preparation

- Develop effective and timely ways of communicating to all key stakeholders. For example, run an annual half-day meeting with all key representatives of core businesses to explore supply chain issues (government should have the names of key companies and their representatives at its fingertips).

70 This aligns with the New Zealand Treasury's Living Standards Framework, which explores risk in terms of preparedness and responsiveness. Managing risk is one of the five dimensions in which public policy is assessed. See http://www.treasury.govt.nz/abouttreasury/higherlivingstandards

- Provide a blueprint/protocol for assessing preparedness for the medical community, the business community and society (e.g. councils). This could be along the lines of the checklist the McGuinness Institute (previously the Sustainable Future Institute) created for businesses in 2006 in *Managing the Business Risk of a Pandemic: Lessons from the past and a checklist for the future*.[71]
- Integrate feedback loops into the system so that responses are based on the latest information both on the ground in New Zealand and internationally (whom do you contact, when and how).
- Be prepared for secondary-level events that compound issues, and explore backup solutions. Secondary events could include a natural disaster (e.g. a severe eruption, flood, storm or earthquake), an infrastructure failure (e.g. power failure, rail disaster or contaminated food) or intentional damage (e.g. bombings).
- Identify private hospitals as a backup to manage epidemics, and discuss how best to manage that before they are needed.
- Build a PC4 laboratory.
- Create a shared understanding of what no action might look like, benchmarking the status quo – a pandemic occurs and New Zealand is not prepared. What does this look like in terms of costs to loss of life, medical systems, chaos, crime, reputation, exports, etc?
- Although risk management can be expensive, not all actions and preparation are expensive or time consuming. New Zealand needs to be clear about what level of risk we are prepared to live with. This will largely depend on benefits, costs and risks of actions that would make New Zealand more resilient in the longer term.

Response

- Transparency is essential (who is doing what and when). Be careful not to over-promise.
- Time of response is critical. Government must inform:

  i) the medical community;
  ii) the core business communities; and
  iii) society quickly in order to help coordinate logistics and build trust.

- Technology and infographics are useful (lengthy reports are no longer the most effective way of communicating complex ideas).

71 See http://www.mcguinnessinstitute.org/Site/Projects/Pandemic_Management/Pandemic.aspx

Appendix 3: Relevant Government Department Strategies and Plans

This appendix contains: (a) terminology, (b) the seven government department strategies (GDSs), (c) operational response plans and (d) miscellaneous emergency resource management information.

a) Terminology

The reasons why a document is called a strategy, as distinct from a plan, are not always clear. To add to the confusion, sometimes both a strategy and a plan can be contained in the same document. For the purposes of this report, we provide the following definitions.

A strategy: 'Maintaining a balance between ends, ways and means; about identifying objectives; and about the resources and methods available for meeting such objectives. This balance requires not only finding out how to achieve desired ends but also adjusting ends so that realistic ways can be found to meet them by available means … By and large, strategy comes into play where there is actual and potential conflict, when interests collide and forms of resolution are required. This is why strategy is much more than a plan.' (Freedman, 2013: xi)[72] While Professor Freedman's is a contemporary definition, it is also useful to look at an earlier interpretation by Professor Henry Mintzberg. In 1987 he wrote about the 'five Ps for strategy': plan, ploy, pattern, position and perspective, indicating a plan was only one component of a strategy.[73] Put simply, a strategy is an allocation or reallocation of resources to achieve success or a desirable goal/goals.

A government department strategy (GDS): A 'government department strategy' (as defined by the McGuinness Institute) is a document that must: (i) be a publicly available statement or report; (ii) be generated by government departments with a national rather than a local focus; (iii) contain long-term thinking, in such a way that the strategy links to a long-term vision or aim, and ideally provide clarity over the factors that may impinge on the attainment of that vision or aim; and (iv) guide the department's thinking and operations over the long term (i.e. contain a work programme to achieve change over two years or more).[74] See the seven GDSs detailed in the following pages.

A plan: A plan is operational in nature; it focuses on who will do what and when. It does not explore the tensions/trade-offs in the external environment or the strategic ways/options in any detail. Some plans are only response related; what we have called 'response plans'.

72 See the book *Strategy: A history* by Lawrence Freedman (2013)
73 See *The Strategy Concept I: Five Ps for Strategy* http://milesazachary.com/MGT%204380%20Sp%202012/Mintzberg,%20H.,%201987.%20The%20Strategy%20Concept%20I-Five%20Ps%20for%20Strategy..pdf
74 See the methodology to *The GDS Index 2015* at http://gdsindexnz.org/methodology/

A response plan: These plans largely remain dormant until a set of events or systems risks occurs that triggers the plan. They should set out clearly what happens when this happens and who is responsible for doing what.

b) The seven government department strategies (GDSs)

Section 3.4 discusses civil defence emergency management instruments and, in particular, strategy documents.

A more in-depth look at the content of the seven GDSs currently in operation to manage a range of emergency events is found below. This information is based on research carried out by the McGuinness Institute and forms part of the *StrategyNZ* project. *StrategyNZ* is a long-term initiative of the Institute that aims to support strategic thinking and effectiveness in the public sector.

The initial stage of this research built on the McGuinness Institute's 2007 publication *Report 2: New Zealand Central Government Strategies: Reviewing the landscape 1990–2007* and was undertaken in 2014. This resulted in the collection of 290 GDSs published over the last twenty years. The second stage involved an 'overview analysis' of the 136 GDSs in operation as at 30 June 2014.

In 2015 each GDS was read in detail and analysed. It is important to note that the McGuinness Institute did not assess the quality of the GDSs' approach nor the extent to which they had been implemented. The strategies were scored across the six elements that the McGuinness Institute believes form the basis of a 'good strategy document':

Element 1: *opportunities and threats*
Element 2: *capabilities and resources*
Element 3: *vision and benefits*
Element 4: *approach and focus*
Element 5: *implementation and accountability*
Element 6: *alignment and authority.*

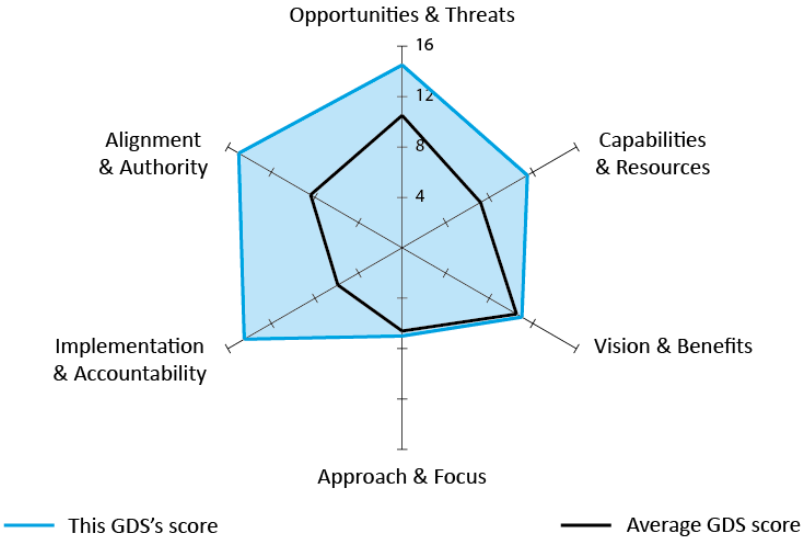
The scores were then totalled and compared, enabling each strategy to be ranked out of 136. Each department and sector was also ranked, based on the average scores of its strategies. As a result of this analysis, seven tables and 136 profiles were published in separate documents called *The Government Department Strategies Index 2015: Tables* and *The Government Department Strategies Index 2015: Profiles*. Together *Tables*, *Profiles*, *Strategy wheels, Observations* and the *Methodology* form *The Government Department Strategies Index 2015*. All 136 strategy documents, along with the methodology behind the scoring, the elements of the scorecard and the ranking, can be found on the website, which hosts all of the results.[75]

75 See *The GDS Index 2015* website for more information at http://www.gdsindexnz.org

The seven strategies were scored across the six elements and illustrated in radar charts (see figures 20, 21, 22, 23, 25, 26 and 27). They are ranked against each other, with their rank out of all 136 operational GDSs in brackets.

1. Recovery Strategy for Greater Christchurch, Mahere Haumanutanga o Waitaha (2012) Rank 1/7 (1=/136)
Department: Canterbury Earthquake Recovery Authority (CERA)
Sector: Economic Development and Infrastructure Sector

Figure 20: Recovery Strategy for Greater Christchurch radar chart
Source: McGuinness Institute, 2015[76]



The approach is to coordinate recovery plans under the Canterbury Earthquake Recovery Act 2011 (the CER Act) by ensuring government, individuals, groups, clubs, communities, iwi, councils, the public and the public sector can share resources when necessary and identify which agency is controlling which recovery programme.

This recovery strategy is the key reference document that guides and coordinates the programmes of work, including recovery plans, under the CER Act. The *Strategy* sets out a shared vision and government's overall approach to recovery. It (i) defines what 'recovery' means for greater Christchurch, (ii) establishes principles to guide how CERA and other agencies will work together towards recovery, (iii) describes in broad terms the pace and phases of recovery, (iv) identifies work programmes and which organisations will lead specific projects and (v) identifies priorities for recovery efforts.

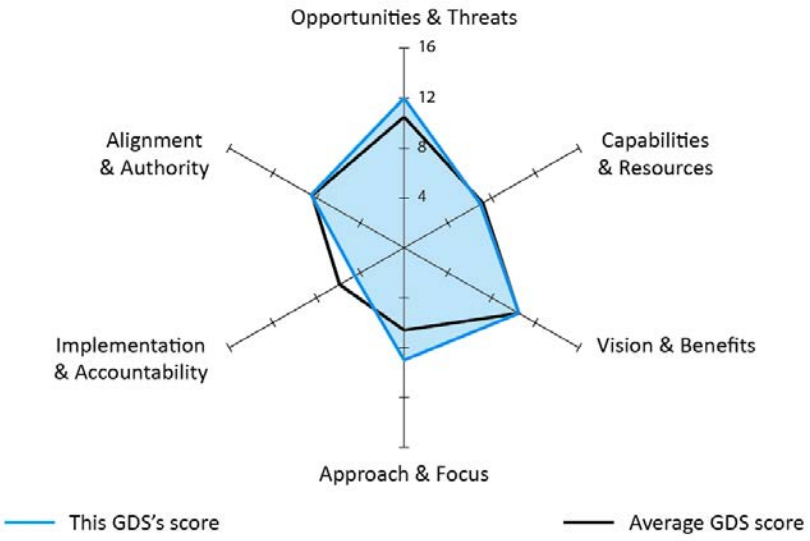
The *Strategy* aims to (i) provide overall direction to all those individuals and organisations that have a role in recovery activities, (ii) coordinate recovery activities by helping individuals and organisations to identify the interests they have in common and to

76 See the radar chart on the profile and a PDF of the strategy document on *The GDS Index 2015* website at http://gdsindexnz.org/profiles/

understand they need to work together in their recovery activities, (iii) give the community confidence that recovery is well planned and progressing and (iv) take every opportunity to restore, renew, revitalise and enhance greater Christchurch.

2. National Civil Defence Emergency Management Strategy
Rank 2/7 (49=/136)
Department: Department of the Prime Minister and Cabinet (previously Department of Internal Affairs)
Sector: Finance and Government Administration Sector

Figure 21: National Civil Defence Emergency Management Strategy radar chart
Source: McGuinness Institute, 2015[77]



(There is also the *National Civil Defence Emergency Management Plan* and *The Guide to the National Civil Defence Emergency Management Plan*. These sit within the same framework. The plan contains more detail on the roles agencies will take during an emergency.)

The approach derives from the Civil Defence Emergency Management Act 2002 and involves managing the risks of dealing with hazards by appointing a CDEM agency to support the implementation of the strategy (when necessary during an emergency). It was the first step in creating an integrated approach to CDEM in New Zealand, and many response plans and guides have followed.

The GDS references previous versions. It discusses the agencies responsible and possible partnerships. The strategic outcomes are understandable albeit slightly confusing because there are many different types of plans, guides and legislation which play a part in the framework. A progress report of the GDS was produced in 2013.[78]

77 See the radar chart on the profile and a PDF of the strategy document on *The GDS Index 2015* website at http://gdsindexnz.org/profiles/
78 See http://www.civildefence.govt.nz/assets/Uploads/publications/national-CDEM-strategy-progress-report-april-2013.pdf

The strategy has four goals: readiness, reduction, response and recovery. These are explained in the website as:

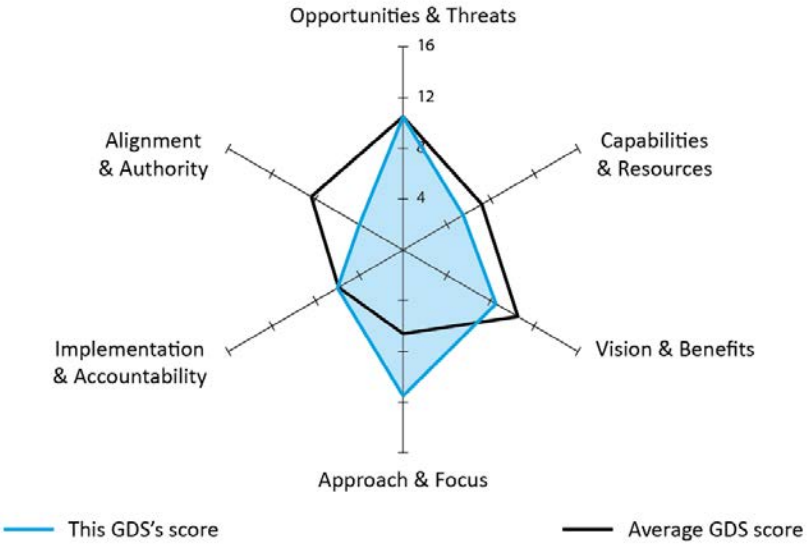
- readiness – increasing community awareness, understanding, preparedness and participation in civil defence emergency management;
- reduction – reducing the risks from hazards to New Zealand;
- response – enhancing New Zealand's capability to manage civil defence emergencies; and
- recovery – enhancing New Zealand's capability to recover from civil defence emergencies.[79]

The strategy's vision is 'resilient New Zealand: communities understanding and managing their hazards'. It sets out principles, goals and objectives at a national level. The strategy was developed following introduction of the CDEM Act in 2002 and revised in 2008. It will be revised before the end of 2018 alongside its progress report, incorporating lessons from the Christchurch earthquakes.

