LOSS ESTIMATION AND DATA STORAGE METHODS UTILISED BY STAKEHOLDERS INVOLVED IN RESIDENTIAL RECONSTRUCTION-A STUDY OF THE CANTERBURY EARTHQUAKE

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ABSTRACT

The importance of natural disaster economic loss estimations cannot be overstated. They help to assist policy maker in mitigation decisions, risk assessments and track the losses which occur due to such events. Despite this New Zealand has not employed a systematic method to estimate or record the losses which have occurred as a result of natural disasters therefore the records are poor.

The Canterbury Earthquake is one the most significant natural disasters in New Zealand's history, with economic loss occurring at all levels of the economy. There are numerous complexities regarding how to measure this loss, and what should be included and excluded in these estimates. To further complicate this there are unique factors to this event such as the government's intervention with red zone residents.

Loss estimates in the past have relied heavily on insurance information and this is one of the main sources of data for large scale events. This research aimed to investigate the estimation and data storage methods utilised by stakeholders involved in the residential reconstruction of Christchurch and compare the findings to the literature reviewed.

By conducting six semi-structured interviews with Insurance and Project Management Companies operating in Christchurch this exploratory research has allowed comparisons between the Insurance Companies, Project Management Companies and the literature with reference to estimation and data storage methods.

Although not all companies interviewed utilised an estimation method the research has found that there is a lack of consistency of process and method within the industry, which is in-line with the main findings from the literature. This was due to a number of factors most notably the lack of regulation within the industry and the competitive environment in which they operate. Due to the inconsistency there could be advantage in employing a systematic framework and centrally storing the information, however this to has its limitations and issues to overcome.

CONFIDENTIALITY STATEMENT

The author has agreed that all personal and company names of participants in this research will be kept confidential.

The confidentiality of the participants has been maintained by referring to the participants and their companies by labels. Details that could lead to the identification of the participants have been excluded from this report.

PUBLICATION AGREEMENT

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ABBREVIATIONS

BAU Business as Usual

EQC Earthquake Commission

GIS Geographical Information System

GNS Institute of Geological and Nuclear Science

ICNZ Insurance Council of New Zealand

NIWA National Institute of Water and Atmospheric Research

1 INTRODUCTION

This chapter outlines the research. It explores the background and rationale as to why it was undertaken and further defines the purpose and scope; this is then followed by the general layout of the report.

1.1 Background and Rationale

This research topic was a result of the publications after the 4th September earthquake in Christchurch, such as the $2 billion initial estimate ("Christchurch earthquake could cost $2b-EQC," 2010), and then subsequently after the 22nd February 2011 earthquake reports of $10 billion ("Earthquake death toll reaches 113," 2011) which was later increased to $ 20 billion ("Chch quake as it happened: Monday February 28," 2011). From the media reports it was unclear as to what the estimates included, excluded or how the figure was derived.

From the research analysed it seems that there is no consistent framework used in New Zealand for what is to be included. This is despite this issue being raised over 25 years ago by Ericksen (1985) and although this reference was to flood loss, the principle is relevant to all natural disasters.

There is extensive literature from a number of sources from both New Zealand and overseas. The research focuses on areas around loss which results from natural disasters; economic loss represents a large amount of this research. Insurance information is used as a main source of data for economic loss estimates (Walton, 2004) and with the Canterbury Earthquake as at April 2011 there were 302,000 claims lodged with the Earthquake Commission EQC (Mathewson, 2011). Residential housing represents a substantial percentage of loss as a result of the Canterbury Earthquake.

1.2 Purpose of this Study

The research question is:

"What are the various stakeholders' evaluative processes for estimating loss to residential housing as a result of a natural disaster in New Zealand, and how is the collected information stored and utilised?

By exploring the methods used by stakeholders to estimate loss and store data in the residential reconstruction work, the aim is to compare the actual methods used against the findings from the literature reviewed.

In order to establish the differences and similarities with the literature, a review of existing literature relating to this topic was undertaken.

1.3 Scope of the Research

The concept of economic loss estimation is broad and dependent on many factors such as time, geographic context, and the need of the end user (Cochrane, 2004). For the purpose of this study the scope has been limited to the residential sector only, due to time constraints and to limit this potentially broad area of research. This sector was chosen due to insurance data being a main source for direct economic loss information (Walton, 2004). It is surmised that the use of consistent loss estimation methods and storage of this information can have a significant effect on other loss estimates which rely on insurance data as a major source.

No similar research it seems has been undertaken on a residential scale in New Zealand before and therefore this research is exploratory research. The study investigates stakeholders involved in Christchurch residential reconstruction work. A sample of six employees representing two Insurance Companies and three Project Management Companies was chosen using a purposive non-random sampling

technique. Employees of two different types of companies were surveyed to compare and contrast the findings with the literature so that triangulation could be used to increase the reliability and validity of the study (Denscombe, 2010). The employees interviewed satisfied the qualifying questions outlined in chapter three. Face-to-face interviews were used as the survey type due to the in-depth knowledge of the topic needed to answer the research question (Denscombe, 2010).

1.4 Report Presentation

The report is structured in the following format:

Chapter 1: An introduction to the research with an overview, scope, rationale and background of the research.

Chapter 2: Presents and critiques the available literature relating to loss estimating and storage of the collected data from New Zealand and overseas.

Chapter 3: Identifies the methodology used to answer the research question. This includes the data requirements and defends the chosen method.

Chapter 4: Presents the findings of the survey.

Chapter 5: Analyses the results presented in Chapter 4 and compares and contrasts the findings to those of the literature review.

Chapter 6: Provides the conclusions of the research as well as discussing the limitations of the study and areas of further research relating the Canterbury Earthquake.

Appendix: The research questions.

2 LITERATURE REVIEW

2.1 Introduction

A large amount of information relating to this topic of loss estimation exists with a number of New Zealand publications, but the majority are from overseas. This chapter explores the literature reviewed and discusses the limitations and gaps in the existing literature.

2.2 Definitions

2.2.1 Direct Loss:

"Direct losses as those that result from the physical destruction or damage to buildings, infrastructure, vehicles and crops" (Committee on Assessing the Costs of Natural Disasters: National Research Council, 1999, p. 35).

2.2.2 Indirect Loss:

"Indirect loss is any loss other than direct loss [which occurs as a result of a natural disaster]" (Cochrane, 2004, p. 291).

2.2.3 Intangible Loss:

Intangible losses are those with no market value (Bureau of Transport Economics, 2001, p. 61).

2.2.4 Natural Disaster

"A natural disaster occurs when a natural hazard event actually causes damage to property or harms people" (Bureau of Transport Economics, 2001, p. 5)

2.3 Loss Estimation Overview

"The importance of realistic and fact-based estimates of natural hazard losses cannot be overstated" (Walton, 2004, p. 250). A consistent methodology allows estimates across time and regions to be compared without fear of mythological bias (Walton, 2004, p. 250). A challenge of this is in defining a consistent dataset for estimating disaster losses and identifying which data should be included in the estimates (Committee on Earthquake Engineering National Research Council, 1990).

Further to this economic loss estimates are important in making informed mitigation decisions, for example, "it would be difficult to gauge the cost-effectiveness of public policy decisions such as relocating residents out of floodplains or earthquake-prone areas [without loss information]" (Committee on Assessing the Costs of Natural Disasters: National Research Council, 1999, p. 7). Despite this "little is known about the economic costs of natural disasters" (Bureau of Transport Economics, 2001, p. 3).

From the literature reviewed it seems there is no consistent approach to economic loss estimation in New Zealand, Australia or the US. This statement is supported by the findings from Walton (2004), The Bureau of Transport Economic (2001) and the Committee on Assessing the Cost of Natural Disasters (1999). The issue of economic loss estimation in New Zealand was raised over 25 years ago with Ericksen (1985), however it has not been greatly acted upon since (Walton, 2004). There are, however, proposed existing frameworks from overseas sources, namely the *Economic Costs of Natural Disasters in Australia* and *the Impacts of Natural Disasters: A Framework for Loss Estimation.* More recently, the development of

HAZUS has provided a integrated framework for loss estimation (Brookshire et al., 1997).

The literature has consistent themes but varies on how losses are calculated and what information is included and excluded. “Some measure only direct losses whereas others purport to include indirect losses”(Committee on Assessing the Costs of Natural Disasters: National Research Council, 1999, p. 8).

Despite there being no agreed framework, losses are generally broken up into two broad categories-direct loss and indirect loss-and from these categories into subcategories-intangible and tangible (see table 1). This same classification has been proposed by Handmer (1985) & Smith et, al (1995) & supported by (Walton, 2004).

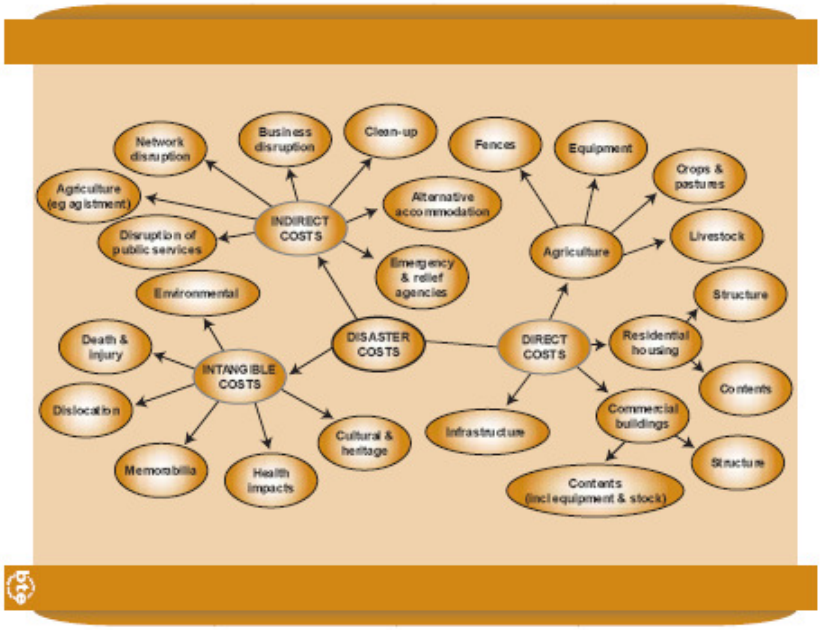
Table 1: Classification of Loss Data

	Type of loss	
Measurement	Direct	Indirect
Tangible (market values)	Damage to infrastructure, buildings and contents, vehicles boats, etc.	Loss of production, emergency response and relief, and clean-up costs.
Intangible (non-market values)	Death and injury, loss of items of cultural significance and personal memorabilia.	Inconvenience and disruption, especially to schooling and social life. Stress induced ill-health and mortality.

(Bureau of Transport Economics, 2001, p. 62)

A further expansion of these classifications as proposed by Bureau of Transport Economics (2001) has broken the classification into 3 categories; direct, indirect and intangible cost:

Table 2: Proposed Framework



(Bureau of Transport Economics, 2001, p. 63)

These classifications have been generally accepted from the literature reviewed. "Although there may appear to be a wide range of opinions as to how to proceed [with use of a consistent framework], this is not the case. In fact, there is a good deal of agreement as to what such a methodology would look like" (Cochrane, 2004, p. 294). The gaps in the literature seem to focus on indirect loss, intangible loss and the issues of measuring the loss.

