

The Revival and Integration of Traditional Knowledge and Practices
for Cyclones into Government of the Cook Islands Policies and
Planning

Charles Matapo Carlson

A thesis submitted to Auckland University of Technology in fulfilment of the
requirements for the degree of Master of Philosophy (MPhil)

2017

Te Ipukarea
Faculty of Culture and Society

ABSTRACT

Cook Island traditional knowledge and practices to prevent, mitigate and respond to disasters has been passed down for generations well before the arrival of missionaries to Cook Island shores. Our forebearers lived in oneness with nature and had a deep spiritual affiliation to the land, the sea and to their *Atua* (God). They were able to forecast future events by observing the behaviour of birds, animals, plants, trees or by reading the signs of the stars, the movement of clouds, the moon and the sun.

This exegesis will critically investigate the use of traditional knowledge and practices in responding to disasters in Cook Islands Disaster Risk Management (DRM). Furthermore, it will be argued that Cook Island traditional knowledge in response to disasters is now being recognised locally and globally as a critical tool to enhance DRM as part of government planning and preparedness. This gives expression to the *Yokohama Strategy* (UNISDR, 1994) which recognises the rights of traditional knowledge and practices and, various Cook Islands policies which integrate traditional knowledge and practices across all sector plans.

The Carlson Kōkā Model, an Indigenous research methodology, provides a culturally appropriate framework to explain the Cook Islands Māori world view being used in conducting this research. The description of the various sections of the Kōkā Model from its *papa* (foundation) to its *Atua* including its supporting systems and emerging themes provides an understanding of the holistic approach to this research and complements the qualitative method used to conduct interviews described as *tuatua mai* (informal conversation). The experiences and stories told by *aronga pakari* (elderly) and *ta'unga* (priest, orator, healer, expert, repository of traditional knowledge) shows the strength of traditional knowledge and practices in the Cook Islands.

There are three research questions: The primary question is, does traditional knowledge enhance the prevention, mitigation, planning and preparedness for natural disasters across all sectors in government planning and policies? Two sub-questions are: How can traditional Indigenous knowledge and science be integrated to strengthen Cook Island resilience toward a safe, secure and sustainable future? How do we bring traditional knowledge to the forefront of our planning and implementation strategies to strengthen resilience in the Cook Islands?

This exegesis is complemented by a documentary of 38 minutes featuring the *ta'unga* who are the traditional knowledge bearers associated with forecasting disasters across the Cook Islands and responding to the weather patterns to keep their communities safe.

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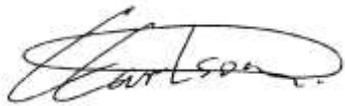
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ATTESTATION OF AUTHORSHIP

I hereby declare that this submission is my own work and that, to the best of my knowledge and belief, it contains no material previously published or written by another person (except where explicitly defined in the acknowledgements), nor material which to a substantial extent has been submitted for the award of any other degree or diploma of a university or other institution of higher learning.

A handwritten signature in black ink, appearing to read "G. J. S. S. S.", is positioned below the text.

ACKNOWLEDGEMENTS

Kia aka meitaki ia to tatou Atua i runga i te rangi teitei, nāna i oronga mai te kite, te pakari e te mārama kia tatou. Koia anake te Atua o te au atua, te Ariki o te au ariki, koia te Taunga mou, tei anga i to te rangi, to te enua e to te moana katoa. Kia kore ā lehova e patu i te are ra, e angaanga puapinga kore ta te aronga e patu ra. Kia kore a lehova e tiaki i te oire ra, e ara anga puapinga kore to te tiaki ra.

To my dear wife Edwina for her on-going support and encouragement to pursue my studies. To the children Severino, Emma, Riki and Gabriel and a special acknowledgement to Riki for his artistic skills in sketching out the original concept for developing the Kōkā model and to my good friend Tony Fe’ao for the final digital design of the Kōkā Model.

A big *meitaki maata* (thank you) to my supervisor Professor Tania Ka’ai, for the inspiration and encouragement to develop our own Cook Islands ideological models to explain the Cook Islands Māori world view used in this research. This was actually very inspiring knowing that we can actually develop our own ideological model and see things thorough our own Cook Islands Māori lens.

To Tania Smith for her administration support in making sure all the paper work was up to date, supervision appointments were arranged, that reminder of deadlines and schedules are followed and completed.

To my sister-inlaw Elizabeth (Peta) Winchester Ravlidge and our dear friend Manutai Leaupepe for their encouragement and input to the topic.

A big thank you and acknowledgement for the Peter Harwood Scholarship in Community Leadership and Excellence Award for financial support in completing this study.

To my colleagues, Diane Puna and Mike Tavioni for their support, sharing and encouragement in helping each other to get our research completed.

To the USP staff, Pastor Tevai Matapo and Director, Rod Dickson for their on-going support. To the Office of the Prime Minister for the opportunity to pursue this research as part of my work.

To all our *aronga pakari* and our *ta'unga* for freely sharing their knowledge and personal experiences so that this knowledge and practice can be kept alive today for the many generations to come.

To Julie Shedden and her late husband Jerome Shedden for the filming and production of the eleven documentaries on traditional knowledge for cyclones in the Cook Islands and for support in the final documentary for this exegesis. To Jeane Matenga-Isamela from Cook Islands Television for assisting with the production of this final documentary.

I also acknowledge my sister Mairi Heather who is the only sibling that followed our father's footsteps of becoming a teacher and now a School Principal herself.

Education was the least of my worries growing up which is one of my many regrets BUT as John Dewey says, "Education is not preparation for life, education is life itself" (cited in Neerukonda, 2017). Therefore life is both formal and informal learning and while it has its fair shares of challenges, it has been an exciting journey.

Meitaki maata

DEDICATION

I would like to dedicate this exegesis to mum and dad, Papa Paiere Mokoroa (OBE) and Mama Ngarouru Carlson Mokoroa who have always encouraged us children in our education. Papa Paiere was a school teacher by profession, a lecturer at the Cook Islands Teachers College and a school Principal before retiring. Education was his passion and he contributed to many articles, books including the development of the Atiu Dictionary (see <http://araaraatiu.cookislandsdictionary.com/>). Among other things, he is a composer, a choreographer of Cook Island dance and a historian for Atiu.

I also dedicate this thesis to my grandparents Papa Charles Carlson and Mama Uneara Carlson who brought me up since I was a baby. While our years together were short, they left a huge impression on my life with some good values and principals that cannot be compromised in life.

Te Atua te Aro'a

PREFACE

Background to the topic

In 2005, five cyclones struck the Cook Islands within a period of one month. Such a phenomenal event has never been experienced in the history of the Cook Islands. In 2006, government re-structured the National Disaster Management Office (NDMO) and placed it under the auspices of the Office of the Prime Minister (OPM). The NDMO name was changed to Emergency Management Cook Islands (EMCI) and three new staff were appointed to the office. The Researcher is the current Director of EMCI and has been since the re-structure in 2006.

In 2008, the National Environment Services (NES) and the Cook Islands Meteorology Service (CIMS) produced a documentary capturing some of the traditional knowledge and practices on natural disasters told by our *aronga pakari* (elders). These knowledge and practices are passed down through generations and very little of these knowledge and practices have been formally recorded or documented (Ngari, 2011).

The documentary raised some interesting discussions among the practitioners, planners and policy makers for DRM about whether traditional knowledge and practices do have a place in our modern society. After all, we are surrounded by all of the latest technology for early warning systems so why would anyone look to traditional knowledge and practices to enhance the nation's preparedness for natural disasters?

The documentary certainly inspired the Researcher to pursue further understanding on the topic mainly out of curiosity. While visiting the *Pā enua* (outer Islands) of the Cook Islands in 2011, he carried out an informal *tuatua* and *tuatua mai* (a rich conversation between two people on any topic of interest) with the old people to capture their knowledge on natural disasters that has been passed down through several generations which included their own personal experiences.

This led to the production of eleven 30-minute documentaries that has since been used for awareness programmes on local television throughout the Cook Islands. These documentaries are also included in the Teachers Resource Kit for disaster risk management which have been

endorsed by the Ministry of Education. These experiences and findings from the informal conversations will be fully discussed in Chapter 3.

In March 2012, Dr. Ka'ai from Te Ipukarea – The National Māori Language Institute at the Auckland University of Technology conducted an 'Introduction to Writing Research Proposal' workshop at USP in the Cook Islands. Dr Ka'ai presented the John Te Rangihau Model showing how the spiritual, the land, culture, traditional knowledge and practices are intertwined with each other. Using the John Te Rangihau Model, the Akapa'anga Cook Islands Māori Model was collectively devised by Cook Islands students involved in Dr Ka'ai's workshop. As a result, The Carlson Kōka Model was developed out of this Akapa'anga Model to try and embed our Cook Island *Papa Māori* (traditional beliefs and values) into the ideological infrastructure of this research.

This exegesis will be accompanied by a 38 minute documentary that will complement the narrative by illuminating the repositories of the respective traditional knowledge associated with forecasting disasters.

Orthographic Conventions

This thesis follows international academic practices whereby italics have been used for non-English words, with the exception of proper nouns, such as Cook Islands Māori.

An English translation will be provided the first time a Cook Islands Māori word is used. A full list of Cook Islands Māori terms can be located in the glossary at the rear of the thesis as further reference. Although Cook Islands Māori words have been italicised and macrons used to denote a lengthened vowel, direct quotes have been reproduced as they appear in the original source.

Clarification of use of Terms

The use of the name *Pā enua* acknowledges the commonly used Cook Islands Māori name for the outer islands and their status as the Indigenous people on the island. Cook Islands Māori will be used throughout this research instead of *Māori* which is more commonly referred to for New Zealand Māori.

The terms Pacific, Pasific and Pasifika will be interchangeable in this thesis referring to individuals or people of Pacific descent/heritage and also referring to the Pacific. Traditional

knowledge and Indigenous knowledge will also be used interchangeably in this exegesis. Ryser (2011) argues that the expression indigenous knowledge, local knowledge is often equated with the expression traditional knowledge, and indeed they are regularly used interchangeably.

Western and Indigenous

The word Indigenous has been spelt with a capital 'I', except where it is part of a direct quote. This convention is used by many Indigenous authors, "as it corresponds with the term 'Western" (Ka'ai-Mahuta, 2010, p.5).

Glossary

A Glossary of Māori terms used in the exegesis has been included after the Bibliography.

Exegesis outline:

The exegesis comprises eight chapters and a 38 minute documentary

Introduction to the Thesis

The preface is an introduction to the thesis and explains the preferred writing conventions including clarification of terms. An outline of the thesis content is also provided.

Chapter 1: Introducing the Researcher

This chapter is introducing the Researcher and the Researcher's position to the Research on traditional knowledge and practices for natural disasters

Chapter 2: The Indigenous Ideological Framework

This chapter describes the Carlson Kōkā Model that is used to embed Cook Island *Papa Māori* into the exegesis as the ideological framework for this research

Chapter 3: Traditional Knowledge of the Cook Islands

The Cook Islands has an established bank of oral traditional knowledge in managing natural disasters that has been passed down for generations. This chapter will focus on the stories told by our *aronga pakari* in their language demonstrating the power of traditional knowledge and its significance in relation to survival of the community. These stories inform the documentary which is the creative component that complements this exegesis.

Chapter 4: Traditional Knowledge and the International Context

Traditional knowledge and practices for disaster risk management is not only restricted to the Cook Islands as is now becoming more discussed at international platforms. This chapter will explore what is happening in other Indigenous communities throughout the world and the influence or impact of traditional knowledge on international policies and best practice.

Chapter 5: Traditional Knowledge and Planning/Policies

The Government Disaster Risk Management policies is governed by an international framework set at the Global Conference for Disaster Risk Management every 10 years. This chapter will explore some of these Global framework and the impact it has on the Pacific Region, the National Framework and the grassroots for disaster risk management.

Chapter 6: Traditional Knowledge and Science

Science is critical to establishing the credibility of integrating and mainstreaming traditional knowledge into government policies and across all sector plans. This chapter will discussed some natural events and traditional knowledge that are directly linked to science.

Chapter 7: Traditional Knowledge and Modern Technology

Our government agencies are totally dependent on modern techonology for our forecasting of weather patterns and early warning systems. This chapter will discuss some of the early warning systems in place and argue how traditional knowledge can enhance modern technology in our early warning systems.

Chapter 8: Conclusion

The chapter draws a conclusion from the various chapters about this research. It briefly summarises and discusses the implications of each chapter.

Documentary Creative Component:

A 38 minute long documentary with a narration will showcase some of the stories told by our elders that are unique to each of the 11 populated islands of the *Pā enua* in the Cook Islands. The documentary will also highlight how Emergency Management Cook Islands have capitalised on the use of technology to enhance their early warning systems in preparedness and response to any natural disasters.

Chapter 1

INTRODUCING THE RESEARCHER

1.1 Introduction

Our traditional knowledge and practices to prevent, mitigate and response to disasters have been passed down for generations well before colonisation and missionaries arrived to our shores. Our forebearers lived in oneness with nature and had a deep spiritual affiliation to the land, the sea and to their *Atua*. They were able to forecast future events by observing the behavior of birds, animals, plants, trees or by reading the signs of the stars, the movement of clouds, the moon and the sun.

Unfortunately, these oral histories and narratives have not been very well documented. Consequently, due to the rapid development and influence of modern technology, these exceedingly renowned familiarisation with nature for generations are diminishing and reliance on modern technology for data relating to natural disasters, are on the increase. The younger generation particularly now relies on technology for globalised information, knowledge and perspectives. This chapter introduces the Researcher and the Researcher's position to the research topic on traditional knowledge and practices for natural disasters.

1.2 Researchers Position

Ko Au ko Makea Arera -	<i>I am Makea Arera</i>
Arera te mimitinui -	<i>Arera the supreme head</i>
Te tu ereere ki Tuoro -	<i>Standing solid on Tuoro</i>
E tapere ko Pokoinu -	<i>Pokoinu is the district</i>
E enua ko Tumu te varovaro -	<i>Tumu te varovaro is the land</i>
E ava tei tai ko Mango Nui -	<i>Mango nui is the landing passage</i>
E rereanga vaerua ki po -	<i>the spiritual pathway to the heavens</i>
E maunga tei uta ko Tapu ki te Rangi -	<i>Tapu ki te Rangi is the mountain</i>
Arara ki te opunga -	<i>slanting westward</i>
Ko au te papa, te tumu enua -	<i>I am the foundation of this Indigenous land</i>

Kare au e teke, e tumu oki au no te enua - *I will not move, I am the foundation of this land*

The above *pe'e* (tribal chant) identifies my tribal affiliations and my linkage to my *Ariki* (paramount chief) from my maternal inheritance. This *pe'e* has been in my family for generations which connects me to my ancestors and cultural roots. A *marae* (ceremonial dwelling site for a chief) encompasses part of this cultural heritage.

I remember a time when my uncle and I were inspecting the banana plantation during Tropical Cyclone (TC) Dolly which was considered one of the worse cyclones to strike Rarotonga in 1969. We also need to bear in mind, bananas were one of the biggest export crops of the Cook Islands during those days and this was their livelihood.

My uncle stood there quiet and then turned around and asked, "*Te akarongo ara koe i te tangi o te meika?*" (Can you hear the murmurings of the banana trees?) A bit confused with the question as I did not hear anything so I answered, "No". The thought crossed my mind that maybe my uncle was a bit spooked by a ghost who protects this *marae*. A *marae* is considered to be *tapu* (sacred). My uncle commented, "*Kare teia uri'ia i oti ake*" (this cyclone is not yet over). After hearing stories of people going crazy for desecrating a *marae*, I thought my uncle had definitely been spooked by the spiritual guardians of the *marae*.