3. Oil Emergency Response Strategy: Government Response to an Oil Supply Disruption Rank 3/7 (76=/136)

Department: Ministry of Business, Innovation and Employment
Sector: Economic Development and Infrastructure Sector

Figure 22: Oil Emergency Response Strategy: Government Response to an Oil Supply Disruption radar chart
Source: McGuinness Institute, 2015[80]



79 See http://www.civildefence.govt.nz/cdem-sector/cdem-framework/national-civil-defence-emergency-management-strategy/
80 See the radar chart on the profile and a PDF of the strategy document on *The GDS Index 2015* website at http://gdsindexnz.org/profiles/

The approach is to outline the range of measures available to businesses and government if an oil supply disruption occurs.

The outcomes sought in this GDS are based on a hypothetical situation, and there is discussion of how these would be achieved. However, more detail is needed for the GDS to be practically useful. The GDS lacks a clear vision statement. It is not set out in the clearest manner, and there is information lacking as to how the GDS will be regulated and reviewed.

Oil companies will initially decide what to do in an oil crisis; however, when the point is reached whereby the strategy can be activated (there is not a comprehensive list of what is necessary to activate the GDS, though there are guidelines) then government will intervene to manage stocks.

The strategy addresses short-term oil supply disruptions only. *The New Zealand Energy Strategy*, the *New Zealand Energy Efficiency and Conservation Strategy* and the *New Zealand Transport Strategy* cover longer-term disruptions. These strategies are intended to reduce New Zealand's reliance on oil over time, which will thereby increase resilience. If an oil supply disruption occurs as part of a wider national emergency, this GDS would be part of the all-of-government response under the system of domestic and external security coordination (DESC).

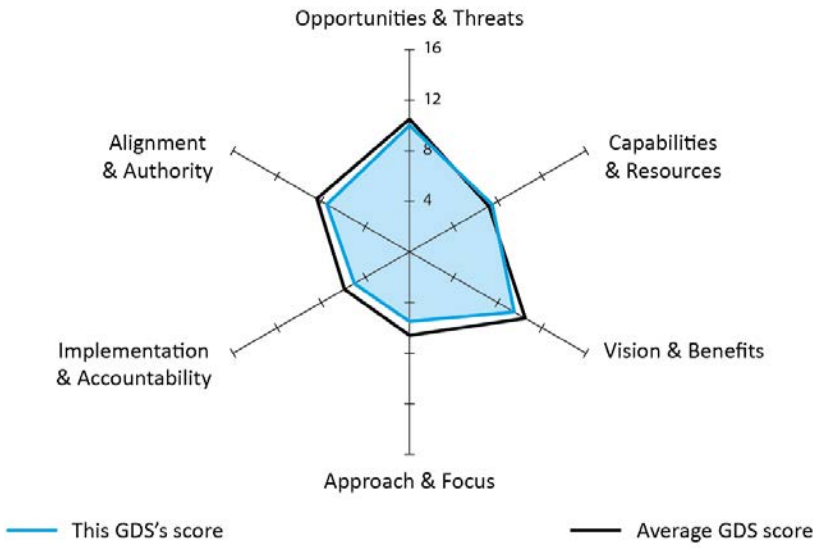
The strategy focuses on disruptions to oil supplies that require a national response. For local or regional emergencies, civil defence response plans are more appropriate.

New Zealand is required due to its membership of the International Energy Agency (IEA) to hold 90 days' worth of oil stocks. If an oil supply disruption impacts other IEA states, New Zealand must restrain demand, switch to other fuels, increase domestic production and share available oil if necessary. Some oil stocks are held on 'ticket contracts', which means the government may purchase petroleum if an IEA-declared emergency occurs.

This GDS states that it is of the position that the primary responsibility for responding in an emergency lies with industry, and, except in severe situations, the role of the government is one of coordination.

4. National Health Emergency Plan
Rank 4/7 (83=/136)
Department: Ministry of Health
Sector: Health Sector

Figure 23: National Health Emergency Plan radar chart
Source: McGuinness Institute, 2015[81]



This is the key emergency strategy for health emergencies, which has several response plans nested underneath it (see Figure 24). The approach is to set out the ways that all stakeholders in the health and disability sector would coordinate with other government agencies in an emergency. It discusses a 'national health emergency' as 'the point at which usual resources are overwhelmed or have the potential to be overwhelmed'.

The GDS is long and technical, with a structure that is difficult to navigate. However, the strategic history and lineage of the GDS is discussed comprehensively. There is insufficient information on how the outcomes sought would be achieved in the event of an emergency. Feedback and review processes for the public are discussed at the beginning of the GDS, and MoH discusses where electronic versions of the GDS can be found.

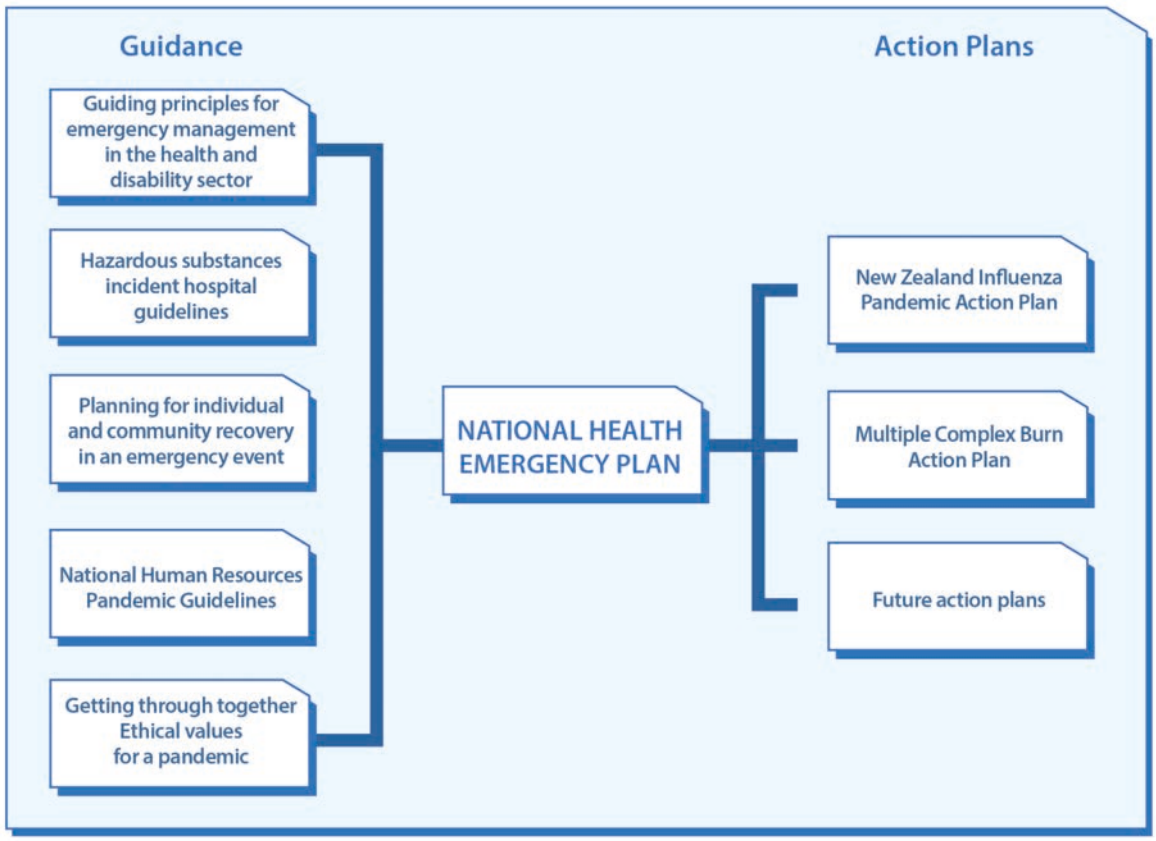
The GDS describes the strategic relationships for emergency management across the health sector using the 'four Rs' (reduction, readiness, response and recovery).

81 See the radar chart on the profile and a PDF of the strategy document on *The GDS Index 2015* website at http://gdsindexnz.org/profiles/

The GDS:

- ‘outlines the structure of emergency management in New Zealand and how the health and disability sector fits within it, and it provides a high-level description of responsibilities held by local and regional groupings compared to those held at the national level by MoH;
- provides the health and disability sector with guidance and strategic direction on its approach to planning for and responding to health emergencies in New Zealand; and
- provides other organisations and government agencies with contextual information on emergency management in the health sector and the structure the health and disability sector uses in response to an emergency.’

Figure 24: Illustration of the relationship between guidance and action
Source: Ministry of Health, 2008

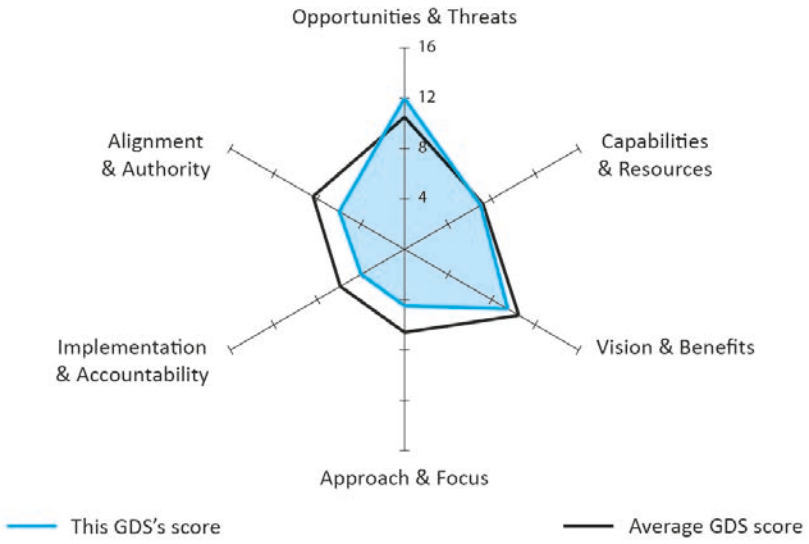


The MoH website noted: *This National Health Emergency Plan describes the larger context within which the Ministry of Health and all New Zealand health services will function during any national health-related emergency, including New Zealand’s responsibilities under international agreements and regulations*.[82]

82 See http://www.health.govt.nz/our-work/emergency-management/national-health-emergency-plan

5. National Health Emergency Plan: Mass Casualty Action Plan
Rank 5/7 (98=/136)
Department: Ministry of Health
Sector: Health Sector

Figure 25: National Health Emergency Plan: Mass Casualty Action Plan radar chart
Source: McGuinness Institute, 2015[83]

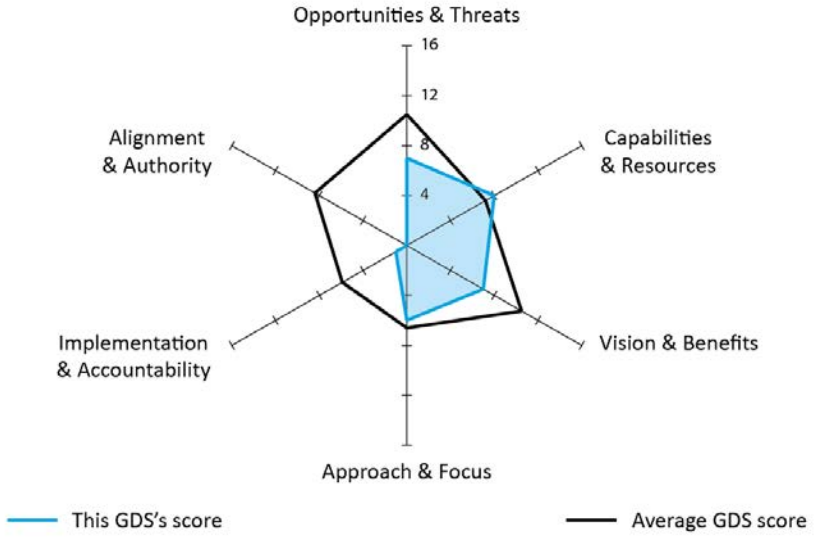


The approach is to guide and coordinate the health sector response in the event of an emergency. The key points of the issue are clear. This GDS is a sub-plan of the *National Health Emergency Plan 2008*, and that GDS explains how it integrates with this GDS. The outcomes sought are hypothetical (i.e. an emergency situation), but the ways that they would be achieved if necessary are still clear. Even though the GDS is dealing with hypothetical events, the GDS is lacking discussion of how it may be reviewed.