2.4 State-of-the-Art Loss Estimation

Natural disaster loss estimation software has been developed over the past two decades to provide an integrated framework and incorporates geographic information systems (GIS) to display spatially referenced data such as population, building types and infrastructure (Strasser, Stafford, Bommer, & Erdik, 2008, p. 1). Examples of earthquake software include HAZUS, KOERILOSS, SELENA, and a relatively new

Riskscape which is a New Zealand application developed by National Institute of Water and Atmospheric Research (NIWA) and Geological and Nuclear Science (GNS) (King & Bell, 2006).

The software based framework follows a similar classification system of breaking the losses into two categories, direct loss and indirect loss, such as HAZUS (Department of Homeland Security & Federal Emergency Management Agency, 2006). Work on HAZUS began in 1992 and the program was released in 1997. It uses mathematical formulas and information on building stock, economic data and GIS to display shaking from an earthquake (Committee on Assessing the Costs of Natural Disasters: National Research Council, 1999). The outputs of the model include, direct and indirect economic losses displayed as dollar losses (Department of Homeland Security & Federal Emergency Management Agency, 2006). Although this was originally developed for earthquake assessment it has been expanded to include flood loss and storm loss.

In New Zealand much is known about earthquakes due to past research by GNS and the Geonet system. This was shown by a report after September 4th "we already know a considerable amount about this [Canterbury Earthquake] because of the data available from Geonet" (Gledhill, Ristau, Reyners, Fry, & Holden, 2010, p. 215). Riskscape uses this information from systems such as Geonet and formulates likely the impacts that can result from natural disasters much like HAZUS. Development of this program began in 2004 and currently this New Zealand application is more limited in scope as it has only a direct loss output (Riskscape, 2010).

Riskscape uses synthetic data for estimation. The output is based on algorithms which model how assets perform in a natural disaster (King & Bell, 2006). Asset inventories are used as base data to the estimates; this includes bridges, buildings and pipeworks (Riskscape, 2010).

Riskscape has two levels for estimation, Level 1 determine damage through the modified mercalli (MM) intensity scale based on past earthquake data, to assess how

buildings react based on the type of building and distance from the centre of the earthquake (King & Bell, 2006). There has been extensive research in this field in New Zealand with Dowrick & Rhoades (2005) & (2010) and a specific model for the Canterbury region (Stirling et al., 2008). Level 2 has more engineering input with the analysis of specific design spectra within a specific building class (King & Bell, 2006).

Although the frameworks discussed provide a clarification and guide to economic loss estimation, there is still no single framework used in New Zealand. With the advance in the development of Riskscape, this technology's function is to predict losses and early assessment of natural disasters (King & Bell, 2006). However Riskscape does have "the potential to become a nationally applied hazard and impact assessment tool enabling a standardised approach across the country" ("Riskscape," 2011).

The accuracies of the output, relying on synthetic data alone with no supplementary collected data has its limitations. Hill & Rossetto (2007) suggests that the choice of damage scale of the building class can have significant impacts on the accuracy of the output. Research conducted in New Zealand suggests that an accuracy factor of 2 is achievable in a high magnitude earthquake in a populous area (Cousins, 2005, p. 18).

2.5 Direct Loss Estimation and Measurement

"There is little debate over the classification of direct economic loss which is the easiest to classify, they are losses that result from the physical destruction or damage to buildings, infrastructure, vehicles and crops" (Bureau of Transport Economics, 2001, p. 15). Merz, Kreibich, Schwarze, & Thieken further includes destruction of agricultural soil and damage to livestock (2010, p. 1699). There are different ways in which direct loss can be calculated, either based on imperial data (collected data), or

synthetic (based on likely impacts) (Handmer, 1985). Riskscape for example uses synthetic data to estimate the likely impact (King & Bell, 2006).

Imperial data collection of direct losses can be divided into two groups: Primary data collection which is most often surveys of businesses and households and the second approach relies on secondary data such as tabulated insurance claims, small business loans and various other sources (Brookshire et al., 1997).

There are issues associated with the collection of the data. Surveys are not always practical in large events and are only as accurate as the survey allows i.e. the size of the survey, respondent numbers and circumstances of the survey and "bias is probable if respondents believe that they may receive compensation" (Bureau of Transport Economics, 2001, p. 68). The Bureau of Transport Economics (2001) suggests that in larger flood events stage-damage curves should be used. These curves are based on synthetic data, and are much like the information used for earthquake modelling.

The Bureau of Transport Economics (2001) attempted to establish the cost of natural disasters in New Zealand from 1968-1998, but no accurate conclusions could be drawn from the data due to the inconsistency of the information supplied by the Earthquake Commission (EQC) and the Insurance Council of New Zealand(ICNZ). One problem found was that the data provided by ICNZ was inflation adjusted while the EQC data was not. Despite the inaccuracies, one of the underlying issues is that estimation is difficult due to the lack of empirical data, (Tierney, Chang, Eguchi, Rose, & Shinozuka, 1999, p. 21) and although this statement is in reference to earthquake loss estimation, the principle holds true to other forms of natural disaster.

A New Zealand publication; *The Edgecumbe Earthquake,* attempted to measure the cost total cost of the earthquake a number of years after the event (Butcher, Latham, & Cleland, 1998). The main focus of this report was on direct loss. No estimates were made against intangible losses and this report also excluded analysis of a number of possible indirect losses as shown in table 3. The findings of this

publication also relied heavily on secondary data from a number of sources including insurance companies and various public organisations. This publication did, however, use the depreciated value from the insurance data (see subheading: Replacement value or depreciated values), which is in agreeance of the Bureau of Economic Transport (2001) & Merz et al (2010).

The Edgecumbe Earthquake publication also highlights one of the potential problems with the data used. There was a significant amount of money involved in restoring chimneys, when in fact this may not have been earthquake related damage and more likely general wear and tear-this would overstate the loss.

Assessment of commercial and industrials losses from the Edgecumbe Earthquake were done by detailed surveys of the building on a case by case basis (Butcher et al., 1998). This method is supported by Ashley, Garvin, Parche Vassilopoulos & Zevenbergen (2007) "damage costs of large non-residential buildings are best estimated by means of a survey" (Ashley et al., 2007, p. 97). Data collection issues were raised yet again by Butcher as not all building losses were available, such as school; instead only early estimations were used as the final loss. With commercial property measurement of depreciated value or replacement value were assessed on a case by case basis (Butcher et al., 1998).

Table 3: Estimated Cost of the Edgecumbe Earthquake 1987

(NZ$'000)[a]	
Cost category	Estimated cost
Direct costs	
Residential structures and contents	25 650
Commercial & industrial building structures and contents	252 500
Public buildings— structures & contents	3 031
Vehicles	
Infrastructure	24 541
Agriculture	
Crops	
Pastures	
Non-house structures and equipment	4 100
Livestock	
Sub-total	309 822
Indirect costs	
Business disruption	42 034
Loss of public services	2 635
Business clean-up	
Household clean-up	
Public buildings clean-up	
Household alternative accommodation	
Agriculture	
Transport networks	
Disaster response & relief (excluding volunteers)	1 667
Volunteer contribution to disaster relief	80
Other indirect costs[b]	1 500
Sub-total [c]	47 916
Intangible costs	
Fatalities	
Injuries	
Health effects	
Environmental damage, memorabilia & cultural heritage	
Sub-total	
TOTAL	357 738

a Costs are in New Zealand 1987 prices.
b Assessor's fees.
c Indirect costs are 15.5 per cent of direct costs.
Source BTE estimates based on Butcher, Andrews & Cleland (1998).

(Bureau of Transport Economics, 2001, p. 113)

2.6 Indirect Economic Loss and Measurement

Indirect Economic losses which are caused by natural disasters are losses resulting from the consequences of physical destruction. These have not been measured, studied, or modelled to the same extent as direct losses" (Committee on Assessing the Costs of Natural Disasters: National Research Council, 1999, p. 35). This statement is also supported by Ashley with respect to urban flood loss in which

estimation has primarily been based on direct loss (2007, p. 197). This is despite the fact that indirect economic loss can have more of an impact than the direct economic loss in large events (Committee on Assessing the Costs of Natural Disasters: National Research Council, 1999). Ashley also found that substantial economic and social disruptions could last over long periods of time as a result of indirect flood losses (2007, p. 195).

There were $100 billion of interruption losses in the 1995 Kobe earthquake (Committee on Assessing the Costs of Natural Disasters: National Research Council, 1999, p. 38). In comparison to this New Zealand could incur far greater indirect losses relatively (Cochrane, 1995). This is due to New Zealand's small and open economy which is vulnerable to "capital flight" i.e. speculative investors withdrawing their investments from the New Zealand Economy (Cochrane, 1995, p. 68).

For the Edgecumbe Earthquake (table 3) indirect losses were measured for:

- Business interruption, source of data: insurance data (measured per business and added)
- Loss of public service (power, phone etc) source of data: District Council and Utility Suppliers
- Disaster response, source of data: direct from emergency resource (Fire, Police), Civil defence based on authors own estimate
- Volunteer hours, source of data: authors own estimate based on known numbers of volunteers and average hourly wage in 1987
- Other (assessors fees), source of data: EQC insurance data

(Butcher et al., 1998)

Butcher found that this earthquake was atypical in comparison to overseas studies as the indirect loss only accounted for 15% of total losses (1998, p. 98). This could however be partly attributed to not all the losses being measured, such as the cleanup cost (Bureau of Transport Economics, 2001, p. 114). This being said Butcher goes on to say the economy was effected both locally and nationally, due to the net gain/loss of production and income (1998, p. 97). However there would be difficult to measure this as the assessment of loss equated to less than 0.5% of GDP; this is less than the annual fluctuation (1998).

"Limited available sources of data and the often high cost of primary data collection have led to attempts to measure indirect losses using statistical models of the type that have long been utilised for economic forecasting and economic impact analysis" (Committee on Assessing the Costs of Natural Disasters: National Research Council, 1999, p. 38). With modelling, it is "particularly important that the correct application of economic principles [is applied]" (Handmer, 1985, p. 5). The first proposed method was with Cochrane (1974), an input-output model (O-I) adapted from economic theory. This research is aimed at higher level economics (i.e. national); "current models for estimating indirect hazard impact are based on economic flow where economies are treated as a series of interconnecting activities" (Ashley et al., 2007, p. 195).

Indirect losses which are measureable and do not need economic modelling, such as those measured by Butcher et al (1998) can still be difficult to estimate. "Losses resulting from business interruption, which is a subcomponent of total indirect losses, are difficult to estimate because businesses and other parties use heuristic (i.e. biased estimates based on rules of thumb) in determining the loss of sales. These are not necessarily reflecting the actual losses" (Ashley et al., 2007, p. 97). Further to this, with the Canterbury earthquake the business interruption payout may be only a fraction of the actual loss due to the specifics of the individual policy and the method of calculation. With reduced foot traffic in the city, the actual loss may not be paid out (Heather, 2011). This would result in under estimating the loss as the true loss would never be calculated.