During the 1960s growing up as a child, the *marae* was *tapu* and there was reverence and respect for the *marae*. We hear of stories told by our *aronga pakari* of bad things happening to individuals that have desecrated the *marae*. I recall coming back from New Zealand in the late 1970s for a holiday and receiving a phone call from a close Land Survey friend of mine who was carrying out some surveying work near our *marae*. One of the survey pegs was on the *marae* and they were too scared to step on the *marae* to carry out the survey. So I had to assist by holding the end of the tape on the *marae* where the peg was located while they carried out their survey around the *marae*.

1.3 Researcher's *Papa'anga*

I was born on the island of Atiu to an Atiuan father and a Rarotongan mother. My grandparents who were my mother's *metua āngai* (feeding parents) took me to Rarotonga as a baby and brought me up as one of their family.

Children that are brought up by their *metua āngai* are called *tamariki āngai* (feeding children). This is an island informal way of adoption that is commonly practiced among Cook Islands families (Dodson, 2009). These *metua āngai* are usually close relatives such as grandparents, aunts, uncles and even brothers or sisters. The *metua āngai* gets the consent by the family to raise the child on behalf of his or her birth parent. One of the *metua āngai* is usually a blood relation of the child in order for the feeding arrangement to be approved by the family. In this arrangement, a legal adoption process is not required as the arrangement is agreed upon by the giving and receiving parents by mutual agreement. It is very common in the Cook Islands context that the first born child is gifted to the grandparents as their own. In some arrangements, the child goes back to his or her birth parents once the grandparents have passed on.

My mother was also brought up by my grandparents, including my mum's brother and two of her first cousins. She is my mother, but she is also my adopted sister including my uncles and aunt who are also my adopted brothers and sisters. While we have moved on with our lives and grew up in different countries, we have remained very close over the years; perhaps a reflection of the bond we have in our upbringing by our grandparents.

When the opportunity came to travel to New Zealand in 1974, a year after college, I did not hesitate to take up the opportunity and get away from this tiny island as I was eager to experience 'The Land of the Long White Cloud'. I totally ignored my own culture and did not want anything to do with it; essentially I wanted to become a *papa'a* (European). My friends were *papa'a*, my culture was *papa'a* and the lifestyle was *papa'a*.

Song writer Justin Young wrote a song, '*Never forget where I'm from*'

*You can take the boy from the island,
But not the island from the boy.
'Cause the island stays in your heart
And I'll never forget where I'm from.
Oh no I'll never forget where I'm from,
No I'll never forget. (Young, 1997)*

After living in New Zealand for 26 years, I finally packed two containers of building materials, household furniture's and moved back to the Cook Islands.

A move, while growing up in New Zealand was unlikely to happen. Thankfully, it was the best move I have ever made in coming back to my *āka* (roots), *papa* (foundation), *ōne* (soil) and my *peu tupuna* (culture).

1.4 Rationale

I have been in my current position as the Director of Emergency Management of the Cook Islands (EMCI) since my appointment in November 2006. The Disaster Managers (DM) role over the past 10 years has changed drastically from managing only disaster responses to now attempting to address disaster risk reduction (DRR) meaning preventative measures, mitigation and preparedness. This shift from DM to DRR allows opportunities for alternative innovation and practices such as using traditional knowledge and practices to enhance DRR measures in the wider community. My own experiences of having witnessed some of the signs spoken about by our *aronga pakari* without giving much notice to them at the time when disasters occurred, are certainly convincing enough for me to consider the importance of pursuing this research. The National Environment Services (NES) and the Cook Islands Meteorology Service (CIMS) documentary capturing some of the traditional knowledge and practices on natural disasters told by the old people certainly raised some interest in the topic.

1.5 Influence of Documentary

The documentary inspired the Researcher to *tuatua mai* with the *aronga pakari* mainly out of curiosity (Ravlich, 2016). The concept of *tuatua mai* is considered important for this research.

Aronga pakari literally means old people; however, the word *pakari*, in Cook Islands Māori, also means strong and tough. With age also comes wisdom and old people are considered to be full of wisdom. Therefore, within this context, our *aronga pakari* are strong in their beliefs, tough and full of wisdom.

While visiting the *Pā enua* of the Cook Islands in 2011-2012, *tuatua mai* were triggered naturally with the *aronga pakari* about their own traditional knowledge and practices on their respective island. My conversations with the *aronga pakari* revealed that these knowledge and practices have been passed down through several generations and they provided many of their own personal experiences as examples to highlight the significance and importance of traditional knowledge and practices in responding to disasters.

1.6 Abundance of *Vī* (Mango)

In October 2001, there was a super abundance of mangoes on the trees that the researcher has never seen before. The Researcher remembers this vividly as he just moved back to the Cook Islands after living in New Zealand for 26 years. The mango trees surrounding the very large family property were planted by their grandfather and these were big trees towering over other trees. He has travelled back and forth over the years and has never seen anything like this; that is, having the ground literally covered with fallen ripe mangoes that were just rotting away. TC Trina unexpectedly hit Rarotonga in Nov 2001 with little warning from the Cook Islands Metrological Services (CIMS) and caused some serious devastation to the island.

1.7 Influence of Documentary Abundance of *Kuru* (Breadfruit)

In early 2010, there was a similar experience with the fruit trees, but this time, it was a super abundance of the *kuru* trees bearing three fruit on each branch when normally a branch will only bear one fruit. Next to the *kuru* tree was an old *vī* tree that had hardly bared fruit in the past; for the first time ever, this *vī* tree was laden with fruit. My curiosity led me to take pictures of the *kuru* Figure 1 (page 23) given the *tuatua mai* with the *aronga pakari* and their stories incorporating traditional knowledge and practices relating to anticipating disasters. Tropical Cyclone Pat struck in February 2010 and devastated the island of Aitutaki.

FIGURE 1: BREADFRUIT



(Source: Carlson private collection)

1.8 Summary

Tuatua mai with the *aronga pakari* and my personal experiences related to the traditional knowledge and practices associated with anticipating natural disasters, informed the shape of this research and the focus of examining the impact traditional knowledge can have on the Cook Islands national planning and policies for Disaster Risk Management. Perhaps curiosity got the best of me to pursue some answers to these traditional knowledge and practices to prove whether they are actually for real or just another myths or legends that has also been pass down generations.

CHAPTER 2

THE INDIGENOUS IDEOLOGICAL FRAMEWORK

2.1. Introduction

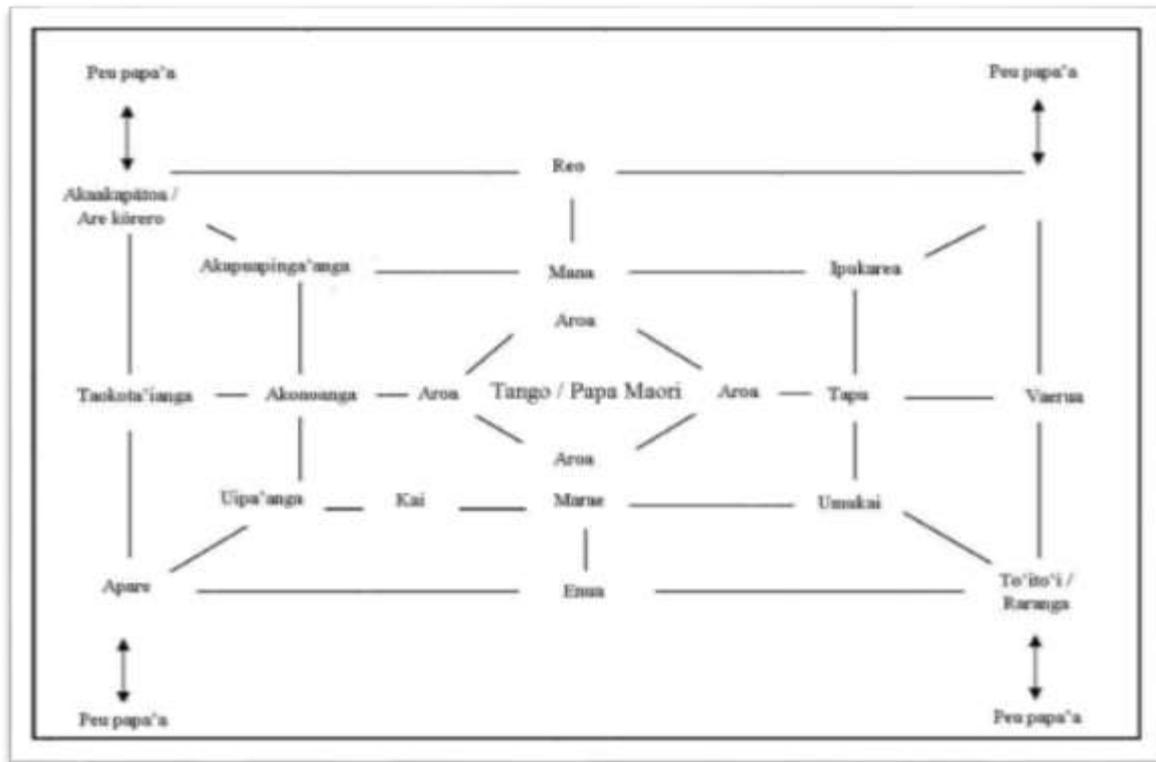
This chapter will discuss the Kōkā (banana tree) Model developed by the Researcher. This chapter will encompass several Cook Islands and Pacifika ideological models to explain the Cook Islands Māori world view being used in conducting this research. An Indigenous methodology will be discussed as the framework from which the research has been undertaken. Traditional knowledge, and practices for natural disasters are similar among the *Pā enua* however, there is some knowledge and practices that are unique to each *Pā enua*. It is the collation of traditional knowledge that underpin this entire study and explains the significance of the Kōkā Model developed by the Researcher.

2.2. The Akapa'anga Cook Islands Māori Model

The Kōkā Model was developed by the Researcher from the *Te Akapa'anga* Model Figure 1, which clearly positions *Peu Māori* (Cook Islands Māori culture) as central to the development of a traditional natural disaster strategy that is based on its *Papa Māori*. The *Akapa'anga* Cook Islands Māori Model was collectively devised by Cook Islands students in the 'Introduction to Writing Research Proposal' workshop taught by Dr Ka'ai in March 2012.

The students enrolled in this course studying through Te Ipukarea, Auckland University of Technology, were certainly inspired by the John Te Rangihau Model enough to develop their own conceptual model, called the *Te Akapa'anga* Model Figure 2.

FIGURE 2: *TE AKAPA'ANGA* COOK ISLANDS MĀORI MODEL



(Source: Cook Islands Students enrolled in the USP Cook Islands workshop on 'Introduction to Writing Research Proposal', 2012)

2.3. John Te Rangihau Model

Given the very close ties historically and genealogically between Māori and Cook Islands Māori, the students did not make any changes to the Rangihau Model except to translate the Māori words into Cook Islands Māori using words to reflect their own values, beliefs and culture. Often referred to as the Rangihau conceptual model in Figure 3 below because the concepts used in the model are Māori, and because the model is not dialectical, the model can be adapted and applied to all Māori (Rangiwai, 2015).

Consequently, Rangihau's model is often adapted by Indigenous scholars and students to inform their research and provide a cultural lens from which to analyse, describe, explain and critique within an Indigenous paradigm. John Te Rangianiwaniwa Rangihau is considered an esteemed Māori scholar and Māori leader of the Ngāi Tūhoe *iwi* (tribe).

FIGURE 3: JOHN TE RANGIHAU CONCEPTUAL MODEL



(Source: The original canvas of John Te Rangihau’s Conceptual Model displayed by his daughter Kararaina Rangihau at a Writing Retreat at Tuatini Marae, Tokomaru Bay, New Zealand. Photo: Carlson private collection).

2.4. The Kōkā Model

The *kōkā* is a tree with many benefits that nature provides to nurture and protect to sustain our people. The word *kōkā* is used on the island of Mangaia to describe the banana tree and the word *meika* or *pū meika* (banana or banana tree) is used by several of the *Pā enua*. The word *kōkā* is often used in the New Zealand Māori language, and in particular, Ngāti Porou, for *māmā* or *whaea* which means, mother (T. Ka’ai, personal communication, 2016). It is therefore quite fitting that the *Kōkā* Model also depicts that of a mother providing, nurturing and protecting her family.

The *Kōkā* Model shows a vertical relationship between Cook Islands Māori people with their *Atua*, their spiritual affiliation to the land, the sea, the culture and to their environment reflected in their *Peu Māori* which is deeply rooted in *Papa Māori*. Since the focus of the research project is on traditional Cook Island knowledge, the *Kōkā* Model has been developed as an Indigenous methodological tool to frame this study.

The *Kōkā* Model places the *Atua* at the top of the diagram reflecting the inextricable link between the spiritual and physical elements in Cook Islands culture. While the spiritual aspect dominates The *Kōkā* Model in Figure 4, below, it has the capability to synthesise both positions so the challenge is to develop a Cook Islands disaster risk management arrangement which is cognisant of Cook Islands Māori *irinaki* (beliefs), *peu* (our culture and customs) and *akono'anga* (tradition) (Crocombe, 2003)

FIGURE 4: THE KŌKĀ MODEL



(Source: Carlson private collection)

The *Kōkā* Model is further described in the various sections from its *papa* to its *Atua*, its supporting systems and emerging themes.

2.4.1 Papa (Foundation)

The *Papa Māori* is the foundational *peu*, *irinaki* and *akono'anga* which every other structure is built upon. *Papa* means mother earth, the ground which reaches deep into the *ōne* (soil) through its *aka* (roots). The *ōne* nourishes the *kōkā* and through its *aka* spreading wide and reaching deep into the *ōne* for its *sustenance and security*.

2.4.2 Aka (Roots)

The *aka* is not seen because it is in the ground which can be described as the subconscious of the unspoken things to be drawn upon or waiting to be exposed in some form of expression. It is therefore the role of the *ta'unga* to draw and gather hidden knowledge, experiences, narratives, perceptions and bring them to the fore.

2.4.3 One (Soil)

The *one* (soil) provides the sustenance for cultivating a healthy *kōkā*. Fertile *ōne* provides essential nutrients to plants and its important physical characteristics of soil-like structures and aggregation allow water and air to infiltrate, roots to explore, and biota to thrive.

Soil varies in its composition and the structure of its particles, and these factors are closely examined by farmers, who need appropriate soil for planting crops, as well as engineers who may need to understand how soil is going to hold up under different demands. Soil is also vitally important to the sustainability of an ecosystem because it serves as the natural medium for the growth of vegetation. Weathering is the mechanical or chemical process by which rocks are broken down into smaller pieces. As rocks are broken down, they mix with organic materials, which are those materials that originate from living organisms. For example, “plants and animals die and decompose, releasing nutrients back into the soil” (Gillaspy, 2003, no page number).

The *one* also needs to be protected from the natural elements such as flooding, erosion, contamination. Like the *one*, our beliefs, values, traditions and protocols needs to be cultivated and protected from the invasion of other cultures and ideologies.

2.4.4 *Peu*

Peu Māori is likened to the trunk of the *Kōkā* tree which expresses our culture and customs that has evolved from our *Papa*.

Our custom is more about practices and our way of life while culture is more about ideas or a group of customs. A custom can be a practice or belief that has been practiced by an individual or a group for a long time. When a custom is transferred from generation to generation, it takes the form of tradition (Cochrane, 1994).