83 See the radar chart on the profile and a PDF of the strategy document on *The GDS Index 2015* website at http://gdsindexnz.org/profiles/

6. National Health Emergency Plan: National Reserve Supplies Management and Usage Policies, 3rd Edition
Rank 6/7 (131/136)
Department: Ministry of Health
Sector: Health Sector

Figure 26: National Health Emergency Plan: National Reserve Supplies Management and Usage Policies, 3rd Edition radar chart
Source: McGuinness Institute, 2015[84]



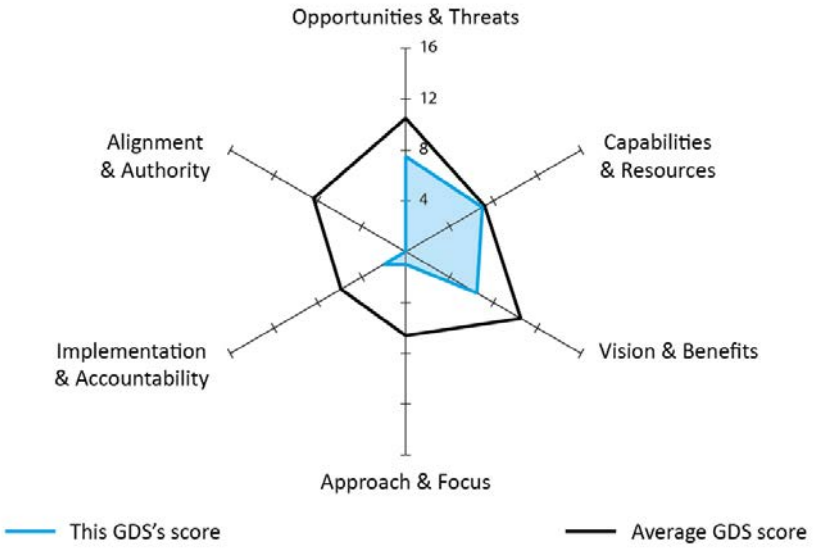
The approach is to prepare district health boards and the MoH for an emergency by setting out the procedures for allocation of national health reserve supplies during this time.

The key points of the issue are simple and set out sufficiently, as this GDS deals with one specific issue. There is a lack of information as to how the outcomes sought will be achieved. The overall purpose of the GDS is clear despite the GDS being of a very technical nature; however, the strategic outcomes are less clear. There is no discussion of review in the GDS.

84 See the radar chart on the profile and a PDF of the strategy document on *The GDS Index 2015* website at http://gdsindexnz.org/profiles/

7. National Health Emergency Plan: H5N1 Pre-Pandemic Vaccine Usage Policy
Rank 7/7 (135/136)
Department: Ministry of Health
Sector: Health Sector

Figure 27: National Health Emergency Plan: H5N1 Pre-Pandemic Vaccine Usage Policy (Revised 2013) radar chart
Source: McGuinness Institute, 2015[85]



The approach is to detail the distribution processes of the H5N1 vaccine by highlighting the bodies that would carry out the distribution (district health boards and the New Zealand Defence Force) and their roles in this process. The key points of the issue are sufficiently explained; however, the GDS would benefit from more information on the time frames of the hypothetical distribution process. The GDS lacks information on how the outcomes will be achieved. The strategic outcomes are not clear due to the nature of the GDS, and there is no provision for review.

The GDS explains that the agencies and occupational groups to be offered the vaccine will be identified and prioritised in the national interest. The overall aim of the policy is to maximise the effectiveness of New Zealand's pandemic response and maintain essential government and health services during this time through the effective use of vaccines.

85 See the radar chart on the profile and a PDF of the strategy document on *The GDS Index 2015* website at http://gdsindexnz.org/profiles/

c) Operational response plans

1. The New Zealand Influenza Pandemic Plan: A framework for action 2010[86]

The plan covers both preparation for, and response to, an influenza pandemic. It is part of the *National Health Emergency Plan*.

It is divided into three parts.

Part A covers the general approach to pandemic planning across MoH, district health boards and the entirety of government. Resource allocation and broader strategic issues are covered, as well as coordination concerns.

Part B articulates the phases of a pandemic and identifies itself as the 'action plan'. Guidance is set out for each phase for the appropriate agencies and persons. The phases of a pandemic give this section its structure. It also makes reference to the authority under which action can be taken. Allowance is made for responding to diverse and unexpected circumstances.

Part C contains more specific information regarding the measures in Part B. The plan is written for both the public and health sector professionals.

2. National Civil Defence Emergency Management Fuel Plan[87]

This document was designed under the Civil Defence Emergency Management Act 2002. It sits alongside the *National Civil Defence Emergency Management Plan*, and its *Guide*, which is much wider in scope, and also the *National Civil Defence Emergency Management Strategy*. The plan explains how it links to the *Oil Emergency Response Plan*: 'The *Oil Emergency Response Strategy* (OERS) is published by MBIE and details potential government response to a major disruption of fuel supplies. The *OERS Operational Handbook* details the processes for implementing fuel specification relaxation measures, fuel rationing, and other response options which may be useful for certain significant regional disruptions during emergencies.'

3. Guides developed under the National Health Emergency Plan

Guidance documents include:

- Guiding Principles for Emergency Management Planning in the Health and Disability Sector (2005)[88]
- Hazardous Substances Incident Hospital Guidelines (2005)[89]
- Planning for Individual and Community Recovery in an Emergency Event (2007)[90]
- Getting Through Together: Ethical Values for a Pandemic (2007)[91]
- Infectious Diseases (2004)[92]

86 See http://www.health.govt.nz/system/files/documents/publications/nzipap-part-a-setting-the-scene.pdf
87 See http://www.civildefence.govt.nz/assets/Uploads/publications/sp-03-12-national-cdem-fuel-plan-part-a.pdf
88 See http://www.health.govt.nz/publication/national-health-emergency-plan-guiding-principles-emergency-management-planning-health-and
89 See http://www.health.govt.nz/publication/national-health-emergency-plan-hazardous-substances-incident-hospital-guidelines
90 See http://www.health.govt.nz/publication/national-health-emergency-plan-planning-individual-and-community-recovery-emergency-event
91 See http://www.health.govt.nz/publication/getting-through-together-ethical-values-pandemic

d) Miscellaneous Emergency Resource Management Information

1. Electricity security

Under the Electricity Industry Act 2010, the Electricity Authority is required to promote a reliable supply in the electricity industry.[93]

Many agencies are concerned with the supply of electricity in New Zealand, for example the Commerce Commission[94] and the System Operator[95] (Transpower).

The Government's 2009 electricity market review recommended a large range of proposals designed to increase security of supply. Initiatives such as the phasing out of the reserve energy scheme and the creation of incentives for market actors to manage supply risk are examples of this.[96]

2. Oil Security Review 2012[97]

In 2011 and 2012 MBIE ran studies into New Zealand's oil security. These studies examined possible domestic and international supply disruptions. Proposals were produced to improve New Zealand's oil security, including:

- additional storage capacity for oil;
- additional truck capacity for transport;
- construction of a link between the Refinery Auckland Pipeline and the Wiri Airport Pipeline; and
- demands for side measures including adoption of more fuel-efficient vehicles.

The reports were carried out by the New Zealand Institute of Economic Research (NZIER), and Hale and Twomey and found that non-regulatory measures could be used to improve oil security.

92 See http://www.health.govt.nz/publication/national-health-emergency-plan-infectious-diseases
93 See http://www.legislation.govt.nz/act/public/2010/0116/latest/DLM2634339.html
94 See http://www.comcom.govt.nz/regulated-industries/electricity/electricity-role
95 See http://www.systemoperator.co.nz/security-supply
96 See http://www.med.govt.nz/sectors-industries/energy/electricity/implementing-electricity-market-review-recommendations
97 See http://www.med.govt.nz/sectors-industries/energy/energy-security/oil-security/oil-security-review-2012

Appendix 4: Relevant Legislation

The table below outlines key components of New Zealand's civil defence emergency management framework, as adapted from the *Briefing to the Incoming Minister of Civil Defence* (8 October 2014)[98] and the CDEM website.[99]

Table 1: Key components of New Zealand's civil defence emergency management legislation

Component	Description	Purpose(s)
Civil Defence Emergency Management Act 2002 (the CDEM Act)	The key underlying principles of the Act are regional and local cooperation and coordination. The Act gives CDEM Groups and their member local authorities responsibility to manage, and plan for, hazards and risks at the local level. It replaced the Civil Defence Act 1983. When an emergency event is of national significance, a national emergency can be declared by the Minister of Civil Defence over all, or part of, New Zealand. Once this declaration is made, the Director of Civil Defence Emergency Management, or other delegated person, will become the National Controller and will be responsible for coordinating the response to the emergency.	• To provide a basis for the integration of national and local planning • To encourage the coordination of planning and activities across the wide range of agencies and organisations preventing or managing emergencies • To improve and promote the sustainable management of hazards • To encourage and enable communities to achieve acceptable levels of risk.

98 See http://www.civildefence.govt.nz/assets/Uploads/publications/Final-MCDEM-BIM-2014.pdf

99 See http://www.civildefence.govt.nz/cdem-sector/cdem-framework/legislation-and-regulations, http://www.civildefence.govt.nz/cdem-sector/cdem-framework/national-civil-defence-emergency-management-plan, http://www.civildefence.govt.nz/cdem-sector/cdem-framework/civil-defence-emergency-management-act-2002 and http://www.civildefence.govt.nz/assets/Uploads/publications/cdem-act-2002-introduction-brochure.pdf

Component	Description	Purpose(s)
Civil Defence Emergency Management Regulations 2003 (the CDEM Regulations)	The CDEM Regulations 2003 came into force on 1 June 2003.	The Regulations cover: • The form and use of the civil defence logo • The form for search warrants • The forms for declaring, extending, and terminating a state of national or local emergency.
National Civil Defence Emergency Management Strategy 2008 (the CDEM Strategy)	The Strategy provides the vision and strategic direction for CDEM and includes the government's vision of a resilient New Zealand with communities understanding and managing their hazards.	• To increase awareness, understanding, preparedness and participation in civil defence emergency management • To reduce the risks from hazards to New Zealand • To enhance New Zealand's capability to manage civil defence emergencies • To enhance New Zealand's capability to recover from civil defence emergencies. Note: An updated *CDEM Strategy* is expected in 2017.
National Civil Defence Emergency Management Plan 2005 (the CDEM Plan)	The National CDEM Plan is a statement of the principles, arrangements and commitments that apply to the management of significant emergencies. The National Civil Defence Emergency Management Plan was made by Order in Council on 14 November 2005, and became operational in conjunction with The Guide to the National Civil Defence Emergency Management Plan on 1 July 2006.	• To set out how government will manage a national emergency and how it will support Groups in their management of local emergencies. Note: Submissions on the revised National Civil Defence Emergency Management Plan closed on 25 July 2014. A new plan is expected shortly.
The Guide to the National Civil Defence Emergency Management Plan 2006 (the CDEM Guide)	The Guide to the National CDEM Plan accompanies the National Plan.	It is a publication that provides further operational detail. • Note: An updated *Guide* (to accompany the updated *Plan)* is expected shortly.

Relevant excerpts from the legislation that relate directly to supply chain management and resilience are:

a) Civil Defence Emergency Management Act 2002;
b) National Civil Defence Emergency Management Plan Order 2005;
c) Epidemic Preparedness Act 2006; and
d) Health Act 1956 – Part 3 (amended 2006)

Other legislation containing provisions relating to hazard risk mitigation and emergency management, not included in this appendix are the Biosecurity Act 1993, the Building Act 2004 and the Building Code, the Local Government Act 2002, the Policing Act 2008 and the Resource Management Act 1991.

A: Civil Defence Emergency Management Act 2002

3 Purpose

The purpose of the CDEM Act 2002, is to*:*

a) improve and promote the sustainable management of hazards (as that term is defined in this Act) in a way that contributes to the social, economic, cultural, and environmental well-being and safety of the public and also to the protection of property; and

b) encourage and enable communities to achieve acceptable levels of risk (as that term is defined in this Act), including, without limitation,—

   i) identifying, assessing, and managing risks; and
   ii) consulting and communicating about risks; and
   iii) identifying and implementing cost-effective risk reduction; and
   iv) monitoring and reviewing the process; and

c) provide for planning and preparation for emergencies and for response and recovery in the event of an emergency; and

d) require local authorities to co-ordinate, through regional groups, planning, programmes, and activities related to civil defence emergency management across the areas of reduction, readiness, response, and recovery, and encourage co-operation and joint action within those regional groups; and

e) provide a basis for the integration of national and local civil defence emergency management planning and activity through the alignment of local planning with a national strategy and national plan; and

f) encourage the co-ordination of emergency management, planning, and activities related to civil defence emergency management across the wide range of agencies and organisations preventing or managing emergencies under this Act and the Acts listed in section 17(3).