The Committee on Assessing the Costs of Natural Disasters (1999) suggests there are two ways of calculating indirect loss. The first relies on surveys to businesses and households (primary data) and the second utilises secondary data such as tabulations of insurance claims, small business loans and other forms of disaster relief (1999, p. 38), This is, however, a relatively limited scope of available methods. Cochrane suggests that there are 6 models used in estimating (2004, p. 292):

- Programming models
- Surveys
- Econometric models
- Input-output models (Cochrane, 1974)
- General equilibrium models (CGE)
- Hybrid models (Brookshire et al., 1997)

Ashley largely agrees with Cochrane, citing use of Unit-loss methods, Input-output models, Econometric models and Computer generated models, in the assessment of indirect economic losses which result from flood damage (2007, p. 196). The focus of these models is on the higher order effects, i.e. at national level.

2.6.1 Econometric Modelling

Econometric estimation ranges from studies of individual sectors to the entire economy. Econometric models use sound statistical approaches. However, since these analyses are typically based on time series data, they often represent extrapolations of past behaviour and thus are not especially adept at modelling the disjointed nature of hazard impacts (Tierney et al., 1999, p. 21).

2.6.2 Input-output Modelling

O-I models have been used widely in the field of regional economics. They have a wide scope and moderate data requirements when compared with other models. They are static, linear models that combine all purchases and sales between sectors of an economy (Cochrane, 2004). This approach has been the "most prevalent approach" (Brookshire et al., 1997, p. 684). However this method does have limitations;

> "The sheer complexity of the relations between micro and macro economy domain models and estimates will always result in suboptimal assessment and neglect of factors. Inclusions of these factors into the I-O model though improving their accuracy, could result non-operability since every extension is also dependent on additional data sets which might not be available or infeasible to acquire. Yet most inaccuracies within the use of O-I models result from incorrect use including double counting, mixing gross and net figures etc" (Ashley et al., 2007, p. 202)

2.6.3 Computer Generated Equilibrium Models

CGE models reflect the responsiveness, subject to resource constraints of individual producers and consumer to price signals in a multi market context. It uses less rigid technologies specifications than O-I models (Brookshire et al., 1997, p. 684)

2.6.4 Hybrid Models

Computer Generated Equilibrium Hybrid models are the type that computer models use. They use computational algorithms which account for natural disaster induced supply shortages and demand reduction over riding defaults to have the ability to input specific data (Cochrane, 2004, p. 292). This is the type of model that HAZUS

uses; unfortunately there is currently not a New Zealand application of this in the Riskscape model, with no indirect economic output function.

Cochrane (2004) is critical of all the models, stating that approach has its proponents and each has its weaknesses. Surveys capture individual decisions but are weak in terms of integration and input output models are demand driven, therefore limited how useful it is when there is a shock to the local market. Hybrid models also has its weaknesses with the use algorithms that rely on a number of ad hoc inputs and assumptions (2004, p. 292).

There are major difficulties in measuring indirect losses by collection and modelling and this has hindered the development of a single method of calculating indirect economic loss:

> "There are general difficulties related to the available data concerning indirect flood losses. First of all the amount of available data is limited, since most effort in data acquisition is put into estimating primary hazard losses. Secondly, the existing data is often not centrally acquired but scattered into fragments distributed through various agents (e.g. individual businesses, insurance companies). Furthermore, loss data is often incomplete since no standard methods are available in data collection. Limited data availability combined with incompleteness make indirect loss estimation based on simple fractions of primary losses highly improbable." (Ashley et al., 2007, p. 198).

The type of economic modelling is dependent on the end user and it is likely that more than one accounting method is needed. For example insurance companies are only interested in insured loss. Gains from increased activity or offsets due to industry moving to other areas is irrelevant (Cochrane, 2004, p. 291).

2.7 Intangible (non-market) Losses

The least work has been done with measuring intangible losses when compared with direct loss and indirect loss estimation, despite the impact being significant; "available estimates of intangible costs suggest that they are very substantial" (Bureau of Transport Economics, 2001, p. 78):

> "A frequently quoted example is that of the Buffalo Creek flood of 1972, which resulted from the collapse of a dam at a coal mine. There were 125 people killed (Erikson 1976). Almost all of the survivors suffered psychological problems and 625 of them sued the company." (Bureau of Transport Economics, 2001, p. 78)

"Generally the importance of intangible loss is accepted, however, since they are often not measured, they are discounted in the evaluation of natural disasters" (Bureau of Transport Economics, 2001, p. 88). Cochrane (2004) supports this statement; "Non-market losses are never estimated. Disaster losses are almost exclusively limited to impacts measured by market values" (2004, p. 291). These losses could be measured by contingent valuation technique [method] (CVM), but such techniques have yet to be employed" (Cochrane, 2004, p. 291). CVM comprise of asking survey questions to find out how much a user would be willing to pay to use that service ("Ecosystem valuation," 2011). This it seems is the area of most contention, and more research needs to be conducted in this area (Cochrane, 2004).

2.8 Limitations of Frameworks

The use of frameworks is limited for three reasons (ignoring the inherent issues of measurement); the time frame in which the estimate is for, the geographic context and unique nature of an event. Further to this with the development of integrated models such as HAZUS, there are issues with the accuracy of the output which limit

the reliability. Due to these reasons “it is not suggested that strict adherence to the concepts found in economic theory is necessarily the best way to calculate flood damages” (Handmer, 1985, p. 11) and that “the framework should be considered as a guide, and not a total prescription of the costs that should be estimated”(Bureau of Transport Economics, 2001, p. 57).

2.8.1 Time

The timing of the estimate is important due to a number of losses occurring over time, “regional and secondary losses are difficult to detect; they may be displaced geographically and over time”(Cochrane, 1995, p. 67). Often the effects are measured over a shorter period to reflect the full range of outcomes from the event “indirect flood loss estimation due to business interruption cannot be estimated over a single point in time but has to be regressed over the recovery period” (Ashley et al., 2007, pp. 197-198). Further to this:

> “Timing of the estimate also has an impact on the estimate. Measuring precisely the losses of natural disasters takes time. In the case of earthquakes, the extent of the damage to houses or businesses have suffered may take weeks to establish. Initial loss estimates may thus understate actual losses, potentially by wide margins” (Committee on Assessing the Costs of Natural Disasters: National Research Council, 1999, p. 18).

Over time as more information is collected, the revised estimates should include more accurate information.

2.8.2 Uniqueness of an Event

“Each disaster has unique characteristics. Consequently, a general framework omits some categories of cost that become evident during the analysis of the specific

disaster" (Bureau of Transport Economics, 2001, p. 123). Also unique events can generate unique (and therefore unpredictable) economic responses (Committee on Assessing the Costs of Natural Disasters: National Research Council, 1999). For example two scenarios for the Canterbury Earthquake are the impacts of the Rugby World Cup ("Christchurch loses all its rugby world cup games," 2011) and the number of tourists visiting New Zealand (Rutherford, 2011).

2.8.3 Geography

Geographic context is important, as Handmer (1985, p. 11) states the importance of clearly defining the area that the estimate relates to and where the losses occur. This statement is supported by both & Cochrane (2004) & Merz (2010). "It is seldom clear whose losses are to be addressed (the region's or the nation's)" (Cochrane, 2004, p. 290) and "A crucial choice for economic damage evaluation is the appropriate time and geographic extent over which flood effects are to be considered" (Merz et al., 2010, p. 1700). The Committee on Assessing the Cost of Natural Disasters (1999) recommends loss estimations should concentrate on those losses that occur in the region of impact near the time of the event with the geographic boundaries and the time horizon over which the measurement clearly defined and standardised (1999, p. 38). Both Cochrane (2004) and The Bureau of Transport Economics (2001) agree that time of the assessment is critical, but have a contrasting view with regard to geographic context, instead suggesting that there is a different need and model when comparing regional to national loss.

There is a significant difference in loss when comparing the national to local level; "At the local level, it is possible that the stimulus afforded by reconstruction spending offsets the economic costs due to the disruption of inter-industry trading patterns"(Cochrane, 2004, p. 290).

2.9 Measurement of Direct and Indirect Losses

There are issues with the measurement of economic losses. Cochrane cites these issues including: ignoring post disaster liabilities, ignoring non-market losses, double counting, differentiation between gross and net values and confusing data as to whether post disaster economic trends are a product of the event or another unrelated factor (2004, p. 290). Ashley also suggests the use of replacement value vs. depreciated value is also an issue (2007, p. 197).

2.9.1 Ignoring Post Disaster Liabilities

Cochrane suggests loss accounting often fails to account for the regions liabilities or borrowings. The cost of indebtedness could be missed if measured over a too shorter period as long term these liabilities could have impacts on the region and economic growth (2004, p. 291).

2.9.2 The Uninsured

Uninsured loss data is difficult to obtain. Effort should be made to collect this information for loss assessments (Committee on Assessing the Costs of Natural Disasters: National Research Council, 1999, p. 2). When collecting this data for the Edgecumbe earthquake, the uninsured amount was estimated by the author as the information was unobtainable (Butcher et al., 1998).

2.9.3 Double Counting

Double counting is a common problem in loss estimation. Cochrane (2004) suggests that double counting is endemic (2004, p. 290). “It is very easy to make the mistake

of double counting disaster losses. A common problem is to ignore the interactions between different economic agents affected by a disaster" (Bureau of Transport Economics, 2001, p. 58)

> "[It is] commonly asserted that total damage is the sum of direct damage (damage to building and contents) and lost value added. Double counting exists here because value added includes the services of capital, whereas direct damage should reflect the cost of replacing the underpreciated portion of such capital. Even if this source of confusion was eliminated, a secondary issue still has to be addressed. What will happen to the other factors of production that are no longer employed in the disaster stricken region? If the resources are employed elsewhere then lost value added could prove to be minimal for the nation as a whole". (Cochrane, 2004, p. 291)

2.9.4 Stock vs. Flow

Handmer (1985) argues that indirect flood losses have been frequently overestimated in the past because two alternative loss estimations have been used; stock and flow. One party has expenditure and another party has income; in estimating disaster losses, only one side of the transaction should be counted (1985, p. 15).

"For example, the price of a firm's products reflects the costs of production, such as wages, interest payments and profits. To count lost sales as a loss, as well as lost expenditure on salaries and dividends, is a double counting of the loss" (Bureau of Transport Economics, 2001, p. 58). Further to this, it is important not to count if there is a redistribution effect "where one person's, loss results in another person's gain income is redistributed but if the gain equals the loss then there is no change in (economic) efficiency"(Handmer, 1985, p. 7)

2.9.5 Gross and Net Output Values

Ashley states that a clear distinction should be made between gross and net output values. “The gross value reflecting the total value of products including intermediate stages, while the net value reflects the value of the final product. The final value does not replicate final value due to market fluctuations” (Ashley et al., 2007, p. 197).

2.9.6 Replacement vs. Depreciated Value

The cost of replacement does not in many cases reflect the economic loss. This statement is supported by Bureau of Transport Economics (2001), Butcher et al (1998), Handmer (1985) & Merz et al (2010). For example the replacement of commercial equipment loss should be devalued by the depreciation value of the machinery to avoid over estimating the value. Further to this “while damage to contents is valued as the cost of restoration to preflood conditions, new items should minus depreciation value (Handmer, 1985). The estimates from the Edgecumbe earthquake used the depreciated value in the estimation of losses to house and content (Butcher et al., 1998).