2.4.5 *Toko (Props)*

The *toko* (props) are normally used to support the *kōkā* tree. The *kōkā* is vulnerable to the elements and can easily topple over during strong winds or a cyclone without the *toko*. This can be likened to the importance of holding on to our culture, customs and traditions; that they should be respected and enhanced rather than trying to change the culture. The arrival of the missionaries to the Cook Islands made an enormous impact on the culture and customs of the islands and therefore threatened the *toko* of the *kōkā* tree.

When missionary John Williams introduced Christianity to the islands in 1821 and the locals were required to burn their idols, this changed their lifestyle and they were required to adapt to the *papa'a* way of living. Perhaps if the missionaries had studied the culture of the natives and learnt to adapt to their way of thinking, they would have found much of value (Crocombe, 2003). The influx of foreign workers into the Cook Islands and mixed marriages was to have an impact on our Cook Islands culture, values and traditions especially as these foreigners came with their own values, beliefs and traditions and eventually would start to exert their own rights over time.

2.4.6 *Kao (Stalk)*

The *kao* of the *kōkā* points to their *Atua* and this relationship to their *Atua* is critical to the people's everyday life. The people were already in tune with the spirit world and when Christianity arrived they were ready to accept this new *Atua* whom they were already aware of called, *Tiova* (Jehova). Ancient Polynesians believed in Tangaroa, Rangi, Rongo, Tāne and many other gods. The missionaries misinterpreted their religion and accused them of worshipping wooden idols, stones or feathers. In reality these objects were represented by physical containers in which the invisible god enters. Some believed in a great god called, 'Io, and a self-created world soul whose name was too *tapu* (sacred) to utter, and whose

identity could never be revealed to human eyes or ears. 'Io could be understood only through the *ta'unga*, who made it a strict sacred law never to give away religious secrets (Crocombe, 2003).

The relationship to their *Atua* is the most important and critical relationship of all.

The worship of our forebears for example, was an everyday affair, when they planted and took care of crops, went fishing, dedicated new canoes or houses, our ancestors carefully followed a set pattern of worship, their prayers acknowledged their connection with the invisible gods and showed spiritual awareness and recognition (Makirere, 2003).

Therefore to turn away or offend their *Atua* is seen as disconnecting themselves from their spiritual life force which may bring disasters to the village, their people or the whole island. According to Crocombe (2003), success in all aspects of existence required knowledge to influence the gods through the correct rites, ceremonies and prayers.

Such was the strong conversion to Christianity in the Cook Islands, that by 1857, 61 missionaries were serving in the field and made a remarkable contribution to Polynesian and Melanesian Christianity. Since their conversion to Christianity, the Cook Islands community has remained a strong Christian nation and this is reflected in the government's legislation including their National Sustainable Development Plan 2016-2030 (NSDP, 2016). It is a very bold statement by government to declare that their NSDP is guided by its Christian values as enshrined in Cook Islands laws and Constitution, and it is on this premise and with divine guidance, that we can take our nation to higher levels of sustainable development. However, despite the strong influence of Christianity, some of their *Peu Maori* survived the test of times and found its way to this generation.

2.4.7 Vaerua (Spirit)

The *vaerua* is described as a spirit, ghost, or the soul of man that only exits after the physical body has died (Dictionary of Cook Islands Languages, 2013). Our forebearers understood the spirit world and the difference between a good spirit and a bad spirit. The Researcher can recall at a young age of 10 years old after his grandfather passed away that he became very ill for over a week and the doctors could not find any physical cause to the sickness. His grandmother then took him to a *ta'unga* (traditional healer) and she told grandma that the cause was spiritual and was a result of the very close bond between the son (Researcher) and his grandfather and his grandfathers passing away which had seriously affected him. Grandma

admitted to the *ta'unga* the emotional and financial struggle that had affected them since grandpa had died. The *ta'unga* closed the session with a *karakia* and they went home fully recovered. The son (Researcher) was able to go back to school.

2.4.8 Karakia

The *karakia* is a form of prayer or chant normally performed by a *ta'unga*. A *ta'unga* is also considered to be someone with divine powers that can predict the future. There is a well-known prophecy performed by a *ta'unga* named Uia, from the Island of Atiu prior to the arrival of the missionaries to Atiu in 1821.

Atiu e... teia te anaunau a te Tumu ka tae ki nua i to tatou enua i Atiu nei. E vaka to ratou kare e ama, kua vaii ia to ratou kopapa, to ratou upoko e to ratou vavia. E Atua mana to ratou tei runga i te rangi, ko Tiova tona ingoa. Ko to tatou atua e Atiu e, kia kite mai kotou, ka tuaru ia ki roto i te i i pō-kioire, e ka tauna ia kite āi (Kautai, 1984, p. 141).

This translates as:

Atiu oh.... the children of the Tumu will soon arrive on our island of Atiu. They have a canoe with no outrigger (describing a mono-hull ship, their bodies are covered, and their heads and feet are covered (describing people wearing clothes and shoes). They have a mighty God in heaven, his name is Jehovah. Our God know this; Atiuans will be driven into the rat-eaten chestnuts and be burned with fire.

Such was the impact of this prophecy, when the missionaries arrived on the island of Atiu that all of *Ngā pū toru* (The three islands of Atiu, Mitiaro and Mauke) was converted to Christianity (Kautai, 1984).

2.4.9 Ariki (Paramount Chief)

The *ariki* sometimes referred to as the *ariki tumu*, the chief, is a ruler over a *vaka tangata* (tribe). Traditional titles in ancient eras, chiefs and titleholders were not united under one banner, and lumped together the way they are today in the House of Ariki and Koutu Nui. Each *ariki* was head of his own tribe, within his own *vaka* or village, on his own island. Traditionally, only males were permitted to hold chiefly titles. Today, there are both male and female *ariki* (Tuara, 1975). While leadership structures varied between islands, generally hierarchies were dominated by the *ariki*, the highest-ranking chiefs, who were said to be imbued with divine power (Reeves, 2014) .

2.4.10 *Are Korero* (House of Knowledge)

The *are korero* is a place where repositories of knowledge meet. Our *aronga pakari* is also acknowledged and seen as the house of knowledge where our traditional knowledge is stored and passed down to generations.

Through the *tuatua mai*, the repositories are then brought to the fore for all to listen to, and to practice and implement for the benefit of all the community.

2.4.11 *Reo* (Language)

Our *reo* (language) is critical to retaining our culture. There is a common saying among our people, '*ko te iti tangata kare ona reo e iti tangata ngaro ia*' meaning, 'a people without its language is a lost people'. The *reo* is captured throughout this study to help retain and preserve the stories of our *aronga pakari* in their own *reo* for future generations. The Cook Islands Māori language is an important part of a culturally responsive pedagogy for Cook Islands students. Vai'imene (2003) argued that the Cook Islands language is vital to the heritage of the Cook Islands. For the local people, language is like a trumpet that carries the identity and value of the culture globally (Ama, 2003).

2.4.12 *Pa Enuā* (Outer Islands)

The contribution and identity of the *Pa Enuā* is strongly acknowledged in this study so we are able to capture the rich and unique knowledge they contribute to our future development. While the economic hub of the Cook Islands is often seen as Rarotonga, perhaps the challenge for the government is to identify and explore the wealth of opportunities that lies within the *Pa Enuā* to contribute to the economy. The *Pa Enuā* is often seen as a Social Welfare system with government having to prop up each island thus creating a culture of dependency.

2.4.13 *Moana* (Ocean)

Our forebearers were once the mighty warriors that navigated the ocean guided by nature and the environment. They fished the sea according to their traditional calendars that have been passed down generations and are still being practiced to this very day. They were a people that lived off the land and the sea and were self-reliant. They regularly travel between islands as though they were driving from one suburb to the next. Michael Tavioni poignantly describes the nature of the relationship between the people and their scattered islands. 'While many see the distance between islands as a challenge to modern society, our forefathers were travelling between island to island for centuries guided by the signs of

nature. They viewed each island as a suburb linked by the ocean, not an island separated by the ocean' (Tavioni, 2012).

2.5. EMERGING THEMES

The emerging themes of the Kōkā Model are indeed the very fruit of the *kōkā* tree.

2.5.1 Aro'a (Giving)

Aro'a in this sense of the word is about giving. It is interesting to note that Cook Islands do not actually have a word for thank you. The practice has been when one person gives something to another whether be food, fish or a present, the person receiving the gift in return, gives something back as their way of showing their appreciation of the gift. Therefore *aro'a* is a practical expression of giving and not in words only of thank you as we practice today.

2.5.2 Kai (Food)

Kai is described as food and food crops. *Kai* is important for survival and without food their people will die. It is therefore critical that the family and the tribal structures are right to produce enough *kai* to feed the tribe.

2.5.3 To'ito'i (Carving)

Toitoi or *tarai* (carving) is to cut, shape and construct a canoe using the adze which is the principle tool. Carving is normally used to express the cultures of the various islands as written expressions were only introduced during the time of the missionaries. In traditional times, one could look at a carving and be able to tell the story of where it came from and who it represents. This cultural expression is now being recognised among the local carvers, artist and tattooist. The unique patterns tells the story of which island they come from and their history.

2.5.4 Tuitui (Craft)

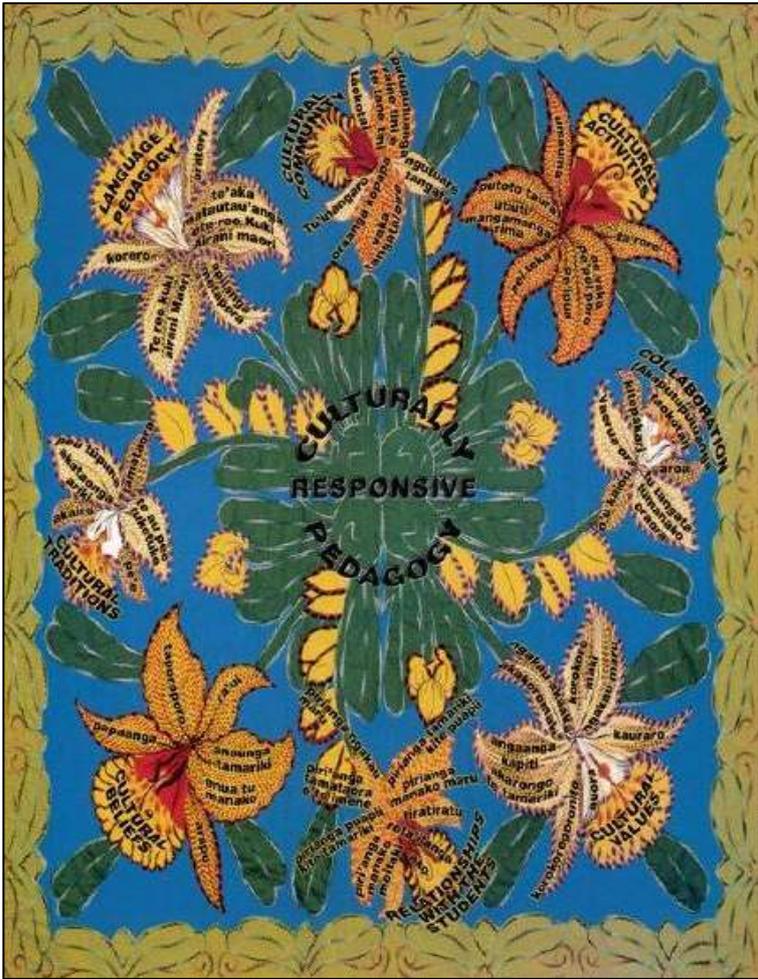
The *tivaevae* (quilt) is the most recognised and much valued *tuitui* (craft) among the women. The *tivaevae* is also been developed into an academic model used across many sectors among Cook Islands academics. *Tivaevae* provides an excellent starting point for a study of cultural practices such as storytelling through the use of designs and patterns. By drawing on knowledge of a Cook Islands Māori world view and values, you can support your students to express or gain insights into the layers of meaning in *tivaevae* (Ava, 2011).

The metaphor of the *tivaevae* has been used as a ‘holistic’ conceptualisation framework which conveys an idea of cultural responsiveness and pedagogy. The *tivaevae* model is chosen because of the strength of the metaphor embedded in the way it is organised in various components of flowers with different designs and patterns (Rongokea, 2001).

2.6. TIVAEVAE MODEL

Rongokea’s Tivaevae Model in Figure 5 below highlights eight cultural concepts to represent a holistic cultural framework including: *Te Reo Māori Kuki Airani* (Cook Islands language), *eeu ui tupuna* (cultural traditions), *peu inangaro* (cultural beliefs), *tu inangaro* (relationships), *peu puapinga* (cultural values), *akaputuputu taokotai* (collaboration), *peu angaanga* (cultural activity), and *peu oire tangata* (cultural community).

FIGURE 5: RONGOKEA’S TIVAEVAE MODEL



(Source: Rongokea, 2001, p.131)

There are normally four different styles of *tivaevae*: the *tivaevae taorei* (piecework/patchwork), *tivaevae manu* (appliqué), *tivaevae tataura* (appliqué and embroidery), and *tivaevae tuitui tataura* (embroidered squares of fabric joined together with either crocheting or lace borders). Times have changed with the introduction of new styles like the *tui auri* (sewing machine).

2.6.1 *Tivaevae taorei* (Fine quilt)

Carlson, E. (personal communication, July 14, 2015) describes the *tivaevae taorei* style is the most challenging of them all to produce. Figure 6 below shows a sample of the *tivaevae taorei* made by the Researcher's wife's grandmother and this pattern is called the 'Crown', a favourite among the women. This style of *tivaevae* is no longer practiced anymore because it requires a collaboration among the women to produce one.

FIGURE 6: TIVAEVAE TAOREI



(Source: Carlson's private collection)

The Researcher recalls his own experience as a young child growing up with his grandmother and a group of about 12 women who would regularly gather at the family house to make a *tivaevae*.

As previously mentioned, the *tivaevae taorei* style is no longer practiced. One could argue that perhaps it is also a reflection of our Cook Islands culture that has changed over time from a collaborative community approach and a closely knitted event among the women to more of an individual approach. The *tivaevae taorei* is traditionally never sold for money as the *tivaevae taorei* is revered as a treasured piece of art. The *tivaevae taorei* is gifted only on special occasions or to someone special to the *ta'unga* of the *tivaevae* such as for a wedding present. It is interesting to note that *tivaevae taorei* are now being commercialised sold in shops and markets. New styles have also been introduced with the use of sewing machines to increase production of sales. It is no longer a social event where women get together to share their knowledge and enjoy each other's company. These changes are now challenging the core fabric of cultural values, beliefs, traditions and collaboration among the community as a whole.

2.6.2 Tivaevae manu (Appliqué)

Figure 7 below shows a *tivaevae manu* created by the Researcher's wife all by herself. This style is the one more practiced among the women these days which involves only one or two people in the making-process as compared to the *tivaevae taorei*.

FIGURE 7: TIVAEVAE MANU



(Source: Carlson's private collection)

The *ta'unga* draws the pattern and cuts out the material following the pattern. These patterns are then spaced out on the canvas and held together by a couple of stitches. The individual

then purchases this canvas from the *ta'unga* and takes it home and stitches the pattern on to the canvas until it is finished. According to Ava (2011), the *tivaevae* model comprises five key concepts and illustrates these concepts holistically.