4 Interpretation

emergency means a situation that—

a) is the result of any happening, whether natural or otherwise, including, without limitation, any explosion, earthquake, eruption, tsunami, land movement, flood, storm, tornado, cyclone, serious fire, leakage or spillage of any dangerous gas or substance, technological failure, infestation, plague, epidemic, failure of or disruption to an emergency service or a lifeline utility, or actual or imminent attack or warlike act; and

b) causes or may cause loss of life or injury or illness or distress or in any way endangers the safety of the public or property in New Zealand or any part of New Zealand; and

c) cannot be dealt with by emergency services, or otherwise requires a significant and co-ordinated response under this Act

hazard means something that may cause, or contribute substantially to the cause of, an emergency

lifeline utility means an entity named or described in Part A of Schedule 1, or that carries on a business described in Part of Schedule 1

national significance includes, without limitation, any case where the Minister or the Director considers that—

a) there is widespread public concern or interest; or

b) there is likely to be significant use of resources; or

c) it is likely that the area of more than 1 Civil Defence Emergency Management Group will be affected; or

d) it affects or is likely to affect or is relevant to New Zealand's international obligations; or

e) it involves or is likely to involve technology, processes, or methods that are new to New Zealand; or

f) it results or is likely to result in or contribute to significant or irreversible changes to the environment (including the global environment)

risk means the likelihood and consequences of a hazard

8 Appointment and functions of Director of Civil Defence Emergency Management

1) The chief executive of the responsible department may appoint under the State Sector Act 1988 a suitably qualified and experienced person as the Director of Civil Defence Emergency Management.

2) The functions of the Director are to—

a) provide advice to the Minister on matters relating to civil defence emergency management:

b) identify hazards and risks that the Director considers are of national significance:

c) monitor and evaluate the national civil defence emergency management strategy:

d) develop, monitor, and evaluate the national civil defence emergency management plan:

e) develop, in consultation with the relevant persons and organisations that have responsibilities under this Act, any guidelines, codes, or technical standards that may be required for the purposes of this Act:

f) monitor the performance of Civil Defence Emergency Management Groups and persons who have responsibilities under this Act:

g) promote civil defence emergency management that is consistent with the purpose of this Act:

h) during a state of national emergency, direct and control for the purposes of this Act the resources available for civil defence emergency management.

3) The Director also has any other functions that are conferred or imposed on the Director by or under this Act or any other enactment.

9 Powers of Director

1) The Director has all the powers that are reasonably necessary or expedient to enable the Director to perform his or her functions.

2) Without limiting the generality of subsection (1), the Director may—

a) co-ordinate the use of and, during a state of national emergency, use, for the purposes of this Act, the personnel, material, information, services, and any other resources made available by departments, Civil Defence Emergency Management Groups, emergency services, New Zealand Defence Force (as provided in the Defence Act 1990), and other persons and in particular, without limitation, for—

i) the provision of transport:
ii) the removal of endangered persons and casualties from any area affected by the emergency to areas of safety or to hospitals:
iii) medical care and attention to casualties:
iv) the relief of distress and suffering:
v) the accommodation, feeding, care, and protection of persons:
vi) the provision of other services necessary to restore community services and provide for the welfare of the public:

b) during a state of national emergency, control the exercise and performance of the functions, duties, and powers of Civil Defence Emergency Management Groups and Group Controllers:

c) enter into arrangements, including employment arrangements, with any person for the purpose of carrying out civil defence emergency management as may be agreed:

d) devise, promote, and carry out, or cause to be carried out, research and investigations into matters relating to civil defence emergency management:

e) issue or cause to be issued warnings of hazards:

f) disseminate information and advice on matters relating to civil defence emergency management:

g) promote and carry out, or cause to be carried out, the training of personnel for civil defence emergency management purposes:

h) co-ordinate the planning of civil defence emergency management between Civil Defence Emergency Management Groups:

i) advise in relation to, and assist in the planning, preparation, co-ordination, and carrying out of, civil defence emergency management.

3) Without limiting the generality of subsection (1), the Director may issue guidelines, codes, or technical standards to any person or organisation with responsibilities under this Act, including guidelines, codes, or technical standards for—

a) the establishment and operation of Civil Defence Emergency Management Groups and Co-ordinating Executive Groups:

b) the development of Civil Defence Emergency Management Group plans and operational plans for responding to specific emergencies:

c) the development of Civil Defence Emergency Management plans by the Crown, local government agencies, emergency services, and lifeline utilities:

d) the operational role of controllers, recovery co-ordinators, and other persons with responsibilities under this Act:

e) any other matters that—

i) the Director considers necessary; and
ii) are consistent with the purposes of this Act.

10 Delegation of certain functions and powers of Director to National Controller

1) The Director may, in writing, either generally or particularly, delegate to any person the functions and powers of the Director referred to in sections 8(2)(h) and 9(2)(a) for the purposes of dealing with any state of national emergency.

2) The Director may exercise the power of delegation at any time, whether or not a state of national emergency is in force or is imminent.

3) A person to whom functions and powers are delegated under this section is, while the delegation is in force, the National Controller, and has all the powers conferred on the National Controller by this Act.

4) If no delegation has been made under this section, the Director is the National Controller and has all the powers conferred on the National Controller by this Act.

31 National civil defence emergency management strategy

1) The Minister must, on behalf of the Crown, complete a national civil defence emergency management strategy.

2) The national civil defence emergency management strategy may include statements of—

a) the Crown's goals in relation to civil defence emergency management in New Zealand:

b) the objectives to be pursued to achieve those goals:

c) the measurable targets to be met to achieve those objectives.

39 National civil defence emergency management plan

1) The Governor-General may, by Order in Council made on the recommendation of the Minister, make a national civil defence emergency management plan.

2) The national civil defence emergency management plan must state and provide for:

a) the hazards and risks to be managed at the national level:

b) the civil defence emergency management necessary at the national level to manage the hazards and risks described under paragraph (a):

c) the objectives of the plan and the relationship of each objective to the national civil defence emergency management strategy:

d) the co-ordination of civil defence emergency management during a state of national emergency:

e) the period for which the plan remains in force.

60 Duties of lifeline utilities

Every lifeline utility must—

a) ensure that it is able to function to the fullest possible extent, even though this may be at a reduced level, during and after an emergency

b) make available to the Director in writing, on request, its plan for functioning during and after an emergency:

c) participate in the development of the national civil defence emergency management strategy and civil defence emergency management plans:

d) provide, free of charge, any technical advice to any Civil Defence Emergency Management Group or the Director that may be reasonably required by that Group or the Director:

e) ensure that any information that is disclosed to the lifeline utility is used by the lifeline utility, or disclosed to another person, only for the purposes of this Act.

Schedule 1 Lifeline utilities

Part A
Specific entities

1) Radio New Zealand Limited and Television New Zealand Limited.

2) The company (as defined in section 2 of the Auckland Airport Act 1987) that operates Auckland international airport.

3) The company (as defined in section 2 of the Wellington Airport Act 1990) that operates Wellington international airport.

4) The airport company (as defined in section 2 of the Airport Authorities Act 1966) that operates Christchurch international airport.

5) The entity (being an airport authority as defined in section 2 of the Airport Authorities Act 1966, whether or not it is also an airport company as defined in that section) that operates the primary airport at Bay of Islands, Blenheim, Dunedin, Gisborne, Hamilton, Hokitika, Invercargill, Napier, Nelson, New Plymouth, Palmerston North, Queenstown, Rotorua, Tauranga, Wanganui, Westport, Whakatane, or Whangarei.

6) The port company (as defined in section 2(1) of the Port Companies Act 1988) that carries out port-related commercial activities at Auckland, Bluff, Port Chalmers, Gisborne, Lyttelton, Napier, Nelson, Picton, Port Taranaki, Tauranga, Timaru, Wellington, Westport, or Whangarei.

7) The Grey District Council, acting as the Greymouth harbour authority and owner and operator of the Port of Greymouth under Parts 4 and 6 of the Local Government (West Coast Region) Reorganisation Order 1989, Part 39A of the Local Government Act 1974, and section 16 of the Local Government Amendment Act (No 2) 1999.

Part B
Entities carrying on certain businesses

1) An entity that produces, supplies, or distributes manufactured gas or natural gas (whether it is supplied or distributed through a network or in bottles of more than 20 kg of gas).

2) An entity that generates electricity for distribution through a network or distributes electricity through a network.

3) An entity that supplies or distributes water to the inhabitants of a city, district, or other place.

4) An entity that provides a waste water or sewerage network or that disposes of sewage or storm water.

5) An entity that provides a telecommunications network (within the meaning of the Telecommunications Act 1987).

6) An entity that provides a road network (including State highways).

7) An entity that produces, processes, or distributes to retail outlets and bulk customers any petroleum products used as an energy source or an essential lubricant or additive for motors for machinery.

8) An entity that provides a rail network or service.

B: National Civil Defence Emergency Management Plan Order 2005

1 Interpretation

DESC means the system of domestic and external security co-ordination used by the Government to manage all national crises

DPMC means the Department of the Prime Minister and Cabinet

NCMC means the National Crisis Management Centre

ODESC means the Committee of Officials for Domestic and External Security Co-ordination

12 System of domestic and external security co-ordination (DESC)

1) DESC is used by central government for the management of significant crises or security events where impacts of national significance warrant the co-ordination of national effort.

2) DESC operates at a strategic level to co-ordinate whole-of-government planning and prioritising.

3) DESC brings together information for Ministers, co-ordinates analysis and development of options, and assists decision making in Cabinet.

4) DESC is collective without affecting the existing responsibilities of Ministers or departments.

5) At the strategic level ODESC exercises policy oversight and advises the Prime Minister, Cabinet, and, when activated, the Cabinet Committee on Domestic and External Security Co-ordination chaired by the Prime Minister.

6) At the operational level a lead agency (which is MCDEM in the case of a civil defence emergency) monitors and assesses the situation, co-ordinates national support, reports to ODESC, and provides policy advice. In a national emergency, the lead agency directs and manages operational responses on the ground.

7) ODESC—

   a) is a group of senior officials; and

   b) is chaired by the DESC co-ordinator, normally the chief executive of DPMC; and

   c) supports Ministers in developing high-level strategic direction, policy, and priorities, and in authorising additional resources to deal with crises; and

   d) is the strategic mechanism for co-ordinating a whole-of-government response to events.

8) ODESC is supported by government public service departments, non-public service departments, and groups of officials drawn from those departments to provide a whole-of-government overview, to address particular issues, and to co-ordinate strategic level public communications.

13 Ministry of Civil Defence and Emergency Management (MCDEM)

1) MCDEM is the agency in central government that co-ordinates the civil defence emergency management necessary during states of national emergency or civil defence emergencies of national significance.

2) At the operational level for civil defence emergency management events, MCDEM—

   a) monitors and assesses the impact at the site of the event; and

   b) provides operational support for civil defence emergency management activities at the local level; and

   c) co-ordinates the operational response of government and national resources during states of national emergency or civil defence emergencies of national significance.

3) When DESC is activated for civil defence emergency management events, MCDEM, as lead agency, provides advice to, and takes strategic direction from, ODESC.

4) In fulfilling these functions, MCDEM will—

   a) use NCMC facilities and establish linkages with relevant CDEM Groups and agencies; and

   b) co-ordinate clusters of agencies engaged in common areas of civil defence emergency management activity; and

   c) provide national co-ordination for recovery activities.

14 Other agencies

1) Other agencies with civil defence emergency management operational roles will co-ordinate with MCDEM or through established clusters to provide integrated and co-ordinated inter-agency responses.

2) Each agency remains responsible for the management of its own response.

3) Particular agencies may be requested to be represented at the level of ODESC and report to ODESC on their respective area of responsibility and respond to strategic direction from ODESC.

15 Director of Civil Defence Emergency Management (Director)

1) The responsibilities of the Director are, in part, to—

a) co-ordinate, for the purposes of civil defence emergency management, the use of resources made available under this plan; and

b) during a state of national emergency,—

i) direct and control, for the purposes of civil defence emergency management, the use of resources made available under this plan; and

ii) control the exercise and performance of the functions, duties, and powers of CDEM Groups and group controllers; and

c) ensure the Minister and ODESC are adequately briefed on the situation in a disaster area; and

d) inform the Minister and ODESC of assistance likely to be required for response and recovery operations; and

e) establish processes under this plan that will allow response and recovery to be effected for the emergency; and

f) recommend to Cabinet any special policies for implementation of civil defence emergency management support; and

g) exercise the powers under sections 8(2) and 9(2) of the Act.

2. The Director is a member of ODESC.

16 National Controller

1) A National Controller can be—

a) appointed by the Director; and

b) delegated the Director's functions and powers under sections 8(2)(h) and 9(2)(a) of the Act.

2) If appointed—

a) a National Controller:

i) during the state of a national emergency, directs, controls, and co-ordinates, for the purposes of civil defence emergency management, the use of resources made available under this plan; and

ii) during a civil defence emergency of national significance, co-ordinates national resources to support the local response; and

b) a National Controller co-ordinates international operational support with the Ministry of Foreign Affairs and Trade.

3) If a National Controller is not appointed the Director retains the powers under sections 8(2)(h) and 9(2)(a) of the Act.