If the replacement value was used then this would overstate the loss as a replacement value has more economic value than that same item had at the time of the event. (Merz et al., 2010, p. 1700).

2.9.7 Computer Based Equilibrium Models

With respect to the use of computer models for loss estimation, these too have limitations in terms of accuracies with the measurements;

> “Uncertainties are inherent in any loss estimation methodology. They arise in part from incomplete scientific knowledge concerning earthquakes and their

> effects upon buildings and facilities. They also result from the approximations and simplifications that are necessary for comprehensive analyses. Incomplete or inaccurate inventories of the built environment, demographics and economic parameters add to the uncertainty. These factors can result in a range of uncertainty in loss estimates produced by the HAZUS-MH Earthquake Model, possibly at best a factor of two or more". (Department of Homeland Security & Federal Emergency Management Agency, 2006).

2.10 Data Collection and Storage

Within New Zealand there is no central agency or organisation collecting this information in a systematic way. This was shown by Walton (2004), & the findings from Bureau of Transport Economics (2001, pp. 141-146). The issues of collecting this information from various sources to attempt a loss estimate was highlighted by Butcher et al (1997) " the work was unexpectedly difficult and inordinately time consuming, principally because many of the records had vanished" (Butcher et al., 1998, p. 4).

This is not an uncommon problem and this is shown by two US reports:

> "The painful truth is we are not very good at initial estimation despite having the luxury of a long-term post-disaster period to carefully assess our losses and we are not very good at achieving a final loss figure either"(Comerio, 1998, p. 37).

This report cited similar reasons discussed earlier in this chapter including the issues of what should be counted and the inherent difficulties of collecting this information on a large scale. Recommendation from Committee on Assessing the Cost of Natural Disasters (1999) was to make one agency responsible for collect and storing this information in a standard way so that better information could be collected (1999, p.

32). HAZUS to has had this problem also with “However, limited and incomplete data about actual earthquake damage precludes complete calibration of the methodology” (Department of Homeland Security & Agency, 2009, p. 7).

2.11 Summary

This chapter has reviewed the methods of loss estimation and potential pit falls when conducting economic loss estimations. The research has revealed there is no formal framework for loss estimation in New Zealand despite this issue being first raised over 25 years ago with Ericksen (1985), and that there are numerous difficulties with collecting the information.

The majority or research has been focused on direct loss estimation, and the areas of most contention are around the classification and measurement of indirect and intangible loss. Indirect loss data has been difficult to collect, which has lead to attempts to model the indirect losses using synthetic data. However this is challenging due to the complexity of the economy and as a result no model is perfect and all have strengths as well as weaknesses. Intangible losses are rarely measured and are therefore excluded from most loss estimates. This is attributed to there being no market or agreed way of measuring them, such as health effects or loss of heritage buildings.

The focus of late has been around integrated frameworks with the development of software such as HAZUS and Riskscape a New Zealand application. However this is still in development and does not have an indirect economic loss output.

The development of a framework has been hindered for reasons including the complexities and the debate over exactly what information should be included or excluded in a framework. Also the issues surrounding measuring indirect and intangible losses have hindered the development. Three measurements that can alter the result significantly are:

- The timeframe in which the loss is measured over
- The unique nature of the event
- The geographic context of the loss estimate

Further to this there are measurement limitations which need to be addressed such as double counting, measurement of the uninsured and replacement verse depreciated values. New Zealand has not measured the economic losses that result from natural disasters consistently in the past. The focus instead has been on understanding the event, this is shown by the extensive works conducted by the likes of Dowrick & Rhoades (Dowrick & Rhoades, 2005, 2010) and Riskscape focusing on the disaster response. It is clear, however, that in a disaster more than one accounting method is required due to the diverse need of the end user. For example, an insurer will not be interested in the loss incurred by the uninsured.

3 METHODOLOGY

3.1 Introduction

This chapter describes the process used to collect the data to answer the research question. The method used involved the use of semi-structured interviews conducted with stakeholders involved in residential reconstruction work in Christchurch.

This research set out to answer the following question:

"What are the various stakeholders' evaluative processes for estimating loss to residential housing as a result of a natural disaster in New Zealand, and how is the collected information stored and utilised?"

This question was in two-parts-firstly what are the methods used to estimate the loss? And secondly-how was that information stored and then utilised? To answer this, this chapter outlines the type of research used and the data collection method, with an explanation as to why this method was used. This is then followed by reliability, validity and research ethics.

3.2 Research Design

The literature did not produce any basis for a methodology that this research could be based on, however the method used aimed to confirm or disprove and further explore findings from the literature:

- There is no consistent approach [between stakeholders] of loss estimation for natural disasters in New Zealand (Walton, 2004)

- There is no central agency or organisation collecting natural disaster loss information in a systematic way (Walton, 2004) & (Bureau of Transport Economics, 2001)

This research explored what methods stakeholders employ to estimate economic loss, then store and utilise the information collected. The findings were compared and contrasted between the various stakeholders and the findings from the literature.

The research used a survey, in the form of a semi-structured interview, which aimed to answer the key finding from the literature with the use qualitative data. The semi-structured interview was conducted with stakeholders involved in the Christchurch earthquake, namely the construction companies and insurance companies involved in loss estimation of residential housing. The interview questions are listed as appendix A.

With loss estimation occurring in many sectors on a local and nation scale due to the events of the Canterbury earthquake it was not possible to research this question on such a scale with a limited amount of time nor was it within the scope or requirements of this research, therefore the scope was limited to residential housing and the insurance sector.

Economic loss estimates occur at a higher level than the sector interviewed, however a significant amount of the information these other parties used relied on tabulated insurance data as discussed in the previous chapter. Therefore the methods that are employed in the residential reconstruction and the storage of this data are important to the overall economic loss estimation.

Due to potential sensitivity of the information, the structure of the interview aimed to focus on methods and processes rather than the figures.

3.3 Qualitative Research

The research undertaken was applied research, which uses some parts of existing research for a driven purpose. This is opposed to pure research within a particular industry or social research which examines aspects of human society (Denscombe, 2010).

The research was also exploratory and confirmatory. It was exploratory as there was a "limited amount of knowledge about the topic" (Naoum, 1998, p. 40). Although there was extensive research conducted in this field of loss estimation, there was limited information about both the specific loss estimation methods used in New Zealand as well as how the data should be stored. It was also confirmatory due to the finding from Walton (2004) and the Bureau of Transport Economics (2001) which stated there is no consistent approach to loss estimation and storage of that information.

Qualitative data collection was the primary source employed for this research. Qualitative data is subjective in nature and concerned with the "meanings, experiences and descriptions" of words (Naoum, 1998, p. 40). The use of a semi-structured interview can be described as qualitative data where the interviewee gives their opinions and description of a process rather than facts and figures. This information can was used to "attempt to develop a coherent and comprehensive view of the subject material from the perspective of those who are being researched (Fellows & Liu, 2008, p. 92).

Qualitative research was chosen over quantitative because it was best suited to the aims of this project due to the following reasons:

- The sensitivity of the information being researched. Since the data collection focuses on the Canterbury Earthquake, there was an issue collecting quantitative data as it was difficult to obtain as parties were not willing to

share that information as it was classed as sensitive. Qualitative data was an appropriate alternative.

- The nature of the question required an in-depth look at processes rather than measurement with numbers and analysis with statistical procedures (Naoum, 1998, p. 38), therefore qualitative data was more suited.

There are disadvantages to the use of qualitative data, such as the data lending itself to interpretation by the researcher (Denscombe, 2010, p. 305). However any limitation or disadvantages were overcome with the research design by ensuring the validity in the process with the use of triangulation.

3.4 Type of Data Collection

There is no single pathway to good research; there are always options and alternatives, such as surveys, case studies or experiments (Denscombe, 2010). For this research the survey approach was chosen over others because it was deemed the best when compared with the aims of this project.

The survey approach is "used to best effect when the researcher wants factual information relating to groups of people" (Denscombe, 2010, p. 12). To meet the aims of this research factual information relating to individuals was needed. Other forms of data collection were deemed to be inappropriate due to limitations with time, resources and relevance to the aims of the research. For example an experiment is "generally concerned with determining the cause of any changes that occur" (Denscombe, 2010, p. 66), which did not coincide with the aims of this research, nor did a case study approach, as this research was concerned with contrasting and comparing different groups rather than an in-depth look at an individual.

A descriptive survey and the analytical survey are two different types of survey. The descriptive survey "deals with counting the number of correspondence with certain

opinions/attributes towards a specific object" (Naoum, 1998, p. 44), and the analytical survey "aims to establish relationships and associations between the attributes/objectives of your questionnaire" (Naoum, 1998, p. 45). This research was an analytical survey where the aim is to compare and contrast the associations between different groups.

There are a number of different types of survey available to collect the research information such as questionnaires, telephone surveys and face-to face interviews. For this research a face to face interview was utilised over other forms of survey. The face-to-face interview was utilised because the question requires insight into people's feelings, emotions and experiences (Denscombe, 2010, p. 94). A semi structured interview was used over structured, or unstructured due to the flexibility whist still being able to answer the questions in a consistent manor. Denscombe (2010) also suggests that interviews are advantageous when the data is based on:

- Opinions, feelings, emotions and experiences. The research question related to opinions and experiences about natural disaster loss estimation, data storage and use.

- Sensitive issue. The questions directly related to the Canterbury Earthquake "participants can be encouraged to discuss personal and sensitive issues in an open and honest manor" (Denscombe, 2010, p. 174).

- Privileged information. The information for this research was not available from a large source, rather key people involved in a management position. Interviews represent the best "value for money".

(Denscombe, 2010, p. 74)

Although this was deemed to be the best method there were limitations with the interview method, namely the interview effect where the interviewee will answer differently depending on the interviewer because of their perceptions and prejudices

(Denscombe, 2010, p. 178). To overcome this inherent effect the aim was to keep the interview as consistent as possible with the structure, formality, format and location. As Burns describes location is important to maintain the validity of the research (Burns, 1997).

3.5 Sampling

The aim of sampling is to produce accurate findings without the need to interview every member of the research population. This saves in time and money without a compromise in the accuracy of the results (Denscombe, 2010, p. 23). For an accurate result, the sample must be the correct type for the chosen project. For this research the sampling method was exploratory non-probability purposeful sampling. This was because it gave the best results when compared with the aims of this research.

An exploratory sample was used as opposed to representative sample as a accurate cross section of the sample was not an important factor, rather the need to "generate insights and information"(Denscombe, 2010, p. 24).

As well as exploratory, the sample was also non-random and purposive. Non-random was used as it was "undesirable to select the sample on pure chance" (Denscombe, 2010, p. 25). With respect to the research question, the randomness of the sample added no value. The sample was purposive as the sample was deliberately selected for their known attributes. Knowledge of the topic was a key factor to the success of this qualitative data which was collected.

The research population for this research was those who worked for insurance and construction companies and had knowledge of the loss estimation process and data storage and were involved with the reconstruction of residential houses in Christchurch. From this population a sample was sought. There was a lack of statistical information regarding the number of companies operating in the industry, however it was known that there is only a limited number of insurance and

construction companies operating in the industry. This was a small population, so the sample size was a reflection of this, with an estimated size of seven, three insurance companies, four construction companies. The actual sample size achieved was less than this due to reasons discussed at the beginning of the next chapter.