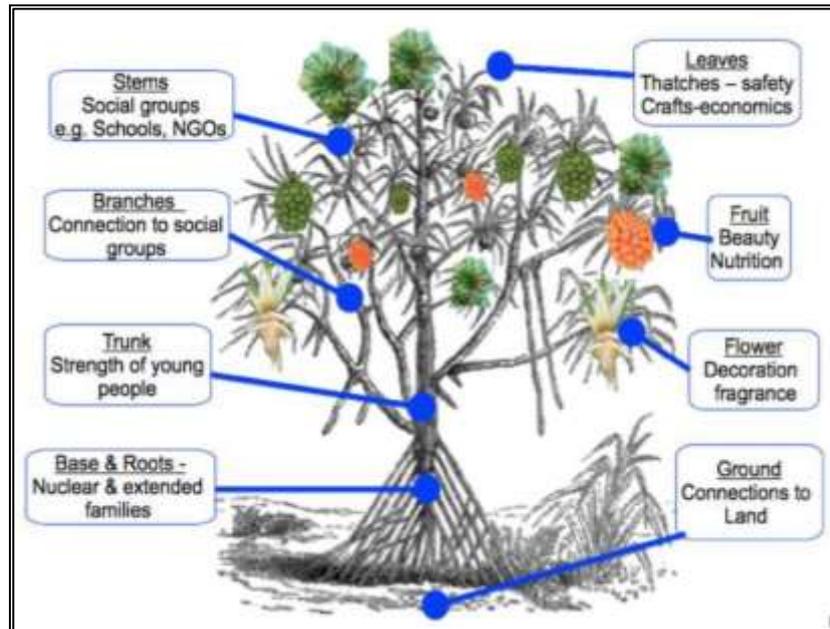
These are *taokotai* (collaboration), *tu akangateitei* (respect), *uriuri kite* (reciprocity), *tu inangaro* (relationships), and *akairi kite* (shared vision).

2.6.3 The *Pou Ara* Model

The *Pou Ara* model in *Figure 8* below developed by Dr Neti Tamarua Herman depicts a “health promotion” and “positive youth development” approach in the Cook Islands context. Young people voiced their need to be part of the big picture and to be part of the solution. The *Pou Ara* model emphasises strength-based and positive development outcomes. Young people need to belong, and be connected to family and communities to thrive. They also need to be empowered, to have a voice, and learn the competencies and leadership skills to prepare them for adulthood, so they can engage and participate in meaningful activities and decision making, take responsibility for their actions and actively participate in civic discourse.

As a key step in developing this model, Herman’s research examined the health and wellbeing experiences of young people in the Cook Islands within a socio-ecological framework. This was guided by Community Based Participatory Research and Participatory Action Research approaches. This investigation explored the health behaviours of young people and how cultural identity, spiritual and health beliefs, and social networks impact on these behaviours (Herman, 2013).

FIGURE 8: TE POU ARA MODEL



(Source: Herman, 2013, p.223)

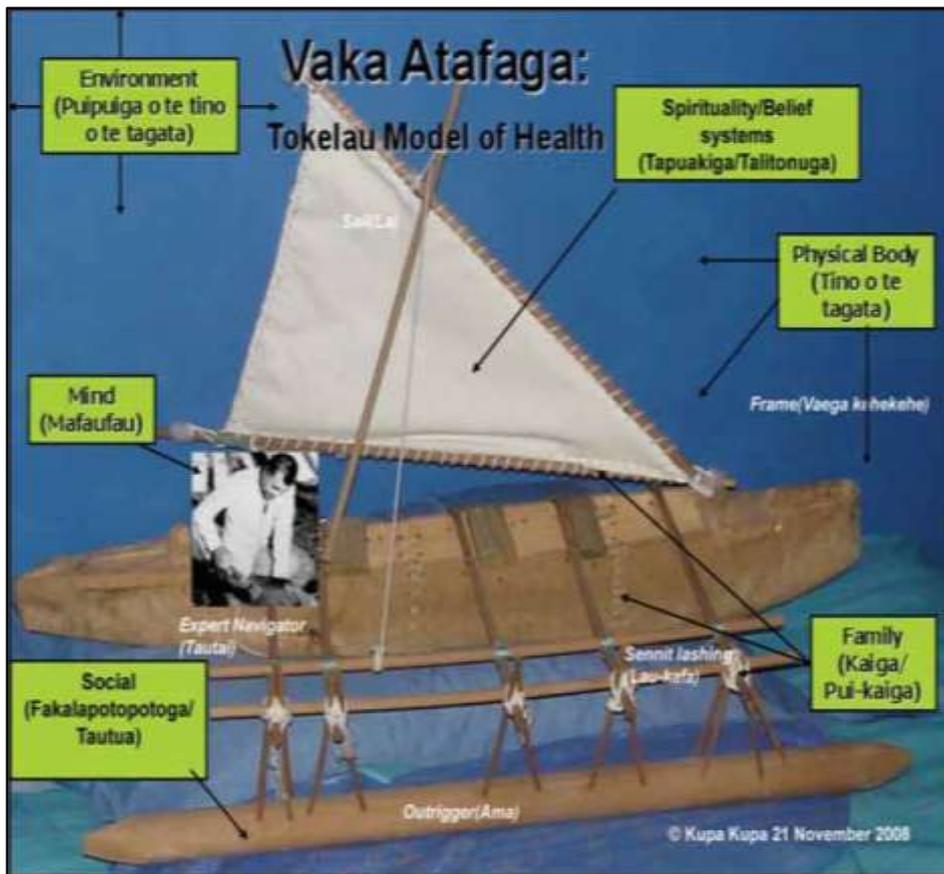
2.7. OTHER PACIFIC MODELS

The researcher has identified other Cook Islands and Pacific Island models that are used among the different sectors which shows some commonalities and affinity to the *Kōkā* Model.

2.7.1 The *Vaka Atafaga* Model

Te Vaka Atafaga is a traditional outrigger vessel with a sail and is commonly used and understood in the Pacific region including the Cook Islands. *Te Vaka Atafaga* is a Tokelau Island model developed by Kupa Kupa consisting of six core concepts which are considered key aspects of health for Tokelau people. They are: *Te Fenua* - Natural environment, *Te Tino o Te Tangata*- Human physique and physical fitness, *Mafaufau*-Conscientiousness and strength of mind, *Inati* - the system of sharing for the benefit of the *kaiga*, *Tapuakiga / Talitonuga* - Ancient beliefs and Christianity, *Kaiga* - Families and traditional sacred relationships between members (Kupa, 2008).

FIGURE 9: THE VAKA ATAFAGA MODEL

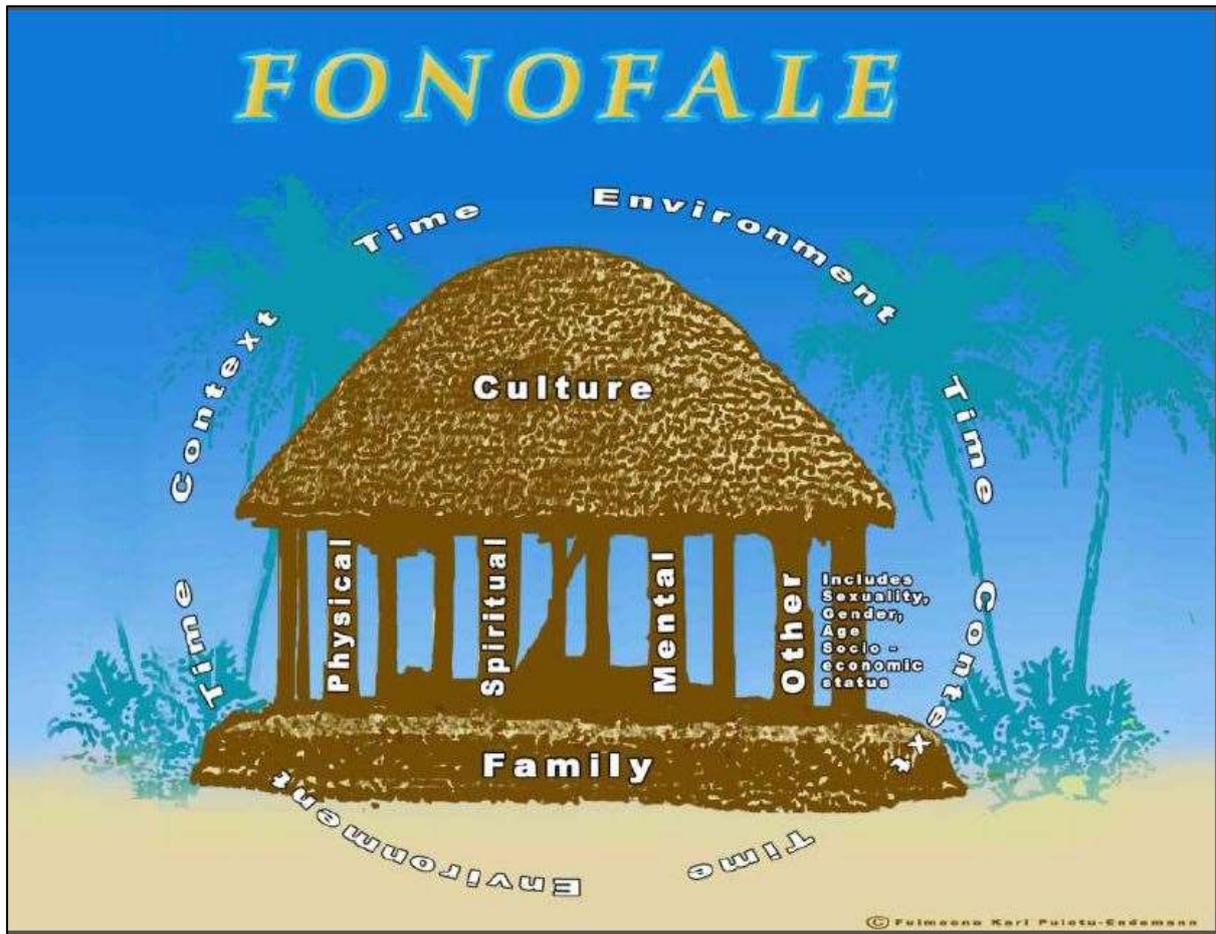


(Source: Kupa, 2008 page 159)

2.7.2 The Fonofale Model

The *Fonofale* Model in Figure 10 below is created by Fuimaono Karl Pulotu-Endemann as a Pacific Island model of health for use in the New Zealand context. The Fonofale Model incorporates the values and beliefs that many Samoans, Cook Islanders, Tongans, Niueans, Tokelauns and Fijians had revealed to Fuimaono Karl during workshops relating to HIV/AIDS, sexuality and mental health in the early 1970's to 1995. In particular, these groups all stated that the most important things for them included family, culture and spirituality (Pulotu-Endemann, 2001). The Fonofale Model is a dynamic model in that all aspects depicted in the model have an interactive relationship with each other.

FIGURE 10: THE FONOFALE MODEL

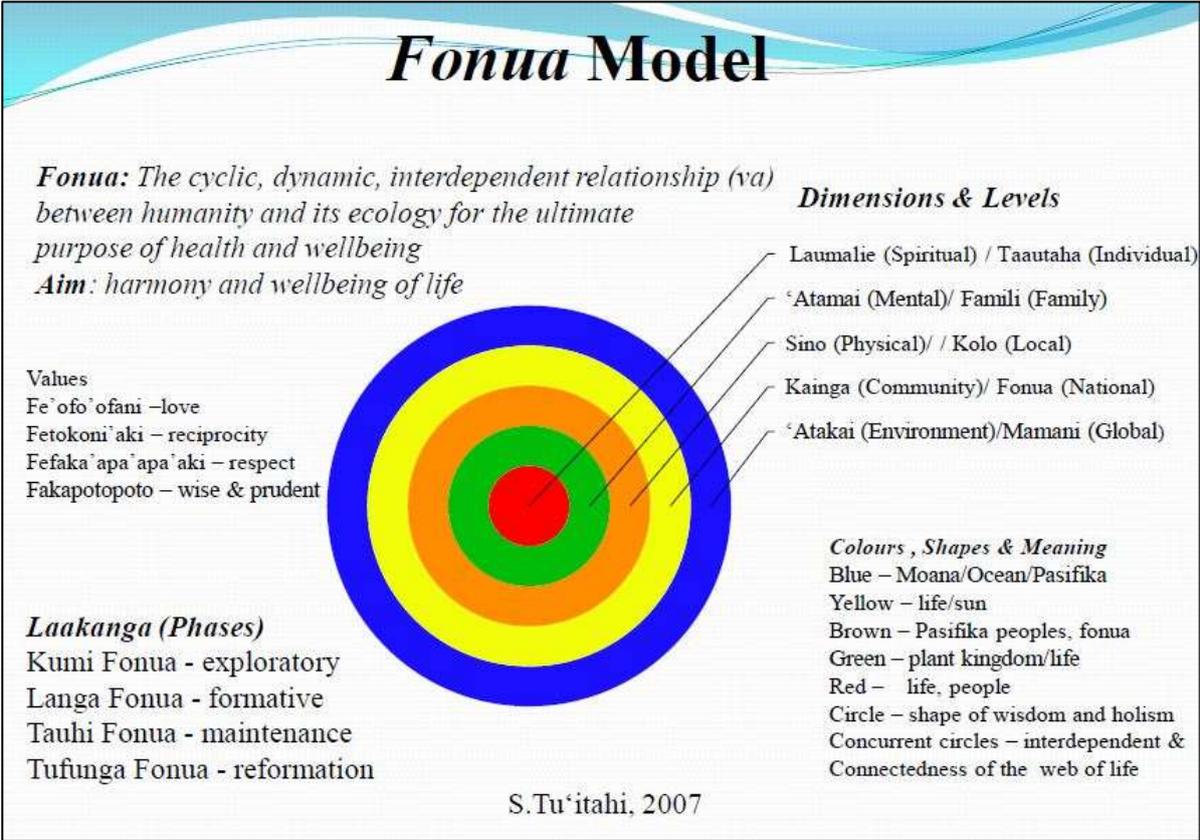


(Source: Pulotu-Endemann, 2001, p.3)

2.7.3 The Fonua Model

The *Fonua* Model in Figure 11 below is a Tongan model developed by Sione Tu’itahi. It is based on the idea that diverse cultures need to have diverse tools in order to be effective; that is, one tool for all is a recipe for disaster; therefore the aim is to provide tools that are culturally appropriate and effective for Pacific peoples in order to improve and maintain their material and spiritual health and wellbeing. This is based on the idea that Pacific peoples see the world through their own eyes and experiences. The ultimate purpose of this relationship and exchange between the environment and humanity is to maintain harmony in life in sustainable ways - *melino* (peace, harmony), or health and wellbeing. Five dimensions identified in this model are: *Sino* – Physical, *Atamai* – Mental, *Laumalie* – Spiritual, *Kainga* - Collective/Community, *Atakai* -Environment (both a built and natural environment). These five dimensions are interconnected. All must be cared for equally in order for holistic wellbeing to be maintained (Tu’itahi, 2009).

FIGURE 11: THE FONUA MODEL



(Source: Tu’itahi, 2009)

2.8. Locating the research

The ‘insider-research’ approach

In a global context, Indigenous peoples have been the subject of research interest since the nineteenth century. Colonisers exploited Indigenous peoples through case-study approaches in developing theories of “cultural evolution that implicitly legitimized the introduction of civilizing institutions to govern Indigenous homelands” (Given, 2008, p.425).