53 Nationwide levels of civil defence emergency management operation

1) The following are the 5 indicative levels of civil defence emergency management operation and the co-ordination or support (or both) required for each:

a) level 1: single-agency incidents with on-site co-ordination:

b) level 2: multi-agency incidents with on-site, local co-ordination; these are managed by the incident controller of the relevant lead agency:

c) level 3: a multi-agency emergency led by an agency other than a CDEM Group, or a state of local emergency at below CDEM Group-level (district or ward); at this level, CDEM Group support and co-ordination will be required and may be monitored by the National Controller:

d) level 4: a multi-agency emergency with more significant consequences than in level 3; co-ordination may be required between agencies or areas or both; CDEM Group-level support and co-ordination is required; the actual or potential need for a declaration of a state of local emergency by a CDEM Group requires consideration; national monitoring will occur and national support is available:

e) level 5: a state of national emergency exists or the civil defence emergency is of national significance; at this level, co-ordination by the National Controller will be required.

2) Local arrangements continue to operate throughout all levels.

3) The Director or National Controller can use NCMC facilities at any time to monitor or support a civil defence emergency irrespective of the CDEM Group level of operation.

4) National agency cluster groups will be activated, to a level required to support the civil defence emergency, at the direction of the National Controller.

64 Principles of NCMC activation

1) Following notification or warning of a civil defence emergency, national agencies with lead roles are to act in support of government crisis management arrangements at a speed and to a level commensurate with the threat. Emergencies requiring a whole-of-government response may require activation of NCMC by ODESC on the recommendation of the responsible lead agency for this purpose.

2) ODESC is responsible for the general management, development, and maintenance of NCMC. ODESC has delegated day-to-day responsibilities for this to MCDEM. NCMC is kept in a constant state of readiness for activation by a lead agency.

68 Principles

1) To ensure that consistent information is available to support decision making at the national level, the following must occur:

   a) the relevant territorial authority gives situation reports to the CDEM Group; and

   b) the affected CDEM Groups, along with emergency services communications centres, report the situation to the National Controller (or, in the absence of the National Controller, to the Director); and

   c) the National Controller (or, in the absence of the National Controller, the Director) provides appropriate consolidated reports, when appropriate, to—

      i) the Minister; and
      ii) ODESC; and
      iii) CDEM Groups; and
      iv) emergency services communications centres; and
      v) other responding agencies.

C: Epidemic Preparedness Act 2006

3 Purpose

1) The principal purpose of this Act is to ensure that there is adequate statutory power for government agencies—

a) to try to prevent the outbreak of epidemics in New Zealand; and
b) to respond to epidemics in New Zealand; and
c) to respond to certain possible consequences of epidemics (whether occurring in New Zealand or overseas).

2) This Act also has the following purposes:

a) to ensure that certain activities normally undertaken by people and agencies interacting with government agencies can continue to be undertaken during an epidemic in New Zealand:

b) to enable the relaxation of some statutory requirements that might not be capable of being complied with, or complied with fully, during an epidemic.

5 Prime Minister may enable use of special powers

1) With the agreement of the Minister of Health, the Prime Minister may, by notice in the Gazette, declare that he or she is satisfied that the effects of an outbreak of a stated quarantinable disease (within the meaning of the Health Act 1956) are likely to disrupt or continue to disrupt essential governmental and business activity in New Zealand (or stated parts of New Zealand) significantly.

2) Subsection 1) applies whether the outbreak is occurring within New Zealand or overseas.

3) If not renewed under section 7(1), the notice expires on the earliest of the following:

a) The day 3 months after its commencement:
b) A day stated in the notice:
c) A day stated for the purpose by the Prime Minister by further notice in the Gazette.

4) The Prime Minister must not give the notice except on, and after considering, the written recommendation of the Director General of Health.

5) As soon as is possible after giving the notice, the Prime Minister must present a copy to the House of Representatives.

6) While the notice is in force, further notices may be given modifying its effect—

a) by lifting its application from stated parts of New Zealand; or
b) in the case of an epidemic notice that applies to only stated parts of New Zealand—

i) by extending its application to other stated parts of New Zealand; or
ii) by extending its application to the whole of New Zealand.

7) After the notice expires, a new notice can be given in respect of the same disease.

7 Renewal and modification of epidemic notices

1) With the agreement of the Minister of Health, the Prime Minister may, by notice in the Gazette given before an epidemic notice expires, renew that notice.

2) The Prime Minister must not give a notice under subsection (1)—

a) except on, and after considering, the written recommendation of the Director-General of Health; and

b) Unless he or she is satisfied that the effects of the outbreak concerned are likely to continue to disrupt essential governmental and business activity in New Zealand (or the parts of New Zealand concerned) significantly.

3) If renewed under subsection (1), an epidemic notice expires on the earliest of the following:

a) the day 3 months after the commencement of the most recent notice renewing it:

b) a day stated in the most recent notice renewing it:

c) a day stated for the purpose by the Prime Minister by further notice in the Gazette.

4) As soon as is possible after the giving of a notice under subsection (1), the Prime Minister must present a copy to the House of Representatives.

D: Health Act 1956 – Part 3 (amended 2006)

70 Special powers of medical officer of health

1) For the purpose of preventing the outbreak or spread of any infectious disease, the medical officer of health may from time to time, if authorised to do so by the Minister or if a state of emergency has been declared under the Civil Defence Emergency Management Act 2002 or while an epidemic notice is in force:

a) declare any land, building, or thing to be insanitary, and prohibit its use for any specified purpose:

b) cause any insanitary building to be pulled down, and the timber and other materials thereof to be destroyed or otherwise disposed of as he thinks fit:

c) cause insanitary things to be destroyed or otherwise disposed of as he thinks fit:

d) cause infected animals to be destroyed in such manner as he thinks fit:

e) require persons to report themselves or submit themselves for medical examination at specified times and places:

ea) if the spread of the disease would be a significant risk to the public, require people to report, or submit themselves for medical testing, at stated times and places:

f) require persons, places, buildings, ships, vehicles, aircraft, animals, or things to be isolated, quarantined, or disinfected as he thinks fit:

fa) if the spread of the disease would be a significant risk to the public, require people, places, buildings, ships, vehicles, aircrafts, animals, or things to be tested as he or she thinks fit:

g) forbid persons, ships, vehicles, aircraft, animals, or things to come or be brought to any port or place in the health district from any port or place which is or is supposed to be infected with any infectious disease:

h) require people to remain in the health district or the place in which they are isolated or quarantined until they have been medically examined and found to be free from infectious disease, and until they have undergone such preventive treatment as he may in any such case prescribe:

i) forbid the removal of ships, vehicles, aircraft, animals, or things from the health district, or from one port or part thereof to another, or from the place where they are isolated or quarantined, until they have been disinfected or examined and found to be free from infection:

j) prohibit the keeping of animals or of any species of animal in any specified part of the health district:

k) forbid the discharge of sewage, drainage, or insanitary matter of any description into any watercourse, stream, lake, or source of water supply:

l) use or authorise any local authority to use as a temporary site for a special hospital or place of isolation any reserve or endowment suitable for the purpose, notwithstanding that such use may conflict with any trust, enactment, or condition affecting the reserve or endowment:

la) by written order to the person appearing to be in charge of the premises concerned, do either or both of the following:

i) require to be closed immediately, until further order or for a fixed period, any premises within the health district (or a stated area of the district):

ii) require to be closed immediately, until further order or for a fixed period, any premises within the health district (or a stated area of the district) in which infection control measures described in the order are not operating:

m) by order published in a newspaper circulating in the health district or by announcement broadcast by a television channel or radio station that can be received by most households in the health district, do any of the following:

i) require to be closed immediately, until further order or for a fixed period, any premises within the health district (or a stated area of the district):

ii) require to be closed immediately, until further order or for a fixed period, any premises within the health district (or a stated area of the district) in which infection control measures described in the order are not operating:

iii) forbid people to congregate in outdoor places of amusement or recreation of any stated kind or description (whether public or private) within the district (or a stated area of the district):

iv) forbid people to congregate in outdoor places of amusement or recreation of any stated kind or description (whether public or private) within the district (or a stated area of the district) in which infection control measures described in the order are not operating.

71 Powers of medical officer of health on outbreak of infectious disease

1) In the event of the outbreak of any infectious disease the medical officer of health, with the authority in writing of the Minister or during a state of emergency declared under the Civil Defence Emergency Management Act 2002 or while an epidemic notice is in force, may—

a) by requisition in writing served on its owner or occupier, take possession of, occupy, and use any land or building (whether public or private) that in his or her opinion is required for the accommodation and treatment of patients:

ab) by requisition in writing served on the owner, occupier, or other person for the time being in charge of it, take possession of, occupy, and use any land, building, vehicle, or craft (other than an aircraft), whether public or private, that in his or her opinion is require for the storage or disposal of bodies:

b) by requisition in writing served on the owner or other person for the time being in charge of it, take possession of and use any vehicle or craft, whether public or private, that in his or her opinion is required for the transport of—

i) patients, medical personnel, medicine, medical equipment o devices, food, or drink; or

ii) clothing, bedding, or tents or other temporary facilities or structures; or

iii) personnel involved in loading, moving, unloading, distributing, erecting, or otherwise dealing with anything transported or to be transported under subparagraph (i) or subparagraph (ii):

c) by requisition in writing served on the occupier of any premises or on any person for the time being in charge of any premises, require to be delivered to him or in accordance with his order such drugs and articles of food or drink, and such other materials, as he deems necessary for the treatment of patients.

2) Every person who suffers any loss or damage by the exercise of any of the powers conferred on the medical officer of health by this section shall be entitled to compensation to be determined in case of dispute by a District Court, whose decision shall be final.

3) Every person who refuses or fails to comply with any requisition under this section, or who counsels, procures, aids, or incites any other person so to do, or who interferes with or obstructs the medical officer of health or any person acting under the authority of the medical officer of health in the exercise of any powers under this section, commits an offence and is liable on conviction before a District Court Judge to a fine not exceeding $1,000.

72 Offences relating to obstructing medical officer of health or people assisting medical officer of health

A person commits an offence and is liable on conviction to imprisonment for a term not exceeding 6 months, a fine not exceeding $4,000, or both who in any way (directly or indirectly, by act or default—

a) threatens, assaults, or intentionally obstructs or hinders a medical officer of health or any person authorised by a medical officer of health in the exercise or performance of powers or functions under section 70 or 71; or

b) threatens, assaults, or intentionally obstructs or hinders a constable acting under section 71A; or

c) does anything forbidden by a medical officer of health or any person authorised by a medical officer of health under section 70 or 71; or

d) fails or refuses to comply with, or delays complying with, a direction or requirement of a medical officer of health or any person authorised by a medical officer of health given in the exercise of powers or functions under section 70 or 71; or

e) does, or delays ceasing to do, a thing prohibited or forbidden by a medical officer of health or any person authorised by a medical officer of health in the exercise of powers or functions under section 70 or 71.

97 People liable to quarantine

1) A person is liable to quarantine if he or she is on board, or disembarks from, a craft that is liable to quarantine.

2) This subsection applies to a person liable to quarantine if the medical officer of health believes or suspects, on reasonable grounds,—

a) that he or she is infected with a quarantinable disease; or

b) that, within the 14 days before he or she arrived in New Zealand, he or she has been exposed to a disease that (whether or not it was a quarantinable disease at the time of the believed or suspected exposure) is a quarantinable disease.

Appendix 5: Ministry of Civil Defence & Emergency Management (MCDEM) Business Plan 2014/15

Source: Ministry of Civil Defence & Emergency Management, 2014: 10–13[100]

6. Key Risks

Through a risk management process MCDEM identifies its organisational risks and the likelihoods, consequences and mitigations are assessed regularly, and the level of residual risk reappraised. Risks identified by MCDEM are fed into the Department's risk register.

The Department uses a 3 x 3 risk matrix of low medium and high consequences rated against the likelihood of unlikely, possible and likely.

The critical risk areas for MCDEM are grouped into five categories:

- Organisational capacity
- Budget constraints
- ICT system reliability
- National Crisis Management Centre (NCMC) operation
- Stakeholder confidence

The table shows the potential impacts of these risks, the treatments and the current and treated risk assessments.

Functional area	Nature of risk	Impact	Likelihood	Treatment	Impact after treatment
Insufficient staff for routine MCDEM business	Inability to maintain effective performance High work demands and stress on existing staff outputs and CDEM development compromised Reduced credibility Loss of stakeholder confidence		Likely	Ensuring staff are well trained and supported. Work prioritised	Medium
Insufficient resources to produce outputs	Inability to maintain effective performance High work demands and stress on existing staff Outputs and CDEM development compromised Reduced credibility Loss of stakeholder confidence	Medium	Likely	Prioritise work Improve forecasting of outputs and capacities	Low

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100 See http://www.civildefence.govt.nz/assets/Uploads/publications/mcdem-business-plan-2014.pdf

Functional area	Nature of risk	Impact	Likelihood	Treatment	Impact after treatment
Inadequate ICT systems availability and reliability	Poor operational response Loss of stakeholder confidence Prolific adverse media comment	High	Possible	Ensure high collaboration with CASS for support including use of performance based SLA. Maintain system update programme	Medium
NCMC facilities compromised disrupting management of a response	Poor response Loss of stakeholder confidence Prolific adverse media comment	High	Possible	Ensure back-up arrangements are in place, and systems accessible from alternative site. Ensure staff trained to adapt to alternative sites.	Medium
Inadequate NCMC processes for managing a response	Poor response Loss of stakeholder confidence Prolific adverse media comment reputational damage	High	Possible	Continually review and adjust procedures Ensure staff are well trained	Medium
Insufficient trained staff for sustained operation of the NCMC	Lack of capacity to manage the response leading to a poor response Stakeholders lose confidence Adverse media coverage / reputational damage	High	Possible	Implement inter-agency MOU for supplementary staff Ensuring agency staff are knowledgeable and trained	Medium

Functional area	Nature of risk	Impact	Likelihood	Treatment	Impact after treatment
Inadequate training for staff operating the NCMC	Poor response Stakeholders lose confidence Reputational damage	High	Possible	Ensuring staff are well trained and knowledgeable	Low
Scale of response exceeds capabilities of supporting agencies	Poor response Loss of stakeholder confidence Prolific adverse media comment	High	Possible	Collaborate with agencies through exercises and training to build capacity	Low
Inadequate support by MCDEM to CDEM Groups	Adverse media comment	Medium	Possible	Roles and responsibilities well defined. Ensure MCDEM supports Groups to implement M&E actions. REMAs well equipped to support Groups	Low

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7. Finance

The table below shows how the appropriation of $11.102M is budgeted in MCDEM. This budget does not include non-departmental expenditure on reimbursing local government for response costs or funding for the CDEM Resilience Fund.