The aims of this project require the knowledge of individuals; this was done by interviewing individuals with in-depth knowledge about the topic. To ensure this, there were qualifying attributes:

- A management position, with an overview of the loss estimation and data storage process
- Knowledge of the estimation method
- Knowledge of the data storage method
- Have been directly involved in the Canterbury Earthquake

These above qualifying questions had to be satisfied for the participant to take part in the research,

3.6 Reliability and Validity

In reference to the interview method for gathering qualitative data, Burns (1997) describes validity as the most important aspect that must be ensured when undertaking a survey. Reliability "concerns the consistency of a measure" (Fellows & Liu, 2008, p. 183) and validity is the truth of the information (Denscombe, 2010).

The questions were pretested with an insurance company employee and a construction company employee to gauge their understanding of the question and changes were made based on their feedback.

Triangulation was used to increase the reliability and validity as suggested by Burns (1997). It was used to checking the findings from more than one source, insurance companies, construction companies and the literature. The benefit of triangulation is twofold:

- Improves the accuracy (a means of validation). Has a focus on the authenticity and accuracy by cross checking the findings

- Fuller picture. Triangulation increases the completeness of the research by using supplementary data as support for the findings

(Denscombe, 2010, p. 348)

The use triangulation improved the accuracy of the research and findings. However it will not prove the research correct as it merely provides more support, increasing confidence and reducing the possible error, increasing the reliability and validity (Denscombe, 2010, p. 349).

3.7 Data Management and Analysis

The data was managed in a way so that it could be analysed in a systematic and consistent way. All interviews used the same collection method, with the use of field notes and a tape recording.

Once the data was collected it was analysed using a typology classification approach where the responses were organised into categories based on the literature. This approach leads to the emergence of sub-categories linkages and relationships (Fellows & Liu, 2008, p. 97), which was the aim of this research to compare and contrast methods between groups. The classifications were based on the literature and the interviews were structured in the same manor, so the research interview question helped to form the main categories, and from there the subcategories.

3.8 Research Ethics

The ethics of this research were considered before the interviews were conducted. It was a key goal and essential to the success of the research "that people should not suffer as a consequence of their involvement with a piece of research" (Denscombe, 2010, p. 136). Before the interviews were conducted the ethics section was approved by the course supervisors. There was full disclosure of the research with the interviewees and any further information they requested was discussed. The interviewees were asked to take part in the research and it was at their discretion to take part or not. A 66% response rate was achieved, with two declining to take part in the interview. All of the questions were open ended so it was at the discretion of the interviewee as to how much information they wished to disclose and how they answer it. The name of the company and individual has been excluded from this research so that neither can be identified; the transcripts of the interviews have also been excluded from this report. Sensitivity of the topic was a known issue before conducting any interviews, therefore the questions and process took this into account to try and limit any potential issues that could arise due to this.

3.9 Summary

This chapter has presented the methodology used to collect data relating to methods of loss estimation and storage of data for insurance and construction companies working in residential Christchurch. Six semi-structured interviews were undertaken so that the findings could be compared and contrasted with one another and the literature.

Non-random purposive sampling was used to select the sample as this provided the greatest ability to reply to the interview questions due to the need for in-depth knowledge of the topic. Only those who met the qualifying criteria set out in this chapter were interviewed.

4 RESULTS

4.1 Introduction

This chapter presents the data collected from six semi-structured interviews conducted with Insurance, Consultant and Project Management Companies involved in residential housing assessment and repair/rebuild work in Christchurch. The interviews were designed to investigate the methods used to estimate the cost of the event and how the information was stored and utilised. The findings were then compared with the main findings from the literature. The participants were sent a 'Participant Information Form' prior to the interview. This was to inform them of the nature and rationale of the research. Participants were also given the interview questions so they could decide whether to take-part, due to the potential sensitivity of the topic. With the permission of the participants the interviews were all recorded and field notes were taken. Copies of the transcripts have been excluded from the appendix of this research due to the potential to identify the individual and company. Five of the interviews were conducted in Christchurch, with the sixth in Auckland, and all were conducted in their respective company's offices. Interview 2 with participant 2 was conducted in their office, while the all others we conducted in a meeting room. Location was important as mentioned in the previous chapter to maintain the validity of the study (Burns, 1997). Effort was also made to have face-to-face interviews due to the ability to assess body language and the ability to gain more in depth information (Denscombe, 2010); all interviews conducted were face to face.

4.2 Participants

The requests for interviews achieved a 66% response rate. Six agreed and two declined to participate and one did not show up at the arranged meeting. The first

declined citing confidentiality, the second citing work load and the third did not show up due to family commitments. This number was less than the intended sample size set-out in the methodology chapter.

Three different types of company were involved, two Insurance Companies (Companies A & B\Participants 1, 2, & 3), two Construction Companies acting as Project Managers (Companies D & E/Participants 5 & 6) and the third a Consultant to an Insurance Company (Company C\Participant 4). The Consultant is to be viewed as a Project Manager as they are acting in the same capacity.

All participants were at senior management level with an overview of the respective company's processes and involvement with Christchurch reconstruction which fulfilled the qualification criteria set out in the previous chapter.

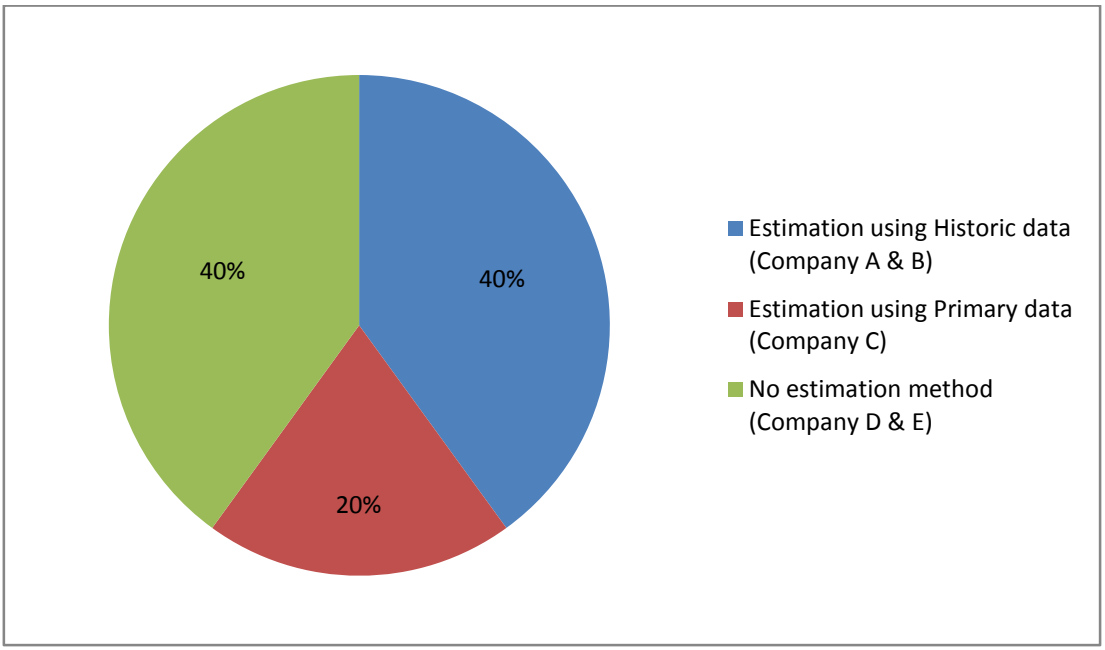
4.3 Initial Estimation Method

Of the participants interviewed, only the two Insurance Companies (Company A & B) and one Project Management Company (Company C) used a form of initial estimation to establish an indicative cost of the loss incurred on a house. Company A used their own historic insurance information "a basic average of historic data over a period of time" (Participant 1) to establish a likely cost based on the insured description of the damage. Similarly Company B used a computer based programme where the cost was calculated using their own insurance information as "historic base line data" (Participant 2) and based on the damage description of the insured. This estimation method for both companies did not differ from their Business as Usual (BAU) work.

Company C's estimation method used primary data collected and combined with secondary cost data from various market sources, established an initial estimate of the loss. This was later used to evaluate residential repair options. This method was more intense than the method employed by the Insurance Companies as it was based

on surveys from the actual damage, rather than historic data and current market rates were used rather than historic costs.

Figure 1: Estimation Method Utilised



Both Company A and B stated this initial estimate is not accurate when compared with the actual cost and that "the initial estimate is essentially never right" (Participant 1) and "this figure is very inaccurate" (Participant 2). Company C did not comment on the accuracy of this method.

An important distinction as previously discussed was that the scope of the estimation for the Insurance Companies was based on a per claim basis rather than the overall loss. An overall loss estimation would occur, however this was not discussed in the interviews due to the sensitivity of that method and the relevance to this research question is limited as that estimate is to serve the Insurance Company in risk assessment rather than loss estimation.

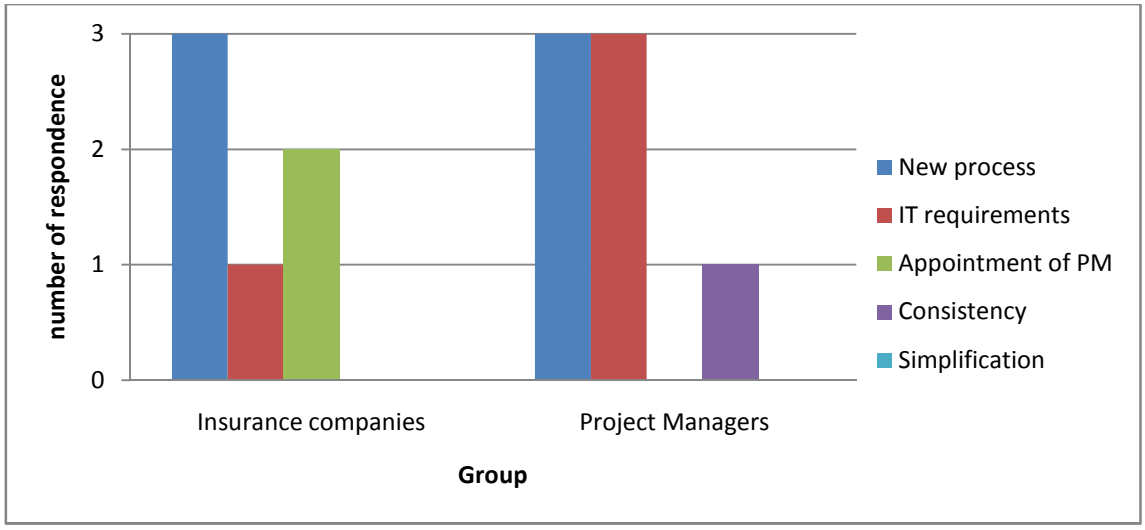
4.4 Natural Disaster Loss Estimation and BAU

There were mixed responses from participants when comparing the natural disaster to BAU work. Estimation of the works were carried out by only 3 of the 6 companies interviewed (Companies A, B & C); both Insurers and one of the three Project Management firms. This question was broadened to include for the process as well as method so that all companies could interviews could answer. The Insurance Companies main difference was the volume of claims, whereas the Project Managers' process was new and it had never been conducted before, so the whole process was new (Companies C, D & E).