The researcher, can be classified as an ‘insider-researcher’ because he is both an Indigenous Cook Islander and the Director of the organisation Emergency Management Cook Islands (EMCI). Having being in the position for the past eight years, he is able to engage with its stakeholders subjectively. One would argue by being an ‘insider-researcher’, the researcher can also bring their own perspectives and experiences and produce a balanced, yet objective interpretation of the development. Therefore, a Cook Islands Māori world view cannot be ignored in this context.

The *tuatua mai* with the *aronga pakari* can also be located within this insider-researcher approach as they are considered informal conversations. The *tuatua mai* can also be considered an Indigenous approach to gathering data that can further inform the topic being explored, in this case, traditional Cook Islands knowledge and practices which anticipate natural disasters.

2.9. Summary

This chapter has provided a critique of several Cook Islands and Pacific ideological models to explain the Cook Islands Māori world view being used in conducting this research. The *Kōkā* Model has provided an Indigenous methodology as the framework for which the research has been undertaken. Various Cook Islands, Maori and Pacifika models were also discussed in this chapter to support the *Kōkā* Model.

The description of the various sections of the *Kōkā* Model from its *papa* to its *Atua* including its supporting systems and emerging themes provides a holistic approach to this research.

Chapter 3

TRADITIONAL KNOWLEDGE OF THE COOK ISLANDS

3.1. Introduction

Traditional Cook Islands knowledge plays a crucial role in early warning disaster systems for those that live on remote islands where telecommunications to the mainland are unreliable. In many cases, their traditional knowledge that has been passed down for generations is the only warning of an oncoming cyclone, tsunami or other natural dangers that will affect the islands.

This chapter captures the stories of many elders and orators where they recall their experiences and knowledge that have been passed down for generations. Unfortunately, these oral histories are not very well documented and with the rapid development of modern technology, the younger generation now relies on technology for their information. These oral histories have informed the documentary and reinforces how traditional knowledge enhances the prevention, mitigation, planning and preparedness for natural disasters across all sectors in government, planning and policies. Furthermore, these oral histories reinforce the fact that traditional indigenous knowledge in science, can be intergrated to strengthen Cook Island resilience towards a safe, secure and sustainable future.

On the island of Atitutaki, one of the *tumu korero* (orator) Pukenga Varu, recalls the days as a young child.

I te tuatau o to matou metua, kare oki e pakau akapapa, e mea akakitekite ua. Teia tuatau ra e tata ana au i taku ki roto i te puka. Teia nu nei, ka taviri oki me kore ka uka oki tona kao ki raro, ka karanga mai to matou Metua, te viviki nei te uria. Me mingi nake te kao, papu meitaki e ka uria. Kare e tarevake ka tupu rae (Ngari, 2011).

This translates as:

In the early days of our old people, none of these things were recorded; they just told us. Today, I write these things down. In realtion to the coconut - when you see the middle stalk twist or it bends down- the old people will say there is going to be a cyclone. When the stalk bends down, it is definite that this means a cyclone is coming. It's never wrong, it really happens.

3.2. *Tuatua/tuatua mai*

The Researcher has travelled and visited all the inhabited islands by plane and by boat as part of his work with the National Disaster Management Office. During these visits he was able to

tuatua and tuatua mai (informal conversation), film and produce a 30-minute documentary for 11 of those inhabited islands, capturing the traditional knowledge and practices from each island relating to disasters in the Cook Islands.

According to Ravlich (2016), the *tuatua mai* is an informal conversation between two people on any topic of interest. This research is an attempt to document and capture as many of these traditional knowledge and practices in their native island language before most of the elderly and traditional leaders pass on taking with them all of this treasured knowledge. While there are some common traditional knowledge and practices across all the islands, this chapter will focus on some of the experiences that is unique to each of the 11 populated islands which are part of the scope of this research.

3.3. Island of Mangaia - *Tieni'anga reva* (climate change)

Traditional knowledge and practices discussed in this research were based around nature, birds, animals, the trees, fruiting of trees and the natural state of the environment. A traditional orator from the island of Mangaia, Mataora Harry, in his 70s at the time of this research, believes climate change and the change in weather patterns will have an impact on our traditional signs.

Ite tuatau mua, takataka meitaki ia tatou e tuatau manaa teia, e tuatau ānu teia, e tuatau māanaana teia, e tuatau ānuānu ua teia. E ā oki tuanga a te pa metua i akanoonoo ei no tatou. I roto i teia ra, kare e taka anga akaou. Mei toku anauanga e tae mai kite 80s, kite au ite ua kōatu. Kua tupu e rua taime teia ua koatu i runga i te enua. Te tuke nei te reva i roto i teia tuatau. Te irinaki nei au e te pera nei ta tatou akairo, ta tatou i matau no te kite no te uriia. Ka tau i a tetai tuatau no te aere anga reva (Carlson & Shedden, 2011a).

This translates as:

In the olden days we were certain that this is a hot period, this is a cold period, a warmer period and this is a cooler period. These are the four seasons our forefathers have established over the years. From the day I was born until the 80s, I saw a hailstorm on our island. This happened twice on our island. The weather is certainly changing now. I believe our traditional signs will also be affected, the ones we are familiar with are the cyclones. It will change some day because of climate change.

3.4. Island of Aitutaki - *Tieni'anga reva*

The former Government representative on the Island of Aitutaki, Tai Turia, now in his 80s, has certainly seen the changes in the weather over the years.

I te tuatau mua, e mou ngakau ua ana ia tatou te au tieni anga reva. Te tuatau o te spring, summer autumn e te winter. Kua kite ana au i te reira, e kua tieni te akapapaanga o te reva (Ngari, 2011).

This translates as:

Before, we knew the changes in the seasons from spring, summer, autumn and winter. I have seen that there are now changes in the seasons.

3.5. Islands of Atiu - *Kōa te meika* (banana tree cries)

The knowledge of the *āa meika* or described by these orators as *me kōa te meika* meaning 'when the banana tree makes this sound as though it is crying, is common on the island of Atiu and some of the Southern group islands. This is what Karika Miria in his late 70s describes growing up in the village as a young child.

Kare oki mei teia ra, e ratio tetai ei akakite mai eaa te ka tupu. Kite uake tatou tupu teia au mea. Te manuia ra oki e bro kite rai oki te au ruaine i te au tuatau e tupu ana te uria. Ka kite ratou i ria e ko te tuatau teia e akamata nei ka teatea mamao. No runga ite āa o te meika, me akarongo oki koe ko tai rai. Te reira pakau kare I te tuatau matangi e tuatau ripo ka akarongo koe iaia i te aue tona mea oki kōa ua oki teia meika aue ua. Ka akarongo koe me aue nake te meika, kare e matangi, kare e uriuri te meika. Ko taku teia i kite mai au, e i irinaki au e ko tetai akairo te ra ta te au tupuna i opu mai (Carlson & Shedden, 2010b).

This translates as:

It is not like today we have a radio to warn us about any cyclone approaching the island. All of a sudden we get hit by a cyclone, but lucky the old people know the signs of the cyclones. Once they see the start of the signs they prepare for it. As for the *āa* (cry) sound of the banana tree, when you hear that sound sometimes just one banana tree there is no wind, everything is quiet, the banana tree does not move. This is what I learnt and I believe in this traditional signs that our forefathers have taught us (Carlson & Shedden, 2010b).

Another elderly man in the same village of Atiu Samuela Koronui also describes the same experience about *kōa te meika* on the island of Atiu.

Tetai akairo taku i kite mata au e i akarongo papu au i te reira koia ko teia āa meika. Karanga tatou e piro meika e mea tangi uake reira. Tuke uake rai kare e rauka iaku i te akataka e te akapeea nei teia tangi. Note mea tupu tikai teia kiaku i raro enua I tetai mataiti ake nei. Oki mai au akakite ki toku papa e tera oki tera pakau ina, kua tangi akaou ki raro. Karanga mai to matou papa i reira e ka matangi. Kare rai i tarevake ana e tupu atu tera mea na mua e matangi mai i reira, uria i te reira mataiti ia tatou i Atiu nei. Kua papu tikai iaku te reira akairo ta to tatou ui tupuna i runga nei i te enua (Carlson & Shedden, 2010b).

This translates as:

One sign that I have witnessed is the *āa meika'*. This is the bark of the banana tree that makes a lot of sound. This happened to me when I was in the plantation so I came back and told my grandpa about the sound the banana trees were making. He said there is going to be strong wind and he wasn't wrong. The wind started followed by a big cyclone on the island of Atiu. I can confirm these signs told by our elderly people on the land.

Rouru George also from the island of Atiu recalls his father telling him to trim the leaves; the leaves of the banana tree and prop the trees to stop it falling over when they recognised the sign for a cyclone approaching the island.

Pera mai i reira toku metua tane kiaku e tipu pouroa au i tera rau meika kia kore e puia e te matangi. Toko rae oki matou i te meika kare ra oki i puapinga ana kua topa ki raro, pakari roa te uriia (Carlson & Shedden, 2010b).

This translates as:

My father told me to cut all the leaves off to stop it from being blown over by the storm. We also tried to support the banana trees with poles but it still didn't do any help, the cyclone was too strong.

3.6. Island of Mangaia - *Takaviri* (twist)

The Mayor for the island of Mangaia, Teremoana Atariki, describes a similar experience growing up on the island.

Taku akairo i kite mata tikai oki au tera kao o te *kōkā* ra ka taviri. Taku oki ia i kite i te reira tuatau. Tae paa kite rua me kore toru ra te uria mai nei. Na toku mama ruou i angai ei iaku, nana i apii mai i teia akairo (Carlson & Shedden, 2011a).

This translates as:

The sign that I have seen with my own eyes is the twisted shoot of the *kōkā*. That is what I have seen at the time. It will take about two to three days before the cyclone strikes. This is what my grandma who brought me up taught me. My grandmother who brought me up told me about this sign.

Also on the island of Mangaia, one of the local growers, Ngatama Marurai, describes a very unusual behaviour of the *kōkā* tree not recognised on the other islands.

Tetai akairo no runga ite *kōkā*, kare i tae ake te manga anga o te *kōkā*, pururu me kore ma'aki te kaui ki raro. Akamaro te rau, kare i tae te tuatau I para ei aia. Pururu vave ua e te tupu nei i runga i te enua I teia nei ra. Me tae ki te reira tuatau ka kite ua koe e apinga tetai ka tupu. Ka tupu te matangi (Carlson & Shedden, 2011a).

This translates as:

One of the signs I have experienced about the *kōkā* tree, is that before the bananas get to the maturity stage, the whole bunch of bananas will just fall on the ground. The leaves will start to dry off before the bananas starts to ripen. When it gets to that stage and you see that happening you will know something is going to happen. There will probably be a strong wind. This is what Maui Tetuanui Peraua shared from the island of Mangaia. Breadfruit tree is a very good indicator for a cyclone coming and this is a sign known across all the islands.

Me kite koe e rua e toru kuru i runga i te tā okotai, e āka taravake tera. Te tika anga tikai e tai rae kuru i runga ite tā okotai. Me tae kite toru kuru na toku papa kerani ei, e mea papu ka uriia. Kite mata ana tikai oki au (Carlson & Shedden, 2011a).

This translates as:

When you see three to four breadfruit in a bunch as shown in Figure: 12, something is wrong. Normally you only get one breadfruit per branch. If you get three fruit in a bunch, there is definitely going to be a cyclone my grandfather tells me. I have seen it with my own eyes.

FIGURE: 12 BREADFRUIT



(Source: Carlson's personal collection)

3.7. Island of Rakahanga - *Hopu* (diving)

The former Member of Parliament Taunga Toka for the island of Rakahanga, also a pearl diver and a professional scuba diver, recalls a phenomenal event that happened prior to Cyclone Martin which devastated the Islands of Manihiki and Rakahanga. Nineteen lives were lost in Manihiki when the island was swamped by a Tsunami-type wave that roared across the narrow strip of island into the lagoon, over the surrounding islets and out into the open sea.

Haere atu matou i te reira popongi i te apii hopu mei te tai ngauru ma rima matou i raro ake i te moana. Kua kite au i teia te tuke i roto oki i te tai mei te puaiioio rai te tu oki i raro i te moana. Koa roa au i te hopu anga i Manihiki, ka tai ra oki au ka kite tetai ka tupu no teia one oki e aere nei mei te puaiioio, aere mai tetai aere mai tetai aere mai tetai na runga nararo i te moana. Hoki mai matou ki Tukao kare i roa ana mei te ora ha paa i te reira ahiahi kua akamata tikai te ngaru i te mea mai e te matangi atu te viviki i te mea i te akamataanga (Carlson & Shedden, 2011g).

This translates as:

We went for a scuba diving session with about 15 students in the lagoon in the morning. I saw at the bottom of the sea this muddy silt spiralling up like a tornado. I have dived in Manihiki for a very long time and this is the first time I have ever seen this happen with this tornado-type muddy silt spiralling all over the place. We went back to the village Tukao and that late afternoon big waves started building up followed by very strong wind.

3.8. Islands of Atiu - *Manu* (birds)

A local tourist operator on the island of Atiu, Mr. George Mateariki (aka Birdman), takes tourists on bird watching tours on the island. He has a very good knowledge of the birds including migrant birds that fly afar.

Ko taku i marama au e manu e Torea, e kapiki ana te Atiu e Toretorea. Teia manu kare aia e noo ana ki runga i te enua, e karanga ana oki te papa e migratory bird, me tae nake ki tatou tuatau anu (winter) ka rere aia ki Alaska ma. Me akaruke te manu i roto i te marama ko Titema me kore ko Tianuvare, e pakau tetai ka tupu, e akairo tera e kua rere te manu (Carlson & Shedden, 2010b).

This translates as:

What I know is the bird called the Torea (Pacific Golden Plover). This bird lives on the island but it is also known as a migratory bird. It is a seasonal bird so during our winter season starting in April, it will migrate to Alaska. If the bird disappears early around December or January, then it is not a good sign.

Gerald McCormack, the Director of the Cook Islands Natural Heritage Trust has worked with the Government of the Cook Islands since 1980 as Science Advisor to the Ministry of Education. He is also the Director of the Conservation Service, has a first Class Masters in Zoology, and is an accomplished photographer and author. McCormack confirms in his article to the Cook Islands News titled, *Torea tere to Alaska via Japan*, that the Torea do migrate in April all the way to Alaska via Japan, but return to the Cook Islands via Hawai'i around September (McCormack, 2017). George Mateariki describes his experience in 2004 – 2005 when five cyclones struck the Cook Islands within a month.

I te mataiti 2004, te ngaro anga te manu ia Titema, kare au i ekoeko ana e ka taii tatou i te 2005. Tera aka uriia i taeria mai ana tatou, kare ra oki au i irinaki atu ana mei tei reira roa tone rinui. Ka tai nei uriia, ano mai aere atu, aru mai tetai aere atu, e rima taime. Kare roa au i toku tuatai i noo ana ki Atiu i kite ana i tetai uriia mei teia rae te tu (Carlson & Shedden, 2010b).

This translates as:

In 2004, this bird disappeared in December, and I didn't doubt that something was going to happen. However I didn't expect it to be this bad. I have never experience five cyclones coming one after the other in my life.

FIGURE 13: TOREA (PACIFIC GOLDEN PLOVER)



(Source: McCormack, 2017)

George Mateariki describes the behaviour of the local birds on Atiu.