Branch Output Expenditure	Crown	Third-party	Total
	$(000)	$(000)	*$(000)*
Revenue			
Revenue Crown	10,872		*10,872*
Revenue Department		230	*230*
Revenue Other			*0*
Total Branch Revenue	**10,872**	**230**	***11,102***
Expenditure			
Personnel	4,352		*4,352*
Other Operating	135		*135*
Travel	596	208	*804*
Accommodation	394		*394*
IT & Communications	217	22	*239*
Professional Services/Consulting	498		*498*
Promotion/Publicity	927		*927*
Depreciation	93		*93*
DPMC Overhead	1,253		*1,253*
CASS Charges	2,406		*2,406*
Total Branch Expenditure	**10,872**	**230**	***11,102***
Net Surplus / (Deficit)	**0**	**0**	***0***

Appendix 6: Lead and Supporting Agencies for Managing National Security Issues

Source: Department of the Prime Minister and Cabinet, 2011[101]

The list of lead and supporting agencies for managing national security issues set out below is based on the national risks outlined earlier. It spans a range of issues that have the potential to affect the security of the nation and its people, including those in overlapping areas of regional and international security. Its weighting is to those matters that are mainly national in character, and does not include matters outside that span such as those that affect mainly individual security or international security. It is arranged around the set of six broad national objectives defined earlier. Within those objectives, the listing covers the individual events or circumstances that might threaten national objectives or create uncertainty about their realisation. As this is the first time that such a list has been compiled for security issues in New Zealand, it should be regarded as indicative only pending detailed consultation. It also needs to be noted that (i) while one agency may be designated the lead often the successful handling of an issue will require two or more agencies to lead work together and (ii) the lead will sometimes change on an issue as events develop.

ISSUE	LEAD AGENCY	SUPPORTING AGENCIES
Preserving sovereignty and territorial integrity		
Territorial claims	MFAT	NZDF, Police, LINZ, DPMC
Armed conflict	NZDF	MOD, DPMC, MFAT, GCSB
Maritime threats (NZEEZ, etc)	NZDF	MOD, NMCC, GCSB, MFAT, MNZ
Illegal migrants/People trafficking	DOL	Customs, Police, NZDF, MFAT, GCSB,
Border violations	Customs	DOL (Immigration), Police, MFAT
Smuggling - arms & drugs	Customs	Police
Illegal Fishing	MFish	NZDF, NMCC, MFAT
Strengthening international order to promote security		
Security of NZ's interests abroad	MFAT	DPMC
Peacekeeping	NZDF	MOD, MFAT
Regional disasters	MFAT	DPMC, MCDEM, MOH, NZDF,NZFS
International initiatives	MFAT	NZAID, NZDF
International terrorism	MFAT	Police, DPMC, NZSIS, GCSB, NZDF
Sustaining economic prosperity		
Public transport failure	MOT	Police, NZFS
Int'l sea lane and air lane closures	MOT	MaritimeNZ, NZDF, MFAT
Global financial crisis	Treasury	Reserve Bank, MFAT
Banking services failure or attack	Res Bank	Treasury, MFAT
Commodities price collapse	MED	Treasury, Reserve Bank, MAF, MFAT
International supply chain failure	MED	MFAT, DPMC
Essential commodities	MED	MFAT
Fuel supply	MED	MFAT
Critical infrastructure & assets	MED	MFAT
Ownership/Control of critical land assets	LINZ/TSY	MFAT
Energy security	MED	MFAT
Telecommunications	MED	MFAT
International communications loss	MED	
Structural collapse (eg dam)	MED	MCDEM, MAF, NZFS

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101 See http://www.dpmc.govt.nz/sites/all/files/publications/national-security-system.pdf

Industrial Espionage	MED	Police, NZSIS, GCSB
Science and Technology	MSI	MED, MFAT
Loss of Intellectual Property	MED	MFAT
Bio-security (plant/animal disease)	MAF	Police, MFAT, Reserve Bank, NZDF, MoH
Cyber-security	MED	GCSB, DIA, MFAT
Internet manipulation or restraint	DIA	
Maintaining democratic institutions and national values		
Insurgency	Police	NZDF, NZSIS
Para-military activities	Police	NZDF
Terrorism	NZSIS/Police	NZDF, NZSIS, GCSB
Civil unrest	Police	
Trans-national crime	Police	NZSIS, Customs, MFAT
Organised violence/crime	Police	
Siege/hostage	Police	NZDF
Government systems		DPMC
Protecting elected representatives	Police	
VIP protection	Police	DIA, MFAT
Management of systemic risk	DPMC	
Domestic extremism	NZSIS/Police	
Ensuring public safety		
Food safety	MAF	
Pandemic human influenza	MOH	MAF, MSD, MCDEM, MFAT
Public health crisis	MOH	
Chronic disease	MOH	
Earthquake disaster	MCDEM	Police, NZFS, NZDF, MOH, MSD,MFAT
Volcanic eruption	MCDEM	Police, NRFA, NZDF, MOH, MSD, NZFS,MFAT
Tsunami	MCDEM	Coastguard, Maritime NZ, NZFS, NZDF,MFAT
Extreme meteorological event	Metservice	MCDEM, NZFS
Flooding	MCDEM	Police, NRFA, NZDF, MOH, MSD
Drought	MAF	NRFA, MSD, NZFS
Hazardous materials	NZFS	ESR, NRL, NPC, NZDF
Mass gatherings (eg, RWC)	Police	NZSIS, MED
Mass casualties	MCDEM	Police, MOH, NZDF, NZFS
Mass evacuation	MCDEM	Police, NZDF, NZFS
Protecting the natural environment		
Environmental catastrophe	MfE	Regional Councils, ERMA, DOC, NZFS
Wildfire	NRFA	NZFS, Regional Councils, NZDF
Major marine oil spill	MNZ	NZFS
Pollution	MfE	Regional Councils, MNZ, ERMA, DOC, NZFS
Biosecurity (plant/animal pest/disease)	MAF	Police, MFAT, Reserve Bank, NZDF, MoH

Appendix 7: Trade Statistics

Understanding our export and import interdependencies is one way to obtain tacit knowledge about New Zealand's supply chain risks. Interdependencies need to be understood in terms of countries that may have a disruptive event and as a result: (i) may no longer be in a position to supply critical products and services; or (ii) are in a situation of an extended emergency and are therefore no longer in a position to purchase our products and services. For example, in the late 19th century, New Zealand was very dependent on Britain, see Figure 28. More recent figures indicate we are more diverse, with China and Australia becoming more significant; see Figure 29 and Figure 30.

Export and import dependencies also need to be explored in terms of specific products and services. Today New Zealand imports a great deal more crude materials, mineral fuels, and machinery and transportation equipment than we used to. This may indicate that a supply chain risk may become apparent if New Zealand is isolated as a result of an extended global emergency. Figure 31 and tables 2 and 3 provide an overview, but the weakest link in the supply chain may equally be something very small and inexpensive – for example a particular part or mineral. Identifying risks in New Zealand's supply chain is not easy and will require conversations with core business units and local authorities.

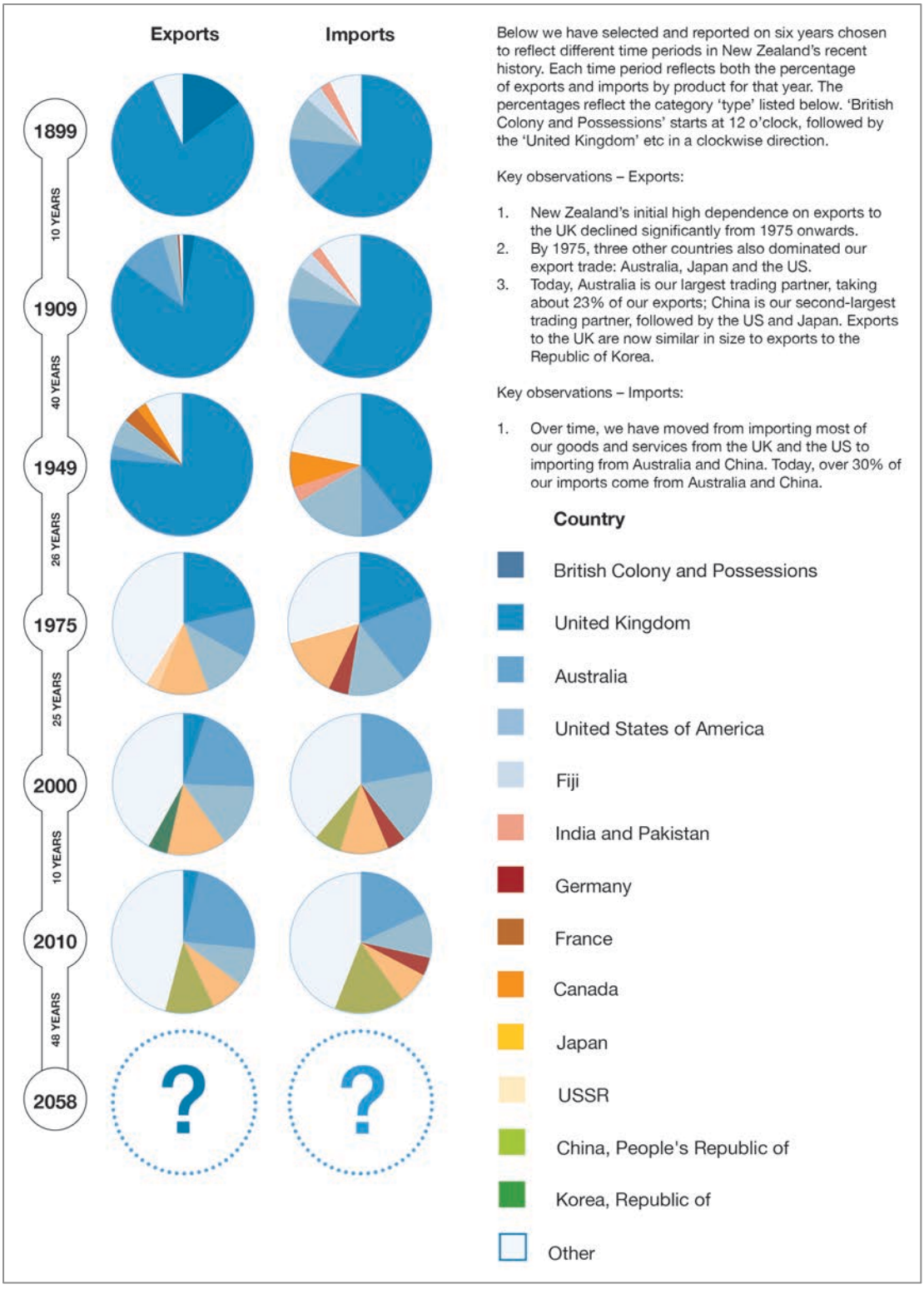
Underlying a conversation about supply chain risks is a discussion about the level of redundancy that exists, and in particular, the extent 'alternative' products and services are available. For example, is it possible to freeze/treat excess export product that we are unable to ship/export in the short term while transportation routes are disestablished in an emergency? Can we source alternative product from another country or create/mine/ manufacture an alternative product here? If our planes are unable to access fuel or the internet fails, are there alternative transportation or communication systems? These examples aim to indicate the challenge and opportunity of exploring supply chain risks before disruptive events occur.

Part A: Exports and imports, by country

Figure 28: Exports and imports, 1899 to 2010, by country

Source: McGuinness Institute, 2011[102]

Using New Zealand Official Yearbooks to understand the past and explore the future.