4.5 Lessons Learnt - Loss Estimation Method/Process

Participants had varied responses to this question. All companies involved had some form of new process, which was due to this event being a unique. One of the Insurance Companies (Company A) biggest change was the inclusion of a Project Manager whereas they used to "manage the process from go to whoa" (Participant 1). Whereas the Project Managers' most significant change was the change in Information Technology (IT) Systems to help manage the claim process, and the development of new processes to manage the claim system, with companies C, D & E all developing new systems to manage the work.

Figure 2: Number and Type of Response for Lessons Learnt

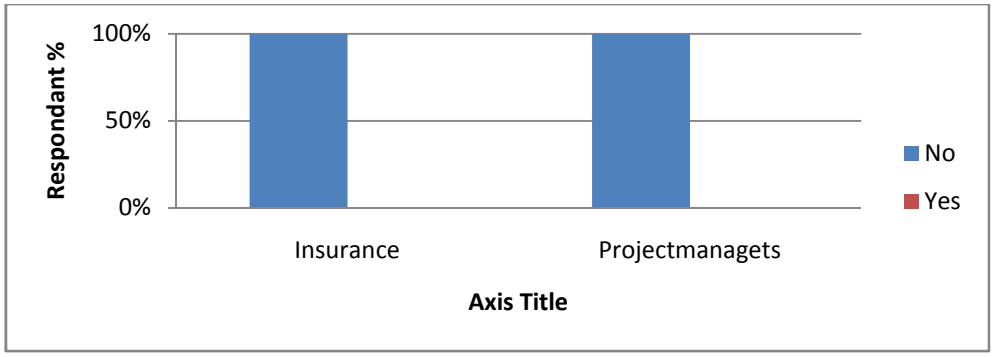


All participates cited some form of new process with regards to loss assessment and handling of claims. This was due to the nature of the event as none of the companies have had to deal with this type of work in the past, either as Insurers or Project Managers; "we didn't have processes, because we never had earthquakes before" (Participant 1) and "we have never been a Project Manager with this type of work before so had no processes in place prior to our involvement" (Participant 6).

4.6 Consistency within the Industry

All participants said that they thought there was a lack of consistency within the process of claim assessment and how the different parties were handing the earthquake related claims "every Insurance Company does it completely different" (Participant 1). This was due to the competitive market in which the Insurance Company's work in (Participants 5&6) and "the policy response of the insurer" (Participant 1), where some are focused on the bottom line while others are customer focused (Participant 1, 2 &3). Furthermore, the situation is complicated by the uniqueness of the event where entire pockets of land are being retired where the insurance policies were never written to account for this (Participant 1).

Figure 3: Interviewee Opinion if there is Consistency in the Industry



Both participant 4 and 6 identified that consistency within their respective companies (Company C & E) was also a factor which they had to consider more so than in the past. Participant 6 stated that consistency was a factor due to the size of the organisation and keeping an identical process and where things were changing frequently was difficult. Participant 4 stated that consistency was a factor due to the turnover of staff and that in the past they might have "thought outside the box" whereas now it s a more prescriptive process and to accommodate this, a simpler system was introduced.

4.7 Depreciated vs. Replacement Value

All Project Managers and one Insurance Company (Company B) stated that replacement value was the recorded information for repair work to houses where the term "like for like" was used by participant 2, 3, 5 & 6. Participant 1 stated that what was recorded was dependent on how the policy responded and how the individual claim was settled as to what figure was recorded.

All companies stated that contents portion was dependent on the specific insurance policy, so what was recorded was dependent on the individual insurance policy.

4.8 Administration Costs

All companies interviewed did not have administration costs allocated to an individual claim; instead they were dealt with separately. Participant 2 stated that the administration costs will be compared with the value of repair work, however this is not allocated on an individual claim bases. Participant 4 stated that the administration costs are not on an individual basis however compared with their BAU work it usually is. The Project Managers charge a separate fee to the Insurance Company, but it was not discusses how this was dealt with by the Insurance Company.

4.9 Storage of Information

All companies used some form of computer based system to manage this collected information centrally. In all cases, the systems were in some way linked to their existing systems, even if applications were custom built for this project.

Company A used their existing claim system, with no changes from their BAU system. Company B & C used their same BAU system, but it was developed further to cater for their needs associated to this project. Company B developed a system that runs parallel to the existing system to cater for the increased IT applications used in the field for assessing homes. Company C used an in house system that was developed before the earthquake but was not used for their BAU work; this system has been utilised in this case and developed further. Companies' D & E have developed custom built applications for this project to manage this kind of work. Their custom built systems are still linked to the existing reporting and payment systems. They were developed by these companies to handle the large quantity of claims as they had no existing system in place to manage this type of event

4.10 I.T Developments

IT developments have been a large part of process development for the majority of these companies. Only One Insurance Company (Company A) did not change their system in some way, and used an existing system. Company B developed there process to accommodate for the inclusion of more computer based systems and companies C, D & E all either further developed an existing system or designed a new system to cater for their needs. Company D stated “yes, it’s a custom built system developed by our in house IT department to cater for this project” (participant 6).

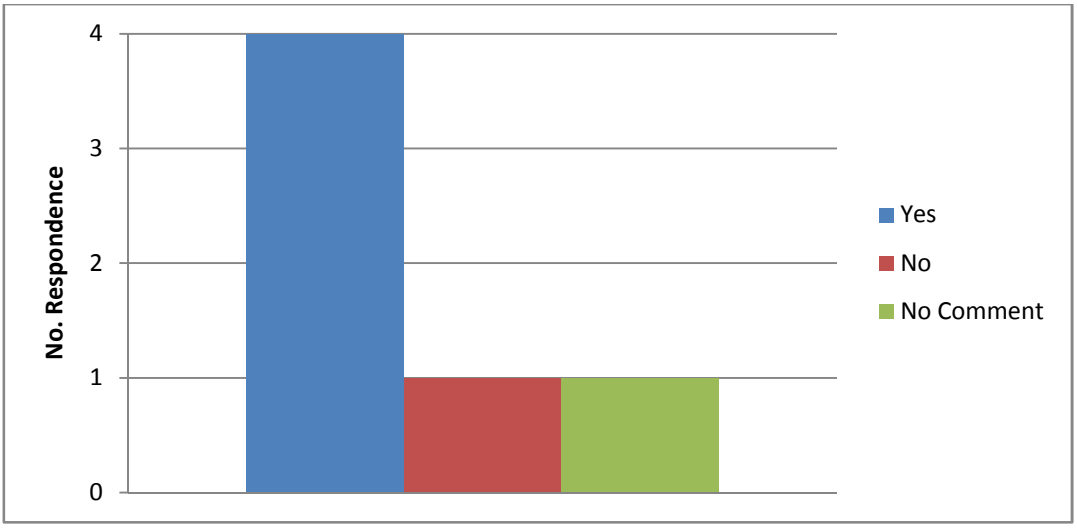
4.11 Sharing and Utilisation of Collected Information

The Project Management Companies only shared the collected information with the respective Insurance Company and no other parties at this stage. Until the Canterbury Earthquake the Insurance Companies interviewed did not share collected information with any third parties. Participant 1 & 6 doubted that the information could be openly shared due to the competitive nature of the industry. However due to this event a limited amount of information was shared. This was different to BAU work as it was necessary to share information due to the extent of damage and number of claims and the involvement with of the EQC. It seems that the information shared is filtered and limited “we provide them with what they need to know (Participant 1).

4.11.1 Advantages of Sharing/Centrally Storing the Information

When asked if the interviewee thought there was value in centrally storing all this collected data, participants 1,4,5 & 6 thought there would be advantage, Participant 3 did not answer and participant 2 thought that there would be no value.

Figure 4: Is there Advantage In Centrally Storing the Information?



Of the participants who thought there would be value added only participant 1 expanded on their response stating they thought there was value due to learning from others mistakes. Participant 2 thought there would be no advantage to their respective company.

Although the majority of participants thought there would be advantage to centrally storing the information, participants 1, 2, 5 & 6 all gave reasons as to why they thought it would be unlikely to happen:

- "There are some issues to overcome in terms of privacy as the private insurers don't want to lose any commercial advantage. You are talking about putting government and private information into a centrally shared database, which is essentially pretty commercially sensitive information" (Participant 2)

- "Due to the sensitivity of the market I don't think it will happen" (Participant 5)

- The current regulation of the insurance industry “I think it is a bit evolved for the industry” (Participant 1)

- Difficulty in gathering the information “Good luck trying to get the information” (Participant 6)

4.12 Future use of the Information

When asked if the participants knew how the collected information was to be used in the future only two knew how, participant 2 & 4. Participant 3 was not asked and participants 1, 5 & 6 did not know how the information would be utilised.

Participant 2 stated their stored information would be utilised by their company as a database to cross reference any future potential claim. While participant 4 had a clear definition of how the information would be used “So it will be used for risk assessment for both hazards” and “a lot of it will be for research purposes”

4.13 Summary

This chapter has presented the findings of the six semi-structured interviews. A 66% response rate was received for the sample group. This was smaller than the intended sample size discussed in Chapter three however the date is sufficient to answer the research question by analysing the findings and drawing conclusions.

5 ANALYSIS

5.1 Introduction

This chapter analyses the results from Chapter 4. The findings are compared and contrasted to the literature presented in Chapter 1 and the differences and similarities are discussed.

5.2 Background

Natural disasters can have major negative effects on short and long term economic growth (Benson & Edward, 2004, p. 1). It is estimated that economic growth in New Zealand will be reduced by 1% as a result of the Canterbury earthquake ("Christchurch earthquake will 'dent growth'," 2011). Information regarding economic loss can assist policy makers, the insurance and reinsurance sectors. (Committee on Assessing the Costs of Natural Disasters: National Research Council, 1999). Despite this it seems “little is known about the economic costs of natural disasters” (Bureau of Transport Economics, 2001, p. 3) and further to this Walton (2004) suggests that there is no consistent method to loss estimation in New Zealand.

The purpose of this research is to establish the methods of loss estimation used in the residential housing sector and how the collected information is stored. The findings are compared and contrasted against existing literature. This research question is:

“What are the various stakeholders’ evaluative processes for estimating loss to residential housing as a result of a natural disaster in New Zealand, and how is the collected information stored and utilised”?

5.3 Data

Six semi-structured interviews were conducted with employees of two Insurance Companies (companies A & B) and 3 Project Management Companies (Companies C, D & E) working in Christchurch residential reconstruction.

A survey was developed in line with the findings of the literature relating to estimation and the data collected. The questions were answered in face-to-face interviews. The results were analysed in similar order and groupings as presented in the previous chapter.

5.4 Initial Estimation Method

As discussed in the literature review there is no consistent loss estimation method in New Zealand. The advantage of a consistent methodology allows estimates across time and regions to be compared without fear of mythological bias (Walton, 2004, p. 250).

Within loss estimation the three main categories of loss that occur as described by the Bureau of Transport Economics (2001) are direct loss, indirect loss and intangible loss. The literature was focused at a higher level of loss estimation where all areas of loss are accounted for; this research has explored only direct loss. However since the insurance sector is one of the largest sources of data for direct loss, the information gathered here must also be estimated and recorded in a consistent manner to gain accurate and reliable information for it to be utilised further. In New Zealand estimates of economic loss has largely been based on insurance claim information and has not employed a systematic methodology (Walton, 2004, p. 249).