Ko ta tatou au manu enua, kare ratou e akaruke i te enua, kare oki e mamao to ratou ngai ka rere. Te marama Titema ka kite koe nui oki te manu no te mea rava oki te manga. Me kare koe e kite putuputu ia ratou, te aite anga kua aere ratou i te kimi ngai akaruru anga no ratou. Me kare koe e kite rupe, kare oki ratou e aere mai ki te ngai ateatea, ka kite koe ia ratou i roto i te makatea (Carlson & Shedden, 2010b).

This translates as:

Our local birds do not leave the island as they cannot fly far. In December you will see them all over the place because there are plenty of food around. If you don't seem them often during this period that means they have gone to find a place of shelter. If you don't see the Rupe (Native Pigeon) in the open, you will see them in the *makatea* (rock cleft).

FIGURE 14: LOCAL PIGEON



(Source: McCormack, 2017)

3.9. Island of Nassau – Behaviour of local bird

On the island of Nassau in the northern island groups, school Principal Mr. Poila Poila, shares his experience about their local birds on the island.

Tetai akairo tupuna tei akakite ia mai e te kite nei rae au e te tupu nei rae te reira no runga i te au manu te aere mai nei mei te moana mai. Teia manu ta matou ingoa e 'āri' te reira. Me kite matou i te reira manu ka matangi e ka uriia (Carlson & Shedden, 2011d).

This translates as:

One of the traditional signs that was told to us and is still happening is about the birds flying from the ocean. This bird we called the 'Ari'; when we see that bird it means strong winds and rain are coming.

3.10. Islands of Rakahanga – Behaviour of the birds

Vaheau Temu (aka Soldier), is an Island Councillor on the atoll island of Rakahanga in the northern island group,

Te au akairo o te uriia i Rakahanga nei taku noti i kite i toku tupuanga mai ko te manu. Me rere mai te manu me makona te manu, kite atu taua e matangi, ka ua e tuketuke. Ka rere mai tera manu na te moana, ka maani mai ratou me aere mai ratou ki runga ki raro ki runga ki raro te akairo ia no te tai kua kite tatou e ka ngaru e ngaru teia (Carlson & Shedden, 2011g).

This translates as:

The sign of the cyclone in Rakahanga that I knew growing up was the birds. When they fly around in abundance that is a sign for strong winds and rain. When they come from the ocean and flying up and down, up and down, we will know for sure the sea is going to be very rough and to expect some big waves.

3.11. Island of Mitiaro – Behaviour of local birds

On the island of Mitiaro, the Environment Office and Island Councillor, Julian Aupuni, shares his experience about their local birds on the island.

Te rere o te manu, me rere te kotaa, e matangi, te tai taime ka kitea te tara, ka aue aia. Tetai manu e kīkīvairāo, kā rere aia i te pō, e maiata ka ngaro aia. Me rere mai aia, tana aue me ta te pēpē rae (Carlson & Shedden, 2011c).

When the birds fly, especially the kotaa (Frigate Bird), it is a sign that there is going to be strong winds. Sometimes we will see this bird called the *tara* and will cry. The other local bird is the kīkīvairāo and normally flies at night and disappears early morning. When it flies, it cries like a baby.

The frigate bird is common on all the islands. It has the largest wingspan in comparison to its body of any bird species in the world which makes the frigate bird naturally an adept pilot. The Frigate bird has been known to stay in the air for nearly a whole week and only land on the rocky cliffs to breed or to rest. This makes the Frigate Bird a good forecaster of wind patterns for the locals.

3.12. Island of Mauke - *Moa* (chicken)

Boys Scout Master Mr Basilio Tutai Kaokao, is a member of the Disaster Management committee on the Island of Mauke. This is what he recalls growing up on the island.

Taku akairo tei apii ia mai e toku tupuna e ko taku numero tai roa atu te reira e tamou nei, e te apii nei ki te tamariki koia oki no runga i te mōa. Me kare te mōa e tau ki runga i tona tauranga i te tuatu tei manako ia e ka uriia tetai me kare e angaanga tetai ka tupu, ko tera manu kare roa aia no te tō ki runga i tona tauranga. Ko te akairo tera kua papu meitaki ia aku e kua tano (Carlson & Shedden, 2011h).

This translates as:

The sign that was taught to me by my grandparents and still my number one sign that I remember and I even taught it to my boy-scout members is about the chicken. If the chicken does not roost on its nest or is up on the trees where they normally roost, then there is a chance for a cyclone or something will happen. This sign is sure to happen.

Traditional Orator and former Speaker for the House of Parliament, the late Hon. Mapu Taia, also from the island of Mauke, supports the sign of the chicken.

Maara nei iaku te rima cyclone i te mataiti 2005 tei akakite ia mai e ka ū ki Mauke nei. Karo atu ki taku vaine kia atoro atu i te moa me te tauranga ra, te karanga mai nei e te mako ua ara

te moa i runga i tona tauranga. Karanga atu au ka mako ua tatou e kare rae tera uriia i tae mai ana ki Mauke nei (Carlson & Shedden, 2011h).

This translates as:

I recall the five cyclones in 2005 and there was a forecast that one of the cyclones will hit Mauke. I asked my wife to see if the chicken is still up its roost. She said the chicken is ok and still up its roost. I told my wife we will be ok and sure enough the cyclone never came.

3.13. Island of Rarotonga - Ūtū (mountain banana *musa trog-lodytarum*)

Madame Speaker of the House of Parliament, Mrs Nikki Rattle, and her husband Colin Rattle for more than 20 years have been planting the traditional bananas called the ūtū in the mountains. They have harvested what they have planted and also those that grow wild in the bush. This is what Madame Speaker Rattle describes about the ūtū tree:

Ko te au pū ou o te meika e tupu mai ana ratou ki raro ake i te pu meika. I tetai taime ra ka tupu mai e tai pu mei te tai ki te tai e te apa mita i te mamao mei te tumu maata. Tuke ua ake rai teia, e kua kite mai maua e ka tupu te uriia me kare te matangi ririnui. Me puia ia te tumu maata ki raro, ka mauti mai te au pu ou katoatoa I raro ake I te pu maata, e ko te pu tei tupu mamao atu, ka tu ua rai te reira. E Kua manako i reira au e, e akairo natura teia e, e uriia tetai e aere mai nei. I te mataiti 2005 e rima cyclone. Kua tupu ana teia and pera katoa I te mataiti 2009. Ko taku teia i kite mata tika e te Irinaki anga e, e akairo natura teia (N. Rattle, personal communication, October 20, 2013).

This translates as:

The new shoots - they normally grow from the bottom of the banana tree. Sometimes one new shoot will grow about one meter or 1.5 metres away from the trunk of the tree. This is quite unique and we realise when there is a cyclone or a very strong wind as all the new shoots under the bottom of the banana tree will be uprooted. The new shoot that grew one metre away will survive and I believe this to be a natural sign for cyclones. In 2005, there were five cyclones and this also happened in 2009. This is what I have seen and believe this to be a natural sign.

3.14. Island of Penhryn - Matangi (wind)

The direction of the wind is closely observed by the people of Penhryn in their forecasting for strong winds, rough seas and cyclones. The wind direction is common among the northern group of islands and the old people know the direction of the good wind which will be good for fishing and the bad wind that predicts a cyclone.

Police Officer, Mita Soatini, on the island of Penhryn in the Northern Group recalls one of the signs told to him by the old people growing up on the island.

Te vai nei hoki i te ui tupuna teia matangi ko tei karanga ia Tūra o te Pū. Te matangi teia me noho hoki kite reira tua, teia tona akairo ka tupu tetai hurihia. Mei teia te tu, me pou iaia te tai epetoma I te noho ua anga ki te reira tua, ka papu e ka urihia tatou (Carlson & Shedden, 2011e).

This translates as:

There is this wind direction called *Tūra o te Pū* often told to me by our old people. This is the wind that comes from that direction and it is a sign for a cyclone. If this wind stays in that particular direction for about a week, there is definitely a cyclone on its way.

One unusual sign told by an Island Council member, Manata Akatauirā, also on the island of Penhryn, is about the super abundance of the nuts on a coconut tree.

E au tuatua oki teia nate ui tupuna, ei akamatakite na ratou i tuku mai ei. E akara matou ki runga i te nū, tei runga i te maviriviri o hūa, te kino rae ia o te uriia. Ka karanga oki ratou e ko te marama ko Tianivare e 'marama paroro mua'. Peperuare ko te 'Paroro muri' te reira. Ko te au marama teia e Mati kua akakite mai ratou kia matakite tatou (Carlson & Shedden, 2011e).

This translates as:

These were some of the warnings our elderly people told us to be aware of. We must observe the nuts on the coconut trees and when these nuts are in super abundance the cyclone will also be a bad one. They told us the months of January, February and March are the months to be aware of.

3.15. Islands of Penhryn and Palmerston - *Kāo*

On the island of Penhryn in the northern group of islands, the Mayor of the island, Mr. Tini Ford, describes the sign of the banana stalk.

Mei roto mai i teia pāpā pakari no matou ia matou te tamariki ara matou. Kua akakite mai kia matou i te tuatau e tupu ei te uriia, me kite koe i te meika ko te kao oki o te meika, kua sape oki i na ratou ei, kua mingi oki ki raro. E akairo te reira no te uriia. Kare e roa me te toru ki te rima ra, kua tupu tera uriia. Akakite mai rae oki aia e ko te natura o te enua e akakite mai e ka uriia (Carlson & Shedden, 2011e).

This translates as:

Our grandfather during the time when we were still young, told us during the time of the cyclone, when you see the banana tree, especially the middle stalk of the banana tree bend (*kua sape*), that is a sign for a cyclone. Normally it takes about three to five days and they get hit by the cyclone. He said this is how nature tells us that there is going to be a cyclone.

On the island of Palmerston, local fisherman, Bill Masters, adds another interpretation to the bent stalk as told to him by the elders. The bent middle stalk means 'the direction the stalk

bends or points to is also the direction the cyclone will be heading towards to (Carlson & Shedden, 2011j).

3.16. Island of Nassau - *Ua te rakau* (abundance)

Nassau Administration Officer Tuakatau Wuatai shares his experience living on this small atoll island of Nassau.

Taku teia i akarongo au, ta te au metua pakari i akakite mai kia aku. No runga i ta tatou au mea tanu, te nu, nita, taro e te vai atura, ka karanga oki ratou me mou te tupu anga o te reira, ruperupe te enua e te au mea katoatoa, ka karanga ratou e ka uriia. I te Mataiti 2005 i u mai ei a Cyclone Percy, ko tetai mataiti mekameka roa atu te enua e oti uriia i reira. Ka irinaki nei au i teia au akairo ta te ui tupuna i aka kite mai (Carlson & Shedden, 2011d).

This translates as:

This is what I heard that the old people told me regarding our crops, the nuts, pawspaws, taro etc. - they used to say when all these grow in abundance then there will be a cyclone. In 2004-2005 before Cyclone Percy struck, the land was plentiful and in abundance and then the cyclone happened. I believe in what the old people have told us (Carlson & Shedden, 2010b).

3.17. Summary

The experiences highlighted in these stories shows the strength of traditional knowledge and practices in the Cook Islands among our *aronga pakari* particularly from the *Pa Enuā*. These practices continue to guide the communities they live in and inform their knowledge about how to read their natural environments especially in terms of anticipating natural disasters. These traditional knowledge and practices have been passed down for many generations and they are still being experienced and practiced today. Therefore by having these traditional knowledge, practices and experiences documented will preserve it for many more generations to come as an important resource to inform communities about how to be resilient in the face of natural disasters.

CHAPTER 4

TRADITIONAL KNOWLEDGE AND THE INTERNATIONAL CONTEXT

4.1. Introduction

This chapter examines some of the traditional knowledge and practices in an international context and will discuss their effectiveness in becoming recognised internationally in response to the increasing severity and frequency of natural disasters. The relationship between Indigenous knowledge and natural disasters has gathered more interest in recent years. Discussions around Indigenous knowledge highlights the potential to improve disaster risk reduction and related policies through integration into disaster education and early warning systems (UNISDR, 2008).

The 2004 Indian Ocean tsunami certainly sparked interest to revive and integrate Indigenous knowledge with science for disaster risk reduction across various sectors. Many witnessed the horrors of one of the worst natural disasters of the century, however, we also need to acknowledge the many lives saved because local villages had the traditional knowledge in recognising the imminent danger when the sea suddenly receded (UNESCO, 2005).

One of the lessons learnt after the 2004 Indian Ocean tsunami is that public awareness and education are essential to protecting people and property. In Thailand over 1,800 lives were saved because a tribal leader recognised the imminent danger when the sea suddenly receded, and so decided to evacuate his people up to the hills. One hundred tourists owe their lives to a 10-year-old girl from England who warned them to flee to safety, moments before the tsunami engulfed the beach. The girl recognised the signs after learning about tsunamis in her geography class (ISDR, 2015).

At Sri Lanka's national wildlife park at Yala, which houses elephants, buffalo, monkeys, and wild cats, no animal corpses were found, but the human devastation there was as tragic as every where else.

There is a good chance the wildlife knew that trouble was on the way. History is littered with tales about animals acting weirdly before natural disasters, but the phenomenon has been hard for scientists to pin down. Sometimes animals get crazy before a quake, sometimes they do not. However, it is argued that animals have sensory abilities different from our own, and these may have alerted them to the impending disaster (Kenneally, 2004).

4.2. United Nations International Strategy for Disaster Reduction (UNISDR)

The UNISDR released a report called *Indigenous Knowledge for Disaster Risk Reduction: Good Practices and Lessons Learned from Experiences in the Asia-Pacific Region*. It argued that throughout disaster risk reduction literature, four primary arguments have been made for the value of Indigenous knowledge.

First, various specific Indigenous practices and strategies embedded in the knowledge, which prove valuable against natural disasters, can be transferred and adapted to other communities in similar situations. Second, an incorporation of Indigenous knowledge in existing practices and policies encourages the participation of the affected community and empowers its members to take the leading role in all disaster risk reduction activities. Third, the information contained in Indigenous knowledge can help improve project implementation by providing valuable information about the local context. Finally, the non-formal means by which Indigenous knowledge is disseminated provides a successful model for other education on disaster risk reduction (UNISDR, 2008).

The senior Regional Coordinator of UNISDR for Asia Pacific, Jerry Velasquez, acknowledges that even before we came up with high technology-based early warning systems, or standard operating procedures for response, numerous local communities worldwide have prepared, operated, acted, and responded to natural disasters using Indigenous methods passed on from one generation to the next.

The United Nations has already considered Indigenous knowledge within Priority 3 of the *Hyogo Framework for Action 2005-2015*, which focuses on education and knowledge. One of the key activities identified under this priority action focuses on the importance of information management and exchange, and highlights the use of “relevant traditional and indigenous knowledge and cultural heritage” to be shared with and adapted to different target audiences. In order to fulfill this objective, we all need to understand, acknowledge

and respect Indigenous knowledge as a valuable source of information and as a key contributor to reducing risk in many parts of the world (UNISDR, 2005, p.9).

4.3. India – Traditional Knowledge

In India, there is a renewed respect for traditional knowledge systems of local and Indigenous communities. Indigenous knowledge is being recognised as on a par with and complementary to scientific knowledge. The oral transmitted and experimentally based knowledge of local and Indigenous peoples compares well against the experimental science of the technology era. Since tribal groups have lived within their local environments since time immemorial, they possess a rich knowledge of nature and natural phenomena (Jha & Jha, 2011).