102 See *Report 12: StrategyNZ: Mapping our Future Workbook* at http://www.mcguinnessinstitute.org/Site/Publications/Project_Reports.aspx

Figure 29: Goods exports (fob), 2012 and 2013, by country of destination
Source: Statistics New Zealand, 2014[103]

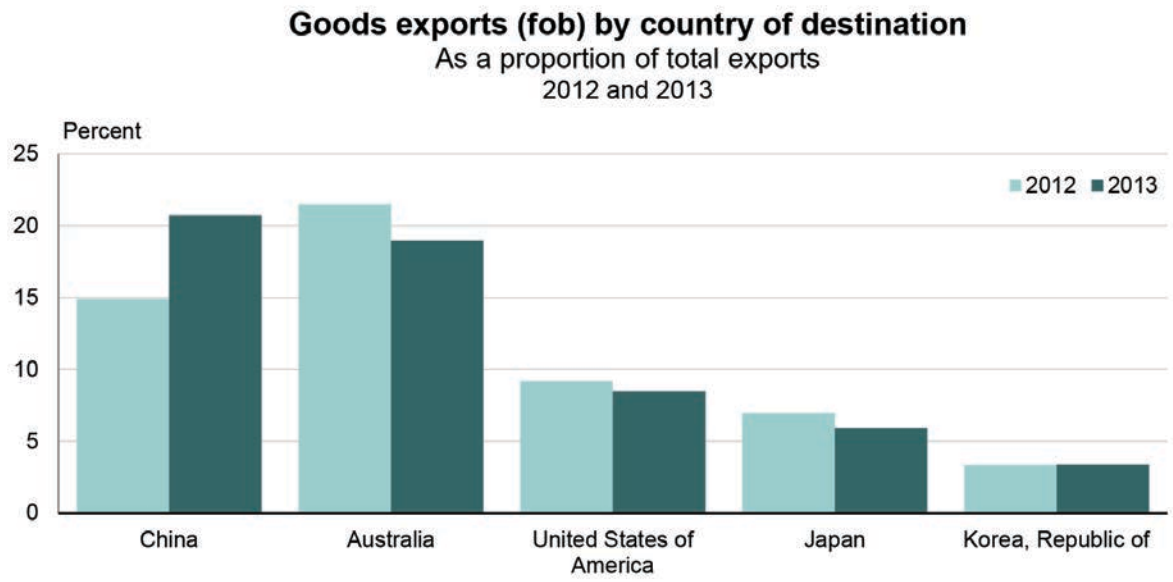
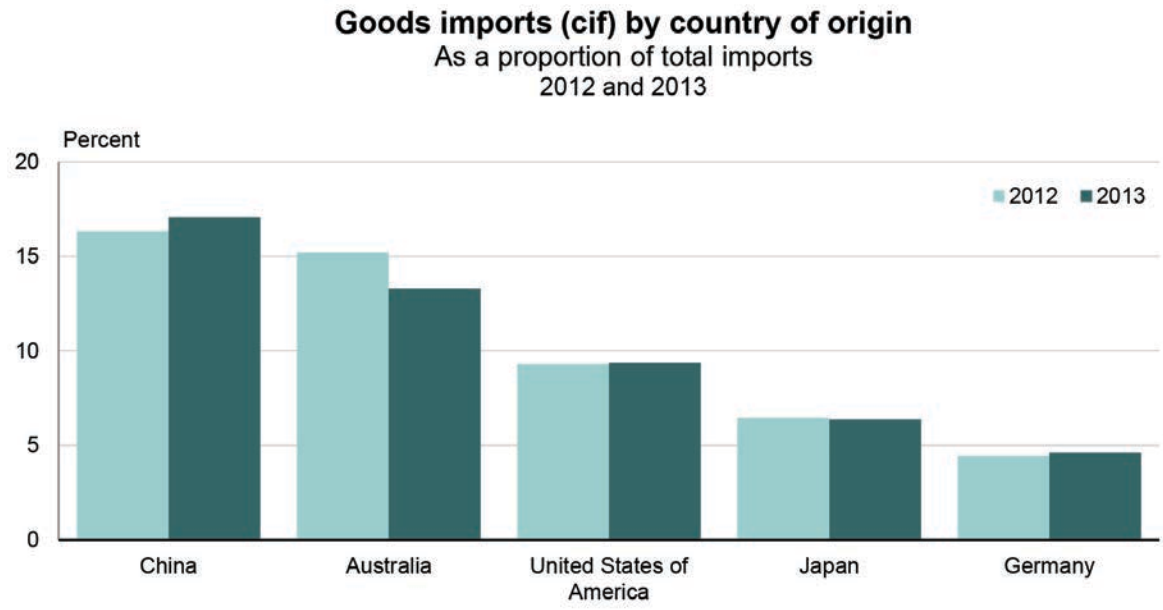


Figure 30: Goods imports (cif), 2012 and 2013, by country of origin
Source: Statistics New Zealand, 2013[104]



103 See http://www.stats.govt.nz/browse_for_stats/industry_sectors/imports_and_exports/global-nz-jun-14/key-points.aspx
104 See http://www.stats.govt.nz/~/media/Statistics/browse-categories/industry-sectors/imports-exports/global-nz/jun-13/Global%20NZ%202013.pdf

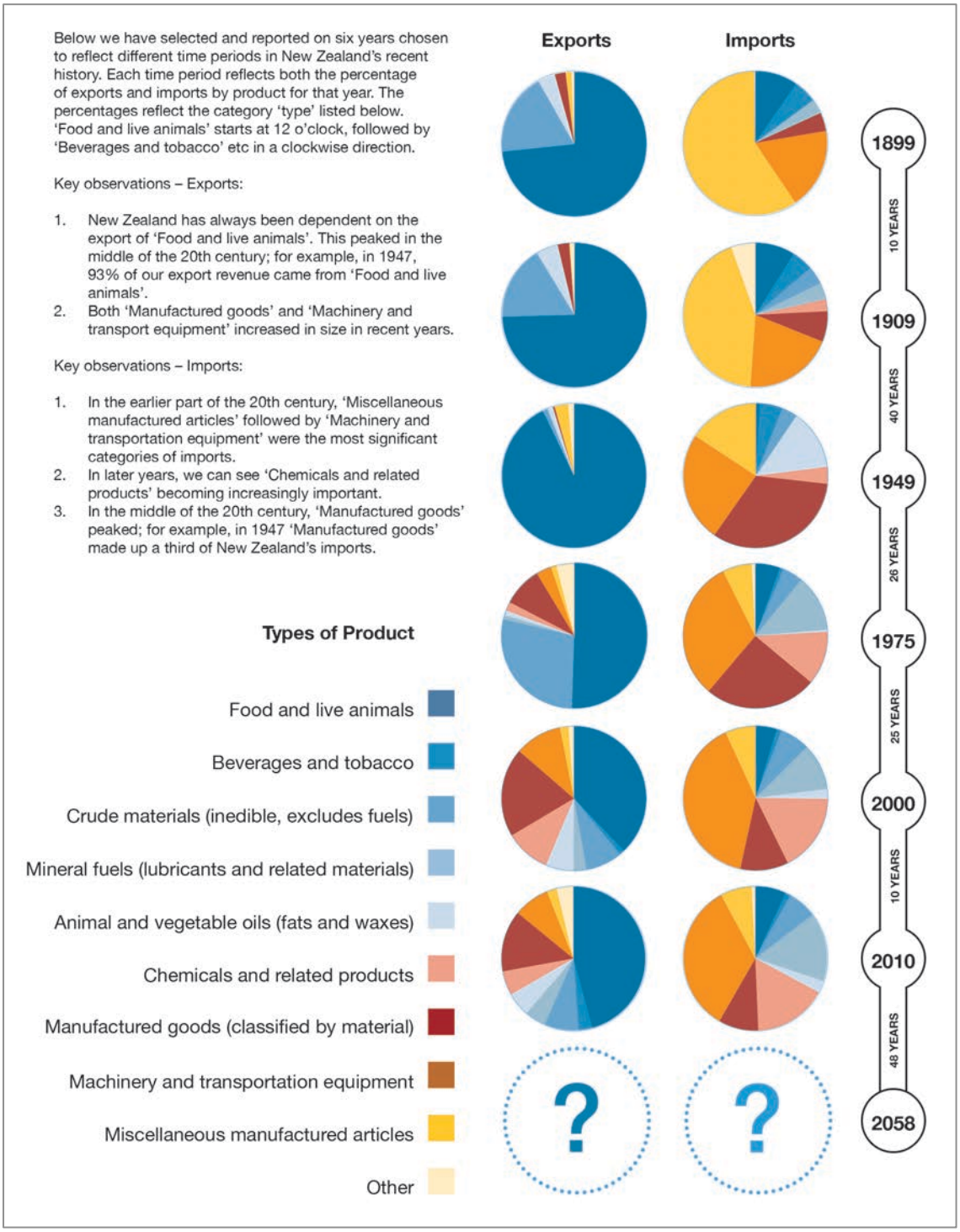
Part B: Exports and imports, by product

Figure 31: Exports and imports, 1899 to 2010, by product

Source: McGuinness Institute, 2011[105]

Using New Zealand Official Yearbooks to understand the past and explore the future.

Classification of types of product is based on Standard International Trade Classification (SITC), an output classification developed by the United Nations.



105 See *Report 12: StrategyNZ: Mapping our Future Workbook* at http://www.mcguinnessinstitute.org/Site/Publications/Project_Reports.aspx

Table 2: Annual value of principal exports, 2014
Source: Statistics New Zealand, n.d.[106]

Exports	2014 total (NZ$, millions)	Share of 2014 total
Dairy produce; birds' eggs; natural honey; edible products of animal origin, not elsewhere specified or included	$ 14,729.4	29.41%
Meat and edible meat offal	$ 5,933.4	11.85%
Wood and articles of wood; wood charcoal	$ 3,665.0	7.32%
Fruit and nuts, edible; peel of citrus fruit or melons	$ 1,773.3	3.54%
Nuclear reactors, boilers, machinery and mechanical appliances; parts thereof	$ 1,609.8	3.21%
Mineral fuels	$ 1,582.5	3.16%
Beverages, spirits and vinegar	$ 1,581.2	3.16%
Albuminoidal substances; modified starches; glues; enzymes	$ 1,433.9	2.86%
Fish and crustaceans, molluscs and other aquatic invertebrates	$ 1,375.3	2.75%
Confidential items	$ 1,299.7	2.60%
Aluminium and articles thereof	$ 1,009.6	2.02%
Electrical machinery and equipment and parts thereof; sound recorders and reproducers; television image and sound recorders and reproducers, parts and accessories of such articles	$ 923.6	1.84%
Miscellaneous edible preparations	$ 842.5	1.68%
Wool, fine or coarse animal hair; horsehair yarn and woven fabric	$ 795.2	1.59%
Preparations of cereals, flour, starch or milk; pastry cooks' products	$ 789.9	1.58%
Natural, cultured pearls; precious, semi-precious stones; precious metals, metals clad with precious metal, and articles thereof; imitation jewellery; coins	$ 713.9	1.43%
Optical, photographic, cinematographic, measuring, checking, medical or surgical instruments and apparatus; parts and accessories	$ 710.1	1.42%
Pulp of wood or other fibrous cellulosic material; recovered (waste and scrap) paper or paperboard	$ 671.5	1.34%
Raw hides and skins (other than fur skins) and leather	$ 550.7	1.10%
Plastics	$ 478.4	0.96%
New Zealand miscellaneous provisions	$ 475.9	0.95%
Iron and steel	$ 473.5	0.95%
Paper and paperboard; articles of paper pulp, of paper or paperboard	$ 439.0	0.88%
Animal originated products; not elsewhere specified or included	$ 430.6	0.86%
Vegetables and certain roots and tubers; edible	$ 393.7	0.79%
Animals; live	$ 378.7	0.76%
Preparations of vegetables, fruit, nuts or other parts of plants	$ 295.9	0.59%
Pharmaceutical products	$ 289.7	0.58%
Food industries, residues and wastes thereof; prepared animal fodder	$ 269.2	0.54%

106 See *Exports for overseas merchandise trade (fob NZ$): Country of destination by commodity (HS2) and period* at http://nzdotstat.stats.govt.nz/wbos/index.aspx#.
Note: includes re-exports.