As previously discussed, an important distinction is that insurance companies conduct loss estimations as part of their risk assessment to manage their exposure or liabilities and the usual insurance terms are maximum possible loss and maximum probable loss. This is a separate issue and is not discussed in this report for reasons including confidentiality. The loss estimation discussed with the Insurance Companies relates to a per claim basis.

Three of five companies interviewed conducted loss estimation; this represents 60% of the companies interviewed. Of these companies, both the Insurance Companies and one Project Management Company conducted estimates of the likely cost. However due to number of respondents in the sample conducting estimates, the validity of the findings is limited. To have greater validity, a larger number of companies in this sector would need to be interviewed.

Despite the lack of validity the responses from the participants suggest that there was no consistency to the method of loss estimation in the industry. The three companies all used different methods to conduct loss estimates. The two Insurance Companies used historic/empirical data and although this was the same, the actual method used to calculate the loss appeared to be different. The Project Management Company used primary collected data rather than synthetic or historic data and rates to estimate the likely loss to the property. This is a more accurate method as it takes into account the unique factor apparent in this event and current market rates, opposed to historical data which is not necessarily relevant to this event.

This is in line with the main findings from the literature, such as Walton (2004) and Bureau of Transport Economics (2001) and Committee on Assessing Cost of Natural Disasters (1999) which all found a lack of consistency in method in the industry, which is largely attributed to a lack of a framework.

Other methods suggested by the literature for loss estimation include the use of state-of-the art software, such as HAZUS, or RISKSCAPE which has a direct loss output

("Riskscape," 2011) and this could be applied to this sector for loss estimation. No company interviewed utilised existing software outside of their company and applied it to the Canterbury Earthquake. It seems that this is due to a number of factors:

- The rare occurrence of the event of this magnitude, which would lessen the need or use of this software by these companies.

- This software it seems is more suited to overall loss estimation; more broad than one area. This software is also suited to evaluating risk assessment options and disaster response rather than estimation on a residential scale.

- Research into the accuracy of software in New Zealand suggested that an accuracy factor of 2 is achievable in a high magnitude earthquake in a populous area (Cousins, 2005, p. 18). The Insurance Companies stated that the estimates were not accurate, so it would be questionable whether there would be any advantage gained using the software for estimation, as it is most probable that is no more accurate than the current situation.

Loss estimation software was not utilised in the sector, nor is it likely to be due to the needs of the user. The needs of the individual company are different, with existing processes in place. These programmes are specifically suited for natural disasters risk assessment and hazard response rather than the needs of this type of company.

For high impact events, the most appropriate method of hazard loss estimation includes surveys, insurance claim data and modelling (Walton, 2004). Based on the findings, there would be value in consistent method or guideline or framework between companies. Due to the different needs of the individual companies, it would be difficult to implement a prescriptive method as there would be more value in outlining requirements of the output information. This leads back to the literature review where most of the gaps in the literature centre on what information should be

included in these estimates. It is also important, however, to have consistently stored information, so it can be accessed and utilised without methodological bias and this has been discussed as a problem with data collected in New Zealand in the past.

5.5 Natural Disaster Loss Estimation and BAU

From the findings it was difficult to compare this event with the companies BAU work. Despite the two Insurance Companies using the existing estimation method, all included some form of new process, to deal with the event. None of the responses were exactly the same. However, from the literature one of the main reasons why there has been no framework introduced is that every event is different and unique (Cochrane, 2004). Participant 1 stated that the insurance policies were never written to deal with this type of event. Such as the land damage in Christchurch and government intervention with offering packages to the red zone residents. This is a unique situation to try and quantify the actual loss. This also affects the insurance industry as the government has taken some of the private insurer's risk. The conclusion is only to highlighting how the uniqueness of the event can alter the estimation and storage process and add unique challenges to overcome.

5.6 Consistency within the Industry

A question asked to the participants, following on from the estimation method was: "In your opinion is the method you have used consistent throughout the industry in New Zealand, and how do you know that?" The unanimous response was no there is not any consistency with in the industry. The aim of this question was to prove that there was no consistent loss estimation method utilised. However after reviewing the findings, any conclusions drawn from the question lack validity due to the manner in which the question was asked. The question had varied from method and towards

process and how the claim was managed rather than estimated; this is outside the scope of this research.

This occurred due to do the original assumption that the process is the same as method, however this is not true. Although it could be argued that the process is part of the method, there is an issue within how the question was asked therefore affecting the validity. However, the findings were that there is a lack of consistency in process and estimation method, due to a number of reasons which did coincide with the findings from the literature.

- The competitive nature of the insurance industry. From the interviews conducted it was clear that that the insurance market is very competitive, with little correspondence between competing Insurance Companies. The Insurance Companies all operated in different ways and did not share information, such as estimation methods, therefore methods are different due to the competitive nature of the industry they operate in. this was not highlighted as an issue within the literature, but would be a prohibitive factor to introducing a loss estimation framework into New Zealand.

- Regulation within the industry. “New Zealand has one of the least regulated insurance markets in the world”(Insurance Council of New Zealand, 2008), this market is largely self governed, therefore there is no framework for compulsory reporting which would be a major factor in having a consistent method of estimation.

- One size fits all. Further to the two points above the loss estimation method will be a reflection of the need or result from the end user. “For example, Insurance Companies only have an interest in insured loss” (Cochrane, 2004, p. 291). This is also true on an individual company basis. With respect to the Project Management Company the reason why the method differed from the Insurance Companies method is the end need is different, therefore the same method would not be used.

For there to be consistently stored information for other parties to be able to further utilise the information, there is advantage in using the same systems and processes as well as an estimation method, so there is consistency in the results and the data can be used by practitioners without fear of methodological bias (Walton, 2004). From the findings it is clear that this is not the case in this sector.

5.7 Depreciated vs. Replacement Value

From the literature one of the findings was the idea of replacement or depreciated value for use in economic loss estimation. The cost of replacement does not in many cases reflect the economic loss. This statement is supported by Bureau of Transport Economics (2001), Butcher et al (1998), Handmer (1985) & Merz et al (2010). Depreciated value should be used for economic loss estimation as replacement value can represent a higher value than its pre-event equivalent. For Butcher (1998), who released a publication assessing the Edgecumbe earthquake, an attempt was made to separate out the "betterment" from the data collected to give a genuine repair value.

From the data collected in this research, the information recorded is not the depreciated value but rather the cost to repair or reconstruction cost. 100% of the participants interviewed stated they recorded the repair cost and not the depreciated value. This is not consistent with the recommendations from the literature. What was recorded was what the respective insurance policy entitles the claimant to, and the actual cost incurred by the Insurance Company, rather than the depreciated value. This recorded data is not in-line with the findings from the literature for what information should be used in the economic loss estimation. If this information was to be used in this form for further loss estimations it could overstate the loss, as this replacement value could give a more valuable product than the pre-event equivalent, and hence overstate the loss.

The findings relate to the point discussed previously, where the estimation and the data collection method is a reflection of the need of the end users; in this case the

Insurance Companies, whose use of the information is different to other parties. The respective insurance or Project Management Company's main concern is the cost incurred, rather that the loss value, therefore it is understandable that cost is stored rather than depreciated value.

For this data to be used in other economic loss estimates it would need to be filtered so the loss was not overstated. No conclusions could be drawn past this initial observation as more investigation would need to be conducted to see who utilises this information and in what manner, and if filtering of data occurs. Again this finding highlights the potential advantage of a consistent method or use of a framework as discussed in the literature. If this information were estimated, recorded and stored in a consistent way then it could be utilised by different parties.

5.8 Administration Costs

No literature was found in relation to how administration costs should be allowed for in an estimate or how it should be recorded. In an event such as this, a large amount of coordination and additional personnel is needed, adding to the administration cost. It was clear from conducting the interviews that there has been significant administration costs relating to the Canterbury Earthquake and this was also shown by EQC paying out $138,000,000 in wages up till September 2011 (Bennett, 2011). This was an indirect cost which was a direct result of the event. Indirect costs as previously discussed are "losses other than direct loss [which occurs as a result of a natural disaster]" (Cochrane, 2004, p. 291).

From the companies interviewed none factored this cost on claim by claim basis, it was treated separately. This was a convenient way of storage if this cost if it were to be analysed and used in economic loss estimations. However, if this information is available to other parties as opposed to being costed against the BAU work was not discussed with the interviewees so any conclusion past this point of observation is impossible.

In reference to the frameworks proposed and the literature reviewed, and administration costs did not feature at all with respect to companies involved in the recovery phase this is a potential area of further study as it seems to be a gap in the literature.

5.9 Storage of Information

Within New Zealand the storage of Natural disaster loss information has been poor. This was shown most notably by three publications; Walton (2004), Bureau of Transport Economics (2001) and Butcher (1998) all noting that reliable information was difficult to obtain. “Nationally the aggregate of flood loss is poorly documented, although this was made in reference to flooding Ericksen’s comment applied equally to economic loss assessments of other natural hazards in New Zealand”(Walton, 2004, p. 249). Further to this the Bureau of Transport Economics also concludes that little is known about the economic costs of natural disasters (2001), although this comment is a reflection of Australia the comment still holds true when applied to New Zealand. This was not a unique situation to New Zealand, where overseas countries such as the US has faced a similar issue with poorly documented information due to the difficulties faced in estimation and collection (Comerio, 1998, p. 37).

The initial findings from the previous chapter were that the collected information from insurance claims is not centrally stored, rather collected and stored by the individual Insurance Companies. The Project Management Companies also supply Information to the Insurance Companies. This is in contradiction to the literature which used information sourced from the Insurance Council of New Zealand (ICNZ) (Walton, 2004, p. 252) (Bureau of Transport Economics, 2001). To be conclusive this would need to be followed up further with the ICNZ to understand how they gather their information, and this was not able to be completed within the timeframe of this research.

From the research it was clear that the storage of the collected data has to be obtained from the individual Insurance Companies. This data as discussed has formed a significant part of loss estimates in the past and there could be advantage in centrally storing the information with an independent body, but this is not done in New Zealand.

5.10 Sharing and Utilisation of Collected Information

Of the companies interviewed, none openly shared all the collected information with third parties. As previously mentioned this is in contradiction to one source that suggests that the information is shared with ICNZ. Due to the size of this event however, the Companies have been forced to share some information with one another as more than one company is involved in a claim, namely the EQC. The EQC deals with all claims relating to all land repairs and house repairs valued from $1-100,000 (EQC, 2011). Once the repair value exceeds this cap it passes over to the Private Insurance Company to settle the claim. This situation has forced the parties to cooperate and share a limited amount of information with one another. As discussed in the findings; this information is limited and not openly shared, where the Insurance Companies filter the information.

It seems from observation that it would be much easier if the information were to be freely available and five of the six interviewees agreed that there would be advantage in centrally storing the information. However all agreed that it would be incredibly difficult to achieve, with some of the issues being raised included the competitiveness of the industry, sensitivity and privacy issues relating to the information. An option on how to make this information more freely available could be to regulate the industry more and have a governing body with a set of rules and regulations on what information has to be disclosed and how, but as mentioned New Zealand does have one of the least regulated insurance industries so this would be difficult. With this information controlled by the private sector, it would be difficult

to use the information without doubt of the accuracy and completeness of the information.