4.4. Australia Red Cross

The Australian Red Cross released a report in 2008 which focused on traditional knowledge and Red Cross disaster preparedness in the Pacific. It highlighted the fact that disaster preparedness, based on a combination of both traditional and scientific knowledge, is the best way of helping local communities during natural disasters. By giving communities greater responsibility for their own preparedness, they will be better able to cope with natural disasters and less dependent on technology and outside help.

The report also recommended that Australian Red Cross and Pacific national societies consider combining traditional knowledge when organising the Pacific Disaster Management Partnership. Benefits of using traditional knowledge include, strategies that are accepted by local cultures, practical strategies that can reduce the impact of natural disasters, the development of strong independent communities that include everyone including older people and women and better, faster and safer ways to respond to disasters, using the help available from members of the local communities, Pacific national societies and Australian Red Cross.

Members of the Pacific community recognise that with time, traditional knowledge is eroding due to a combination of factors such as migration, urbanisation, and the passing away of elders. It is essential therefore that beneficial traditional knowledge and cultural values are used and preserved in order to improve the ability of Pacific Islanders to build

long-term resilience to natural disasters over time (Fletcher, Thiessen, Gero, Rumsey, Kuruppu & Williets, 2013).

4.5. Solomon Islands – Lack of Traditional Knowledge cost many lives

On 2 April 2007 at 7:39AM local time, a magnitude 8.1 earthquake hit the Solomon Islands' Western Province. The earthquake caused strong shaking (hard enough that most people had problems remaining standing) which lasted over one minute, damaging structures and shearing off coral reef colonies, while at the same time warning the populace of the potential for a tsunami. Of the 52 people that died during the Solomon Islands earthquake and tsunami, 31 (59.6%) were immigrant Gilbertese from Titiana, New Manra and Nusa Mbaruku that did not react properly because they had no memory in their culture of such an event. Their homeland Kiribati is a coral atoll nation, situated far from any regular earthquake sources. Because there have been no major, tsunamigenic earthquakes in the 50 years since their emigration, they simply lacked the Indigenous knowledge of their adopted environment that could have helped save their lives.

Gilbertese children were particularly vulnerable because not only were they too weak to swim against the relatively slow-moving yet deep tsunami, but they too lacked the Indigenous knowledge that would have kept them from exploring the emptied lagoons. The indigenous Solomon Islanders, on the other hand, in large part responded in a way that reduced their overall mortality. Indigenous knowledge of the Solomon Islands, where active volcanoes and earthquakes are more common, mitigated the effects of this tsunami.

In Indigenous villages on hard-hit Ghizo Island, the effects of the tsunami were mitigated by an Indigenous knowledge of what to do during a strong earthquake followed by an emptying lagoon. Immigrant Gilbertese villages with both the same physiography and who were hit by a tsunami of equal intensity, lacked Indigenous knowledge which led them to suffer more casualties (McAdoo, Dengerler, Prastya & Titov, 2006).

4.6. Simeulue, Indonesia – Oral History saved lives

Just before 1am GMT or 7.58am local time on 26 December 2004, an earthquake with the magnitude 9.1 struck 30km below the surface around 160km off the western coast of northern Sumatra. The Burma plate subducted below the Indian plate, with the latter being thrust upwards 20m. Rather than small sections of the plate shifting, a stretch of 1,200km

suddenly moved. The relatively shallow water where the earthquake struck meant the energy released was equivalent to 23,000 Hiroshima-type atomic bombs. The disaster was the world's deadliest tsunami, with over 230,000 people killed and half a million injured by the waves that battered the low-lying coast. However, on Simeulue Island in Indonesia's Aceh province only 40 km south of the December earthquake's epicenter, maximum wave heights exceeded 10m less than 10 minutes after the shaking ceased, killing only seven people. In the more populous south, wave heights averaged 3m and caused significant structural damage, destroying entire villages (McAdoo et al, 2006).

Oral histories recount a massive 1907 tsunami and advice running to the hills after "significant" shaking (1 minute). All the interviewed Simeulue survivors knew of this event and of the necessary action. However, Jantang, on the Aceh mainland, suffered far more casualties. Simeulue's oral history provided an extraordinarily powerful mitigation tool that saved countless lives where even a high-tech warning system with a 15-minute response time would have been of no help.

The leaders of the Simeulue community received a prestigious U.N. Award for saving tens of thousands of lives during the tsunami. Thanks to faith in their own knowledge of how the sea behaves and the reaction of buffalos ahead of the tsunami, this community of some 80,500 people fled the shore for nearby hills on that fateful Sunday morning. Consequently, only seven people died from the tsunami in this island community, while 163,795 died across the rest of Indonesia's northern Aceh province.

The community had been shaped by the destruction that shook this community of farmers, fishermen and traders when an earthquake followed by a tsunami hit the islanders in 1907, killing thousands. Since then they have learned how to escape, and last December it took about 30 minutes to get to higher ground (McAdoo et al, 2006).

4.7. Sri Lanka (Animals running to the hills)

K. David worked as a wildlife tracker for Sri Lanka's Department of Wildlife for 30 years. He was near Yala National Park when the tsunami hit. They set out at about 6am on the morning of December 26 at about 7:30am and noticed the elephants started to run. They had their tails raised up and some were running very close to their jeep and not a single animal would stop. All the elephants and wild boars and other animals were all running away from the sea

towards Galkanda. David thought that a large number of hunters had come forcing the animals to run away. Every day, David takes this same route and the animals are there and they do not pay any attention to the people. He lived in the area for more than 40 years and never witnessed anything like this before. All the animals escaped because they went up to higher ground and not a single deer, sambhur, wild boar, tiger, bear, or elephant died here in comparison to the 1000s of people that were killed (David, 2008).

4.8. Sri Lanka – Dogs Behaviour Saved Life

Ravi Corea, the founder and president of the Sri Lanka Preservation Society recalls his experience during 2004 Tsunami. Half an hour before the tsunami happened, there was an elephant right in front of the hotel, and that is exactly where the waters came. So by the time the waters came, the elephant had moved away — he was way up on the sand dunes, opposite the hotel. And there is another friend of mine who has a house right by the beach, and he has two dogs that go for a run every day. But on that particular day the dogs were not excited at all to go with him. They were very reluctant, and that probably saved his life. So they had the idea that something was not quite right with the sea that day (Mott, 2005, no page number).

Also in Sri Lanka, Gehan De Silva Wijeyeratne is the CEO of an adventure and ecotravel company. He is also a self-professed naturalist, geographer, writer, and tourism personality for Sri Lanka. After the tsunami, he spent four days working with search teams looking for survivors and bodies. What was astonishing was that he did not come across any dead bodies of animals, except one fish. He said,

It's remarkable that with so many human casualties, the wildlife could have escaped unscathed (Wijeyeratne, 2008, no page number).

4.9. Thailand (Elephant detects tsunami with infrasound hearing)

Wit Aniwat is a mahout (elephant driver) at his family's elephant-riding center near Phuket, Thailand. On December 26th, at about 5 or 6 o'clock in the morning, the elephant trainer brought two elephants back from the forest to the camp. Those two elephants cried, felt uneasy ... something was unusual. Eventually, the elephant pulled and broke the chains and ran to the mountaintop. The trainer ran after those two elephants and tried to call them to come back. The trainer did not know that the wave was coming and no matter what they did, the elephants would not return. Wit and many others believe it was because the

elephants knew the wave was coming. Scientists say there is a possibility that Wit is right because elephants are among a handful of animals known to be able to hear "infrasound," that is, the extremely low-frequency rumbles that are produced by natural phenomena from earthquakes and volcanoes to heavy winds and avalanches (Mohandas, 2015).

4.10. Sri Lanka – (Dolphins behaviour)

Chris Cruz, a scuba diving instructor and trip leader from Phuket in Thailand, says he was saved because he followed dolphins to safety. The earthquake [occurred] around 8:30am, and around 10:30am, most of the boats on the west side of one of the main islands, reported that the waters were all acting the same, "like whirlpools whirling, whirlpools all over the place. All of a sudden there were dolphins jumping right in front of our boats. They were just jumping, playing, jumping, jumping." So I told one of the dive masters, "We probably have to radio some of the diving instructors; some of the captains. Let's order the captain to follow the dolphins." The [captains] agreed, so we all followed the dolphins. They kept jumping and jumping and jumping and jumping. Once more we followed them. Maybe we were five, seven, 10 boats all together. ... Then we realised the dolphins at that point were trying to lead us westward, farther away from the island — not the mainland, but the islands. Basically it will be breaking 50 kilometers (31 miles) away, but there are the small islands that experienced some waves, around 5 meters (16 feet) high.

When we came back we realised some of the tents, some of the kitchen utensils, the restaurant tables and chairs, sleeping facilities, were all destroyed and taken out in the water. Which meant that if we [hadn't] followed the dolphins we would have smashed into the island (Mohandas, 2015).

4.11. Cook Islands (Fish behaviour)

The Porcupine fish is commonly known on the island of Mangaia in the Cook Islands as an indicator for cyclones or for very rough seas and strong winds. According to Island Council member, Ngametua Papatua, when you see an abundance of this fish in the lagoon, this is not a good sign (Carlson & Shedden, 2011a).

On another island in the Cook Islands called Mitiaro, the Convict Surgeon fish is also known as an indicator for a cyclone or very rough seas on that island. Local resident and spear

fisherman, Nooroa Pouao, recalls the time he has seen the behaviour of this fish moving in groups as though they can sense something is coming (Carlson & Shedden, 2011c)

4.12. Thailand (Birds)

Ravi Corea shares the experience of another good friend of his who saw nocturnal bats flying away, half an hour before the tsunami. These type of bats normally come out at night only and yet they were flying away during the day. Bats have incredible sensory perception communicating by using sonar and so they have very good sonar reception. So obviously they hear intensely and during the tsunami, for instance, they were hearing signals that we have no clue about (Mohandas, 2015).

Uditha Hedige, a tsunami survivor, was eating breakfast at his hotel near Yala National Park in Sri Lanka when he noticed unusual bird activity and water levels in the nearby lagoon rising. He escaped by heeding the natural warnings and running inland only seconds before the tidal wave broke on the shore.

I was in Yala the moment the tsunami hit and I saw some unusual behavior from the animals. First in the morning around 8 o'clock I saw a group of banded storks and black-headed ibis flying like they were confused. I didn't think at this point this can be a very dangerous thing, because I have seen them do this when they were frightened by another animal or something else. Also, in the morning I saw several, three or four frogs going away and leaving their roost. These particular frogs are nocturnal and to see them during the daylight was a bit unusual. It still didn't strike me that this could be a sign of danger. There are a lot of peacocks in the area and you can hear them call. It's a very loud call and you can hear it from a distance. And I didn't hear any peacocks call. I thought it was unusual, but I didn't put it all into one picture. My brain didn't get the whole picture and get the warning earlier (Hedige, 2008, no page number).

4.13. Samoa (Sea Residing Saved Lives)

During the Samoa Tsunami 2009, the Wutzler family from New Zealand were enjoying the day down the beach when one of the children who learnt about tsunami in schools noticed the sea recede shortly after the earthquake. She ran and told their parents about the signs of a tsunami which is about to hit the island and they need to evacuate the beach immediately. The parents ignored her warning and were reluctant to move but persistence from the daughter finally convinced them to move just in time before the first wave hit. They barely made it to the hill to see the whole village being demolished before their eyes. Another minute late, they would have been caught in the waves and possibly have drowned, but due to the quick thinking and persistence from the daughter, they lived to tell their story.

The tsunami killed more than 189 people along the coastline and most of them were children (NZMCDEM, 2009).

4.14. Japan (Ansei-Nankai Tsunami)

The well-known Japanese story of the Ansei-Nankai Tsunami which happened in 1854 gives an account of a village Chief who saved the lives of his villagers from a big tsunami disaster. The village Chief noticed during the earthquake that it was not that strong but it was different from other earthquakes. It was long, slow and the rumbling on the ground was like a roar. He also noticed that the wind was blowing from the sea to the coastline but the water was quickly drying out exposing areas of sand and rocks on the seabed. Realising that his people in great danger along the coastline, he rushed to his house, grabbed a large torch and ran to his rice field and set fire to his precious rice sheaves which he just harvested and dried. The people seeing the fire ran up the hill where the Chief was and tried to put the fire out. The Chief shouted to the men to leave the fire alone but to go and tell everyone to hurry up the hill. Everyone made it safely up the hill but shocked to learn about the Chief burning his whole year's precious harvest. Suddenly out of the horizon, a tsunami came and totally demolished the whole village and the people was spared because of the quick action by their Chief (Jinjo-ka, 2017).

4.15. Cook Islands (Pigs Behaviour)

A Cook Islands woman R. Pirangi (personal communication, March 21, 2017) shared her experience at a *Vainetini* (women's) workshop about a tsunami and her pig.

I heard about animals being very sensitive to earthquakes and Tsunami. We live near the beach and we had a pig. When the Tsunami warning was issued by the authorities, I went outside to look for my pig and found it lying under the tree having a nap. I thought to myself all these people are panicking but my pig is having a nap so it must be OK. I told the family don't worry we will be OK, my pig is still here. Sure enough nothing happened but if my pig did run away, I will also be running away following my pig.

4.16. SUMMARY

There is no doubt traditional knowledge that has been passed down for generations does save lives. The animal behaviour relating to disasters is now being widely discussed. While some argue for scientific proof to verify these animal behaviours before disasters strike, the fact remains over 300,000 people lost their lives and no animal was found dead. One would

therefore argue that traditional knowledge and animal behaviours are now being recognised locally and globally as a critical tool to enhance Disaster Risk Management as part of government planning and preparedness. It is important that this topic is being widely discussed in public fora and gaining more recognition from academics and scientists which increases the credibility of respecting Indigenous traditional knowledge and practices in Disaster Risk Management.

Chapter 5

TRADITIONAL KNOWLEDGE AND PLANNING/POLICIES

5.1 Introduction

This chapter will discuss global frameworks and how these have been influential in shifting the mind-set from a disaster management and a response only approach to a more holistic disaster risk management approach to disasters. This research will also explore how these frameworks are being implemented at national and community level particularly in relation to traditional knowledge and practices in the Cook Islands.

As a result of the five cyclones in 2005 that devastated the Cook Islands, the government took some bold steps in reviewing and updating its institutional arrangements for disaster management. One of the key outcomes of the review was a shift in policy from focusing only on Disaster Management to a holistic approach from Disaster Management to Disaster Risk Reduction. What's required was a drastic mind shift away from waiting until a disaster happens and acting retrospectively, to becoming proactive in doing what we can to prevent natural and man-made hazards from becoming disasters. If total prevention is not possible, our actions will at least serve to reduce the impact of a disaster if it does happen (EMCI, 2011).

The UNISDR describes disaster management (DM) as the organisation, planning and application of measures preparing for, responding to and recovering from disasters. Disaster Risk Management (DRM) is the application of Disaster Risk Reduction (DRR) policies and strategies to prevent new disaster risk, reduce existing disaster risk and manage residual risk, contributing to the strengthening of resilience and reduction of disaster losses. Until recently, Disaster Managers and practitioners have focused their efforts mainly on the response phase or immediately after the crisis and this practice is still dominant across the region and even internationally. Disaster risk management does not replace the more traditional disaster management which is more focused on emergency response, but adds to it the more proactive approach of disaster risk reduction (UNISDR, 2009).

The global frameworks have been influential in changing mind-sets from focusing on disaster management only to start strengthening the area of disaster risk management and risk

reduction across all sectors. Ban Ki Moon the eighth Secretary-General of the United Nations says,

we cannot eliminate disasters, but we can reduce the risk. We can lessen the damage. We can save more lives (UNISDR, 2012, no page number).