Exports	2014 total (NZ$, millions)	Share of 2014 total
Iron or steel articles	$ 257.4	0.51%
Meat, fish or crustaceans, molluscs or other aquatic invertebrates; preparations thereof	$ 257.2	0.51%
Ships, boats and floating structures	$ 228.8	0.46%
Vehicles (not including locomotives or related items)	$ 202.9	0.41%
Oil seeds and oleaginous fruits; miscellaneous grains, seeds and fruit, industrial or medicinal plants; straw and fodder	$ 186.7	0.37%
Chemical products n.e.s.	$ 171.6	0.34%
Animal or vegetable fats and oils and their cleavage products; prepared animal fats; animal or vegetable waxes	$ 163.7	0.33%
Apparel and clothing accessories; not knitted or crocheted	$ 158.0	0.32%
Sugars and sugar confectionery	$ 157.4	0.31%
Organic chemicals	$ 156.0	0.31%
Cocoa and cocoa preparations	$ 153.6	0.31%
Furniture	$ 152.6	0.30%
Carpets and other textile floor coverings	$ 135.4	0.27%
Apparel and clothing accessories; knitted or crocheted	$ 134.8	0.27%
Copper	$ 114.1	0.23%
Stone, plaster, cement, asbestos, mica or similar materials; articles thereof	$ 112.4	0.22%
Aircraft, spacecraft and parts thereof	$ 109.0	0.22%
Tobacco and manufactured tobacco substitutes	$ 98.2	0.20%
Essential oils and resinoids; perfumery, cosmetic or toilet preparations	$ 96.5	0.19%
Soap, organic surface-active agents; washing, lubricating, polishing or scouring preparations; artificial or prepared waxes, candles and similar articles, modelling pastes, dental waxes and dental preparations with a basis of plaster	$ 85.4	0.17%
Tanning or dyeing extracts; tannins and their derivatives; dyes, pigments and other colouring matter; paints, varnishes; putty, other mastics; inks	$ 83.8	0.17%
Trees and other plants, live; bulbs, roots and the like; cut flowers and ornamental foliage	$ 67.2	0.13%
Salt; sulphur; earths, stone; plastering materials, lime and cement	$ 65.5	0.13%
Textiles, made up articles; sets; worn clothing and worn textile articles; rags	$ 57.6	0.12%
Tools, implements, cutlery, spoons and forks, of base metal; parts thereof, of base metal	$ 56.9	0.11%
Works of art; collectors' pieces and antiques	$ 53.6	0.11%
Cereals	$ 52.7	0.11%
Printed books, newspapers, pictures and other products of the printing industry; manuscripts, typescripts and plans	$ 52.2	0.10%
Rubber and articles thereof	$ 50.9	0.10%
Toys, games and sports requisites; parts and accessories thereof	$ 50.7	0.10%

Exports	2014 total (NZ$, millions)	Share of 2014 total
Fur skins and artificial fur; manufactures thereof	$ 49.4	0.10%
Metal; miscellaneous products of base metal	$ 43.6	0.09%
Footwear; gaiters and the like; parts of such articles	$ 38.9	0.08%
Wadding, felt and non-wovens, special yarns; twine, cordage, ropes and cables and articles thereof	$ 27.3	0.05%
Glass and glassware	$ 27.1	0.05%
Products of the milling industry; malt, starches, inulin, wheat gluten	$ 26.3	0.05%
Textile fabrics; impregnated, coated, covered or laminated; textile articles of a kind suitable for industrial use	$ 20.3	0.04%
Miscellaneous manufactured articles	$ 19.1	0.04%
Articles of leather; saddlery and harnesses; travel goods, handbags and similar containers; articles of animal gut (other than silk-worm gut)	$ 17.5	0.04%
Inorganic chemicals; organic and inorganic compounds of precious metals; of rare earth metals, of radio-active elements and of isotopes	$ 17.3	0.03%
Photographic or cinematographic goods	$ 15.8	0.03%
Fabrics; knitted or crocheted	$ 14.5	0.03%
Headgear and parts thereof	$ 12.1	0.02%
Man-made staple fibres	$ 11.4	0.02%
Railway, tramway locomotives, rolling-stock and parts thereof; railway or tramway track fixtures and fittings and parts thereof; mechanical (including electro-mechanical) traffic signalling equipment of all kinds	$ 9.8	0.02%
Ores, slag and ash	$ 8.9	0.02%
Clocks and watches and parts thereof	$ 8.4	0.02%
Coffee, tea, maté and spices	$ 6.9	0.01%
Fertilizers	$ 6.8	0.01%
Cotton	$ 6.3	0.01%
Arms and ammunition; parts and accessories thereof	$ 6.2	0.01%
Ceramic products	$ 6.1	0.01%
Fabrics; special woven fabrics, tufted textile fabrics, lace, tapestries, trimmings, embroidery	$ 5.8	0.01%
Vegetable plaiting materials; vegetable products not elsewhere specified or included	$ 5.4	0.01%
Man-made filaments	$ 5.2	0.01%
Lac; gums, resins and other vegetable saps and extracts	$ 5.1	0.01%
Explosives; pyrotechnic products; matches; pyrophoric alloys; certain combustible preparations	$ 2.8	0.01%
Vegetable textile fibres; paper yarn and woven fabrics of paper yarn	$ 2.5	0.00%
Feathers and down, prepared; and articles made of feather or of down; artificial flowers; articles of human hair	$ 2.1	0.00%
Tin	$ 2.0	0.00%

Exports	2014 total (NZ$, millions)	Share of 2014 total
Cork and articles of cork	$ 1.7	0.00%
Lead and articles thereof	$ 1.4	0.00%
Musical instruments; parts and accessories of such articles	$ 1.3	0.00%
Zinc and articles thereof	$ 1.3	0.00%
Metals; n.e.s., cermets and articles thereof	$ 1.0	0.00%
Umbrellas, sun umbrellas, walking-sticks, seat sticks, whips, riding crops; and parts thereof	$ 0.6	0.00%
Silk	$ 0.5	0.00%

Table 3: Annual value of principal imports by commodity, 2014
Source: Statistics New Zealand, n.d.[107]

Imports	2014 total (NZ$, millions)	Share of 2014 total
Mineral fuels	$ 7,706.4	15.03%
Vehicles (not including locomotives or related items)	$ 6,761.9	13.19%
Nuclear reactors, boilers, machinery and mechanical appliances; parts thereof	$ 6,388.0	12.46%
Electrical machinery and equipment and parts thereof	$ 3,832.6	7.48%
Plastics	$ 1,937.0	3.78%
Aircraft, spacecraft and parts thereof	$ 1,907.1	3.72%
Optical, photographic, cinematographic, measuring, checking, medical or surgical instruments and apparatus	$ 1,457.1	2.84%
Apparel and clothing accessories	$ 1,362.8	2.66%
Pharmaceutical products	$ 1,129.1	2.20%
Food industries, residues and wastes, prepared animal fodder	$ 985.5	1.92%
Iron or steel articles	$ 893.1	1.74%
Furniture	$ 880.4	1.72%
Paper and paperboard; articles of paper pulp, of paper or paperboard	$ 878.2	1.71%
Fertilizers	$ 697.3	1.36%
Miscellaneous edible preparations	$ 667.0	1.30%
Rubber and articles thereof	$ 595.6	1.16%
Chemical products	$ 506.3	0.99%
Iron and steel	$ 479.2	0.93%
Beverages, spirits and vinegar	$ 475.1	0.93%
Toys, games and sports requisites	$ 469.6	0.92%
Essential oils and resinoids; perfumery, cosmetic or toilet preparations	$ 453.1	0.88%
Inorganic chemicals; organic and inorganic compounds of precious metals; of rare earth metals, of radio-active elements and of isotopes	$ 446.5	0.87%
Preparations of cereals, flour, starch or milk; pastry cooks' products	$ 400.1	0.78%
Fruit and nuts, edible; peel of citrus fruit or melons	$ 383.4	0.75%
Sugars and sugar confectionery	$ 377.4	0.74%
Organic chemicals	$ 374.8	0.73%
Ships, boats and floating structures	$ 373.5	0.73%
Footwear; gaiters and the like	$ 338.0	0.66%
Cereals	$ 333.3	0.65%
Printed books, newspapers, pictures and other products of the printing industry; manuscripts, typescripts and plans	$ 322.8	0.63%
Salt; sulphur; earths, stone; plastering materials, lime and cement	$ 310.7	0.61%

107 See *Imports for overseas merchandise trade (cif NZ$): Country of origin by commodity (HS2) and period* at http://nzdotstat.stats.govt.nz/wbos/index.aspx#

Imports	2014 total (NZ$, millions)	Share of 2014 total
Confidential items	$ 308.5	0.60%
Natural, cultured pearls; precious, semi-precious stones; precious metals, metals clad with precious metal, and articles thereof; imitation jewellery; coin	$ 308.4	0.60%
Textiles, made up articles; sets; worn clothing and worn textile articles; rags	$ 299.1	0.58%
Tanning or dyeing extracts; tannins and their derivatives; dyes, pigments and other colouring matter; paints, varnishes; putty, other mastics; inks	$ 288.6	0.56%
Aluminium	$ 277.6	0.54%
Soap, organic surface-active agents; washing, lubricating, polishing or scouring preparations; artificial or prepared waxes, candles and similar articles, modelling pastes, dental waxes and dental preparations with a basis of plaster	$ 268.3	0.52%
Railway, tramway locomotives, rolling-stock and parts thereof; railway or tramway track fixtures and fittings and parts thereof; mechanical (including electro-mechanical) traffic signalling equipment of all kinds	$ 265.4	0.52%
Glass and glassware	$ 265.0	0.52%
Preparations of vegetables, fruit, nuts or other parts of plants	$ 262.6	0.51%
Meat and edible meat offal	$ 259.6	0.51%
Animal or vegetable fats and oils and their cleavage products; prepared animal fats; animal or vegetable waxes	$ 246.6	0.48%
Cocoa and cocoa preparations	$ 245.0	0.48%
Wood and articles of wood; wood charcoal	$ 240.6	0.47%
Tools, implements, cutlery, spoons and forks, of base metal; parts thereof, of base metal	$ 214.1	0.42%
Dairy produce; birds' eggs; natural honey; edible products of animal origin, not elsewhere specified or included	$ 213.3	0.42%
Metal; miscellaneous products of base metal	$ 203.3	0.40%
Articles of leather; saddlery and harnesses; travel goods, handbags and similar containers; articles of animal gut (other than silk-worm gut)	$ 201.9	0.39%
Copper	$ 189.5	0.37%
Miscellaneous manufactured articles	$ 183.1	0.36%
Ceramic products	$ 167.4	0.33%
Stone, plaster, cement, asbestos, mica or similar materials	$ 145.2	0.28%
Carpets and other textile floor coverings	$ 137.0	0.27%
Fish and crustaceans, molluscs and other aquatic invertebrates	$ 129.0	0.25%
Tobacco and manufactured tobacco substitutes	$ 127.6	0.25%
Meat, fish or crustaceans, molluscs or other aquatic invertebrates; preparations thereof	$ 127.6	0.25%
Coffee, tea, maté and spices	$ 126.6	0.25%
Albuminoidal substances; modified starches; glues; enzymes	$ 97.5	0.19%
Man-made filaments	$ 91.2	0.18%

Imports	2014 total (NZ$, millions)	Share of 2014 total
Vegetables and certain roots and tubers; edible	$ 88.0	0.17%
Man-made staple fibres	$ 85.5	0.17%
Oil seeds and oleaginous fruits; miscellaneous grains, seeds and fruit, industrial or medicinal plants; straw and fodder	$ 84.1	0.16%
Photographic or cinematographic goods	$ 82.9	0.16%
Clocks and watches and parts thereof	$ 75.3	0.15%
Wadding, felt and non-wovens, special yarns; twine, cordage, ropes and cables and articles thereof	$ 72.6	0.14%
Animals; live	$ 70.1	0.14%
Products of the milling industry; malt, starches, inulin, wheat gluten	$ 57.3	0.11%
Arms and ammunition; parts and accessories thereof	$ 57.3	0.11%
Works of art; collectors' pieces and antiques	$ 46.7	0.09%
Textile fabrics; impregnated, coated, covered or laminated; textile articles of a kind suitable for industrial use	$ 46.5	0.09%
Headgear and parts thereof	$ 44.1	0.09%
Animal originated products; not elsewhere specified or included	$ 41.5	0.08%
Zinc and articles thereof	$ 36.5	0.07%
Wool, fine or coarse animal hair; horsehair yarn and woven fabric	$ 35.1	0.07%
Tin	$ 34.9	0.07%
Pulp of wood or other fibrous cellulosic material; recovered (waste and scrap) paper or paperboard	$ 32.6	0.06%
Cotton	$ 28.4	0.06%
Musical instruments; parts and accessories of such articles	$ 26.6	0.05%
Fabrics; knitted or crocheted	$ 26.4	0.05%
Lac; gums, resins and other vegetable saps and extracts	$ 22.9	0.04%
Explosives; pyrotechnic products; matches; pyrophoric alloys; certain combustible preparations	$ 19.3	0.04%
Fabrics; special woven fabrics, tufted textile fabrics, lace, tapestries, trimmings, embroidery	$ 18.4	0.04%
Fur skins and artificial fur; manufactures thereof	$ 16.0	0.03%
Vegetable textile fibres; paper yarn and woven fabrics of paper yarn	$ 13.4	0.03%
Metals; n.e.s., cermets and articles thereof	$ 13.3	0.03%
Umbrellas, sun umbrellas, walking-sticks, seat sticks, whips, riding crops; and parts thereof	$ 13.1	0.03%
Trees and other plants, live; bulbs, roots and the like; cut flowers and ornamental foliage	$ 12.8	0.02%
Raw hides and skins (other than fur skins) and leather	$ 11.3	0.02%
Feathers and down, prepared; and articles made of feather or of down; artificial flowers; articles of human hair	$ 7.7	0.02%

Imports	2014 total (NZ$, millions)	Share of 2014 total
Manufactures of straw, esparto or other plaiting materials; basketware and wickerwork	$ 7.3	0.01%
Cork and articles of cork	$ 4.4	0.01%
Silk	$ 3.5	0.01%
Lead and articles thereof	$ 3.3	0.01%
Nickel and articles thereof	$ 3.1	0.01%
Ores, slag and ash	$ 1.5	0.00%
Vegetable plaiting materials; vegetable products not elsewhere specified or included	$ 0.9	0.00%

Appendix 8: Supply Chain Risk Matrix

No doubt there is already some form of framework for discussing supply chain risk in existence within government, but this appendix aims to showcase what a supply chain risk matrix might look like. Importantly, a matrix is a tool for framing an ongoing discussion about which risks deserve further consideration. This tool can be used periodically to review and assess actions over time.

Based on what we have learned from our initial discussions, we have included a few tentative examples. The matrix below is in no way based on accurate or robust analysis.

It aims instead to showcase how government and communities might find such a matrix a useful tool when in discussions with local government and businesses on the specific needs/characteristics of each region and/or industry sector.

Figure 32: Tentative supply chain matrix