5.11 I.T Developments

Information and Technology developments it seems played a major role in the companies interviewed in managing the claims form the event. This was not an intended finding from this research, rather a by-product resulting from questions relating to storage of the information. There is a lack of literature relating to how claims should be managed in the event of a natural disaster. From the interviews it was evidently clear that IT has played a significant role in the majority of the Companies, with Two Project Management Companies developing a data management tool in-house to manage the process for assessing the damage and managing the repairs. This is an area of future research; to investigate the area of IT within the event and how it has been utilised. An interesting note is that none of the Companies I talked to looked overseas for existing software which could potentially exist.

5.12 Future use of Information

From the findings only two Companies knew how this information would be utilised, one for the in-house use of cross-referencing any future claims, and the other for earthquake design work. The other interviewees were unsure how it would be utilised. From the literature one of the main uses of this data is for risk assessment and mitigation decision making (Committee on Assessing the Costs of Natural Disasters: National Research Council, 1999). It is unclear how exactly this information will be utilised but likely be applicable to numerous sectors of the economy. As discussed with participant 5, due to the management of the event those Companies which develop a process for managing this repair work will become

experts with a unique skill set which could potentially be developed and applied elsewhere in the world.

5.13 Summary

This chapter has analysed and discussed the results of the survey of five companies based in Christchurch managing the residential reconstruction work following the Canterbury Earthquake. The results have been compared to the findings from the literature reviewed and it appears that the findings generally agree with the literature.

6 CONCLUSION

6.1 Introduction

This chapter summarises and evaluates the findings of the research paper. The conclusions are discussed as well as the limitations of the study and potential topics for future research are proposed.

6.2 Purpose of this Study

The topic of natural disaster loss estimation is extensive, with research focusing on various aspects being published worldwide. The use of a loss estimation framework has been proposed, but there is a lack of research relating to the process of storing the information. Within New Zealand there is no framework or consistent way of organising and storing the information.

The research conducted was exploratory as it seems from the literature that there are no comparable studies have been undertaken examining this issue in a residential context in New Zealand.

The research question is:

"What are the various stakeholders' evaluative processes for estimating loss to residential housing as a result of a natural disaster in New Zealand and how is the collected information stored and utilised?

The research interviewed employees of Insurance and Project Management Companies involved in the Christchurch residential reconstruction work. The two

different types of company were interviewed to increase the validity with the use of triangulation.

6.3 Summary of the Findings

This research has investigated the loss estimation methods and storage of information in residential reconstruction work following the Canterbury Earthquake 2011. In addition to this it has indentified that there is no consistent estimation method nor consistent method of storage utilised. This is despite the issues the consistency of loss estimation in New Zealand being raised over twenty five years ago with Handmer (1985), and was shown with the varied estimation methods between companies.

The literature that was identified in Chapter 1 focused on economic loss estimation at a national level. This research was focused on the residential sector namely the insurers which only measure direct loss rather than the three categories of: direct, indirect and intangible loss. However, residential insurance loss has been used as a main source of data for economic loss estimates conducted in New Zealand (Walton, 2004), therefore, the methods applied here can have a substantial impact on other loss estimates depending on the method of collection and storage.

The estimation methods used by the companies interviewed varied. Three of the six companies conducted a loss estimate-two Insurance and one Project Management Company; all of which utilised different methods. The Insurance Companies relied on historic based data whereas the Project Management Company used primary collected data and applied market rates to assess the likely cost of the damage. This finding was in-line with the literature as there was no consistent method to the loss estimation.

The literature suggests the potential use of software in economic loss estimation such as HAZUS or Riskscape. None of the companies interviewed utilised software from New Zealand or overseas for loss estimation. This it seems was due to a number of reasons including: the lack of need or relevance to the residential insurance sector as they already have their own internal processes in place and there potentially being no advantage due to gaining no increase in estimate accuracy in comparison to existing processes. It also seems that currently this software is more suited to risk assessment and hazard response rather than loss estimation on this scale.

Further to this idea of a lack of a consistent, all participants agreed that there was a lack of consistency within the industry regarding the process of managing the reconstruction work, although this question lacked validity for reasons outlined in the previous chapter, it did highlight potential issues in introducing a consistent framework.

- The competitive nature of the insurance industry. The companies were operating in a competitive market which was not conducive to a consistent process. This issue was not highlighted in the literature.

- Lack of regulation. New Zealand has one of the least regulated industries in the world (Insurance Council of New Zealand, 2008). It would be difficult to implement a standard method when there is a lack of control or a governing body that can implement a scheme.

- The needs of the end user: Cochrane (2004) suggests an insurer is only concerned with insurance loss. The company's method was a direct result of their own individual needs, as shown by the use of three different companies having three different methods.

Two points investigated regarding specifics of loss estimation were: the recording of administrations costs and depreciated vs. replacement value. Administration costs

were not raised in the proposed framework or discussed in any literature reviewed, despite the significance of the cost in a large scale event. It was highlighted in the findings that administration costs were treated as a separate fee, but was unclear how they were factored into the estimates and this would need to be investigated further. Ashley (2007) stated that depreciated value should be used in economic loss estimates so loss is not overstated. This value was not recorded by the companies interviewed, rather the cost incurred and if it were to be used in economic loss estimated the data would have to be altered, but this too would require further investigation.

The storage of this estimate information is important so it can be utilised by other parties for further studies, however, due to previously discussed issues including the competitiveness of the industry and lack of regulation it seems from the findings it is not centrally nor consistently stored. There could be advantage in centrally storing the information, but this is unlikely to happen as highlighted by 5 or the 6 participants giving reason as to why it was unlikely to happen.

In general the findings were in-line with the literature where there was no consistent method of estimation or storage due to the points outlined above. There could be advantage in centrally storing the information and employing a consistent method but this would be difficult to implement.

6.4 Conclusions

The literature review established the current state of loss estimation and the limitations and problems in establishing a framework. The literature also highlighted that in the past the data stored has not been to a high quality. The findings from the research agreed with the literature, when no consistent method of estimation or storage was utilised and the reasoning as to why this occurred generally coincided with the findings from the literature.

It appears that within the residential sector it would be difficult to establish a consistent method between companies due to the difficulties experience within the current market including:

The competitiveness of the private market; this is not conducive to working together and also the lack of regulation within the insurance industry does not aid in establishing a consistent process.

Further to this the need of the end user is different within each company is different, where the process and storage of information is a reflection of the individual company rather than a generic output for others to use.

There would be value in having a consistent framework for natural disaster loss estimation in New Zealand to assist policy makers in the future and aid in mitigation decisions by having comprehensive loss data stored in a consistent manner so that comparison can be made without fear of bias within the data, however, this would be difficult to implement due to the issues discussed above.

6.5 Limitations of this Study

A sample size of six participants representing two Insurance and three Project Management Companies was selected for the collection of data related to the research topic. The aim of the data collection was to investigate of the methods of estimation and storage used by the companies in Christchurch. Although the target sample size was not meet due to limiting factors including the sensitivity of the topic and participant workload, the interviews conducted were adequate for this purpose of this study. For the validity in increase however, a larger sample size would be required, at a minimum one more Insurance Company, this would also help with the triangulation to further increase the validity of the study.

The lack of information identifying the number of Insurance and Project Management Companies working is residential Christchurch limited the validity of the study, due to an unknown population size. It was however known that the Insurance sector does not have a significant number of companies, nor does the construction sector have a large number of companies capable of project managing on this scale. It is therefore know that the population is not large, however, the exact size was not known.

The sensitivity of the topic was an issue that was obvious in conducting the interviews. This was due to the situation in Christchurch, where the Companies were working in a competitive market and there were apprehensions relating to the sharing of the information. This is likely that it has affected the validity of the finding where information has been withheld, but this is impossible to measure. However, the use of triangulation has been used to limit the effects by comparing them against a third party and the literature. The sensitivity was also addressed in the question as they are not 'probing' rather gave the interviewee the opportunity to answer in as much detail they felt appropriate, this was done to maintain the reliability of the findings.

Time could have had an impact on the results, as with the event in Christchurch, processes are changing depending on the needs of the Company. It could be possible that in the future, that the process evolves and uniformity does occur. This research is a snap shot of the current position in Christchurch.

This research was exploratory with no basis of existing research for this to be based on. Due to the limited timeframe in which this report had to be completed and the large amount of literature from varied sources, it is probable that not all relevant sources have been reviewed. Despite this enough literature was reviewed to ensure that valid conclusions could be drawn from the research.

Despite the limitation presented above, they did not compromise the research as they were limited as much as practically possible and the collected data was adequate to enable the research question to be answered.

6.6 Topics for Future Research

This study has investigated the different methods used for loss estimation and storage in Christchurch residential sector. From the findings it is clear that there are numerous areas of further study. Three areas of future study are outlined below:

The project management of the reconstruction work is complex and challenging; this was indirectly discussed in the interviews and could be researched to compare management approaches between different companies or on a case study basis. The reoccurring themes of how competitive the industry is and the needs of the user, results in contrasting methods on how to manage the reconstruction process.

One of the indirect findings from the interviews was the importance of I.T in collecting and storing the claim information. Christchurch has over three hundred thousand claims, and to manage this process requires substantial I.T requirements. This is potentially a substantial topic to investigate with some notable problems which seem apparent;

- There seems to be a lack of literature relating to the topic of data storage in the recovery and rebuild phase

- As discussed in this research, the companies operate in a competitive market, where a number of the companies have custom built software and applications so it is commercially sensitive and potentially difficult to investigate.

If this was to be a research topic it would be recommended that this be conducted sometime in the future and ensure that data collection is possible before any work is done.

The insurance industry is a large source of information for economic loss estimation. The findings showed that information collected was not centrally or consistently stored. Further study could aim to look out how this information is accessed by other parties for use in higher level loss estimate and if there is any filtering of the information, such as if the information is adjusted to account for any added value. This would be a good extension to this research.

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8 APPENDIX A-Research Questions

Part 1 Loss Estimation

1. What method does your company use to establish an initial estimate of the financial loss as a result of a natural disaster event?

2. In the case of a natural disaster with reference to the Christchurch Earthquake:

   a) Has the method of loss estimation changed in any way, or
   b) Was\is the same method used with regards to "normal" loss estimation?

3. Has anything been learnt to date regarding the loss estimation method for the Christchurch earthquake, and if so what?

4. In your opinion is the method you use\have used consistent throughout the industry in New Zealand, and how do you know that?

5. Is the initial estimate calculated and compared with the actual cost of the event, and how?

6. Are administration costs factored into this? And if so how?

7. Is the replacement value or depreciated value used for assessing the value of the contents and house repairs in the initial estimate?

Part 2 Storage and retrieval of data/information collected

8. How is the information/data from the Christchurch earthquake stored and going to be stored?

9. Is this system (in Q8) any different to the “normal” storage of information/data, and if so how?

10. Is the information given to other organisations to utilise, and if so how and to whom?

11. How will this information will be used in the future? i.e. for risk assessment etc