An independent study from organisations including the World Bank and the European Commission have indicated that for every \$1 invested in disaster prevention, \$4 to \$7 are saved in disaster response (DARMA, 2016).

Kelman (2014) highlights the main reasons why DRR savings are not always enacted is because political capital is rarely gained from cost-effective DRR measures. There are three principal dimensions to this challenge, firstly, those in power seek visible and tangible outcomes for expenditure. Secondly, they seek visibility for themselves and finally politicians gain more political capital with post-disaster aid than with less visible, longer-term DRR measures (Healy & Malhotra, 2009).

5.2 The Yokohama Strategy 1994

The '*Yokohama Strategy*' launched in Yokohama, Japan, May 1994 is the first document providing guidelines at the international level for preparation for and prevention and mitigation of disaster impacts. The adopted strategy provides landmark guidance on reducing disaster risk and the impacts of disasters. The *Yokohama Strategy 1994*, encourages active participation in order to gain greater insight into the individual and collective perception of development and risk, and to have a clear understanding of the cultural and organisational characteristics of each society as well as of its behaviour and interactions with the physical and natural environment (UNISDR, 1994). This knowledge is of the utmost importance to determine those things which favour and hinder prevention and mitigation or encourage or limit the preservation of the environment for the development of future generations, and in order to find effective and efficient means to reduce the impact of disasters.

The Yokohama Strategy's principles and the extent to which they relate to community participation therefore recommends a plan of action aiming at the application of traditional knowledge, practices and values of local communities for disaster reduction, thereby recognising these traditional coping mechanisms as a valuable contribution to the empowerment of local communities and the enabling of their spontaneous cooperation in all disaster reduction programmes (Shaw, Uy & Baumwoll, 1994, no page number).

5.3 The Hyogo Framework 2005-2015

The World Conference on Disaster Reduction held from 18 to 22 January 2005 in Kobe, Hyogo, Japan, adopted the Framework for Action (HFA) 2005-2015: *Building the Resilience of Nations and Communities to Disasters*. The Hyogo Framework is the first plan to explain, describe and detail the work that is required from all different sectors and actors to reduce disaster losses. The HFA outlines five Priorities for Action, and offers guiding principles and practical means for achieving disaster resilience. **Priority Action 3** is to use knowledge, innovation and education to build a culture of safety and resilience at all levels.

Under Priority 3 Action 3;

Encourages that information should incorporate relevant traditional and indigenous knowledge and culture heritage and be tailored to different target audiences, taking into account cultural and social factors (UNISDR, 2005, p.8).

Note that while the term “disaster reduction” is sometimes used, the term “disaster risk reduction” provides a better recognition of the ongoing nature of disaster risks and the ongoing potential to reduce these risks. Disaster Risk Reduction (DRR) is the concept and practice of reducing disaster risks through systematic efforts to analyse and manage the causal factors of disasters, including through reduced exposure to hazards, lessened vulnerability of people and property, wise management of land and the environment, and improved preparedness for adverse events.

5.4 Sendai Framework 2015 – 2030

The Sendai Framework for Disaster Risk Reduction (SFDRR) was launched in Sendai, Japan, March 2015 with a renewed commitment to disaster risk reduction. The new SFDRR is, in theory, built on the lessons learned from the implementation of HFA during the past decade. It comprises a voluntary set of targets and priorities to foster increased resilience to present and future hazards and to prevent setbacks to development as the result of small and large disasters. The Sendai has four priority areas **and the** Sendai Framework acknowledge the use of traditional, Indigenous and local knowledge and practices as one of its activities under Priority 1 (i);

...is to ensure the use of traditional, indigenous and local knowledge and practices, as appropriate, to complement scientific knowledge in disaster risk assessment and the development and implementation of policies, strategies, plans and programs of

specific sectors, with a cross-sectoral approach, which should be tailored to localities and to the context (UNISDR, 2015, p.15)

5.5 The Pacific Framework for Action 2005-2015

The Pacific Disaster Risk Reduction and Disaster Management Framework for Action 2005-2015 contributes to the implementation of the Hyogo Framework for Action 2005-2015, which underscore the extreme vulnerability of small island developing states to disasters. The vision is for a safer, more resilient Pacific island nations and communities to disasters, so that Pacific peoples may achieve sustainable livelihoods and lead free and worthwhile lives. The Pacific framework had six key themes and under Theme 2, Knowledge, Information, Public Awareness and Education, one of its guiding principles is to increase Public awareness and education, incorporating traditional coping mechanisms and local knowledge, will enhance individual and community resilience (UNISDR, 2005, p.9)

One of its key national activities is to integrate traditional knowledge into information management systems. The Pacific Framework for Action 2005-2015 acknowledges the importance of integrating traditional knowledge into information management systems and to be encouraged across all sectors. The successful implementation of this Pacific Framework for Action is dependent on the ownership and combined efforts of governments and all other stakeholders working in partnership to ensure a multi-disciplinary, multi-sectoral, integrated approach at regional, national and community levels.

5.6 Framework for Resilient Development in the Pacific 2017 – 2030

In 2012, at the Pacific Island Leaders Forum, it was decided to support the development of a single integrated regional framework on climate change and disaster risk management, to succeed the two separate regional frameworks on disaster risk management and climate change. The terms of the Pacific Disaster Risk Reduction and Disaster Management Framework for Action (commonly referred to as the Regional Framework for Action or RFA) and the Pacific Islands Framework for Action on Climate Change (PIFACC) ended in 2015.

The Framework for Resilient Development in the Pacific: An Integrated Approach to Address Climate Change and Disaster Risk Management (FRDP) provides high level strategic guidance to different stakeholder groups on how to enhance resilience to climate change and disasters, in ways that contribute to and are embedded in sustainable development. Many actions

contribute to eradicate poverty through building more resilient communities. These actions have been identified from relevant regional, national and subnational policies and plans, as well as from national and regional experiences and lessons learned.

Goal 1: Strengthened Integrated Adaption and Risk Reduction to Enhance Resilience to Climate Change and Disasters;

Goal 2: Low Carbon Development; and

Goal 3: Strengthened Disaster Preparedness, Response and Recovery.

One of its Priority Actions under Goal 1 (r) to be implemented by National and Sub-national Governments and Administrations:

To improve understanding and applications of successful strategies to increase resilience by documenting traditional, contemporary and scientific knowledge, and lessons learned, to develop and utilise appropriate awareness, communication, education and information materials for communities, media, schools, training providers and universities (SPC, 2017, p.22)

5.7 The National Frameworks

The challenge for these small island states is to integrate these global and regional frameworks into their national framework. Even more challenging is how these frameworks filters down to community planning and implementation.

5.7.1 Te Kaveinga Nui

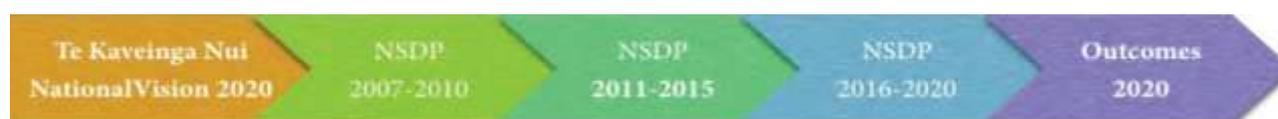
In 2007, the Cook Islands launched the country's 2020 visionary framework - Te Kaveinga Nui, articulating the National Vision and Development Outcomes desired by the Cook Islands which would be realised through a three phase medium-term planning approach. Te Kaveinga Nui was accompanied by the first National Sustainable Development Plan (NSDP) 2007-2010, a strategy on how to progress towards the 2020 outcomes during the first phase, then to be followed by NSDP 2011-2015 and finally 2015-2020. The purpose of the NSDP is to set national goals, the expected results and effective strategies to guide policy decisions over the medium-term in order to realise the 2020 Development Outcomes that aim to deliver on Te Kaveinga Nui National Vision. The National Vision is;

To enjoy the highest quality of life consistent with the aspirations of our people in harmony with our culture and environment.

Te oraanga tu rangatira kia tau ki te anoano o te iti tangata, e kia tau ki ta tatou peu Maori e te aotini taporoporoia o te basileia.

(Government of the Cook Islands, 2016, p.8)

FIGURE 15: Te Kaveinga Nui Pathway



(Source: Government of the Cook Islands, 2016)

5.7.2 NSDP 2007-2010

The Government of the Cook Islands National Sustainable Disaster Development Plan (NSDP) 2007-2010 was launched with the primary objective of ‘Building a sustainable future that meets our economic and social needs in partnership with government, the private sector and local, regional and international stakeholders, without compromising prudent economic management, environmental integrity, social stability and the needs of future generations’. The vision of the NSDP 2007-2010 is to ‘enjoy the highest quality of life consistent with the aspirations of our people, and in harmony with our culture and environment.’

One of its guiding principles, ‘Sustainable Development is a National Responsibility for all Cook Islanders’ means that **all** people of the Cook Islands have a responsibility to ensure that the three pillars of sustainable development – economic growth, social cohesion and environmental protection – are given balanced treatment to guide the future development of the Cook Islands.

The NSDP had 10 Goals to address all sectors and in particular Goal 9 referred to ‘a safe, secure and resilient Nation’. Its strategy is to establish a coordinated and effective national disaster risk reduction and disaster management system for all hazards. The expected outcome is to develop and enact a Disaster Risk Management legislation and develop a National Disaster Risk Management Plan highlighting the roles and responsibilities of response agencies.

Interesting to note that there is no mention of traditional knowledge and practices for DRM in the NSDP 2007-2010. This highlights the fact that those responsible for national emergency and national policies have no knowledge and understanding of traditional knowledge and practices related to disasters at the time of developing the NSDP (Government of the Cook Islands, 2007a).

5.7.3 The NSDP 2011 – 2015

The NSDP 2011-2015 continues with its National vision “To enjoy the highest quality of life consistent with the aspirations of our people in harmony with our culture and environment” (Government of the Cook Islands, 2011). It has eight priority areas. Priority Area 5 highlights the goal for ‘A resilient and sustainable Cook Islands, a Cook Islands where our people are resilient to disasters and climate change to achieve sustainable livelihoods’. Objective 2 under Priority Area 5 of the NSDP 2011-2015;

Encouraged learning from our communities through the documentation and use of traditional knowledge and through conducting participatory vulnerability assessments for all inhabited islands (Government of the Cook Islands, 2011, p.33).

This is certainly a milestone by the government to recognise the importance of learning from our communities through the documentation and use of traditional knowledge and practices to enhance DRM in the Cook Islands. It is also important to note that since the NSDP 2007-2010, there has been a wider discussion on the topic of traditional knowledge and practices in the community. Those in management of our National Emergency and National policies have a better understanding and knowledge of the topic. The production of 11 documentaries by EMCI on Traditional Knowledge and practices of all the *Pa Enua* in 2010-2011 certainly raised the awareness on the topic. These documentaries were used as part of their awareness programmes on the local television during the cyclone season from November to March every year since 2011.

5.7.4 The NSDP 2016-2020

The National Sustainable Development Plan (NSDP, 2016) also known as the Kaveinga Nui is an ambitious undertaking which looks to encapsulate the aspirations and ambitions of the entire country over a five year period into a single document. This document is the third iteration and builds upon the successes of the previous plans, but also marks an evolution in how the Cook Islands plans for its future. The NSDP had 16 National Development Goals.

Goal 13 is to strengthen resilience to combat the impacts of climate change and natural disasters. Goal 14 is to preserve our heritage and history, protect our traditional knowledge, and develop our language, creative and cultural endeavours (Government of the Cook Islands, 2016, p.44-46).

5.7.5 National Action Plan (NAP)

In 2009, the Cook Islands launched its National Action Plan (NAP) for Disaster Risk Management with the assistance of the Pacific Islands Applied Geoscience Commission (SOPAC). It has been interesting to see the development of disaster risk management over the past 10 years since the introduction of National Action plans in the Pacific region. Vanuatu was the first to launch their National Action Plan 2008 in the Pacific followed by the Cook Islands in 2009 (Emergency Management Cook Islands, 2009). The NAP 2009 had six Goals and Goal 2 focuses on a Strong Knowledge Base for more Effective Disaster Risk Management.

One of its strategy target is to incorporate traditional knowledge where appropriate in DRM programmes and is preserved and integrated into disaster risk management. The actions are to document traditional DRM knowledge and practices and to explore the use of traditional knowledge for application to current disaster risk reduction and disaster preparedness, response and recovery initiatives (Emergency Management Cook Islands, p.50)

5.7.6 Joint National Action Plan (JNAP)

In 2011, the Cook Islands launched their Joint National Action Plan (JNAP) for Disaster Risk Management and Climate Change 2011-2015 was launched. The Kingdom of Tonga was the first to launch their JNAP in the Pacific and again followed by the Cook Islands. EMCI and Climate Change divisions are under the auspices of the Office of the Prime Minister which certainly adds some political credibility to the two divisions. It also benefits the two divisions in sharing resources and avoids duplication of services. After all both parties are dealing with potential disastrous hazards except EMCI deals with the immediate disasters while climate change deals with the long and slow onslaught hazards. In Strategic Area 2 of the JNAP: one of its strategies was to document traditional knowledge and coping mechanisms.

The Actions required for this strategy is:

To use traditional knowledge and coping strategies to inform the design of disaster risk reduction and climate change adaptation activities (Emergency Management Cook Islands, 2011).

5.7.7 Joint National Action (JNAP 2)

In 2017, the Cook Islands was first to launch their Joint National Action Plan (JNAP2) for Disaster Risk Management and Climate Change 2016-2020. Vanuatu have continued with their NAP, Tonga with their JNAP and the rest of the Pacific are in the process of developing

their National Action Plans or Joint National Action Plans. The JNAP2 describes the Cook Islands response to the severe challenges presented by a range of hazards, most notable of which are cyclones, sea surges, flooding, droughts and climate change. It also brings Climate Change (CC) and Disaster Risk Management (DRM) to the forefront of national planning. According to Emergency Management Cook Islands (2016), there are three thematic areas and nine Strategic Areas in JNAP2 and under Thematic Area One, Strategy 2: Water and food security, *Action 7(d)*,

Document traditional knowledge on fishing, navigation and preservation techniques with the expected outputs of Traditional knowledge and preservation techniques published and awareness material distributed to communities (p.55).

Under Thematic Area One, Strategy 4: Research, monitoring and information management, *Action 16 (g)*,

Collect information, data and traditional knowledge, relevant to adaptive fishing and farming (p.59).

Under Thematic Area One, Strategy 5: Cook Islands culture and identity

Action 18 (b) under Strategy 5 is to record traditional knowledge on early warning signs and coping strategies paying attention to gender considerations. (c) Promote traditional knowledge in public awareness and within Climate Change Adaptation and DRM programmes where relevant. The expected outcome is that traditional knowledge is kept alive and used in the design of CC and DRM activities including early warnings (p.60).

Under Thematic Area Two, Strategy 8: Climate and disaster risk resilience

Action 25 (d) Incorporate traditional means of early warning signals at the island level. The expected outcome is traditional methods of early warning form part of official early warning systems (p.65).

5.7.8 The National Disaster Risk Management Plan 2017

The NDRM Plan describes the structure and processes for disaster risk reduction and disaster management decision-making for the Cook Islands. These in turn, guide the agencies who must prepare the plans, procedures and programmes that are necessary to strengthen the resilience of the nation and its communities.

Part 4 of the NDRM Plan Sec 4.1 gives special consideration to traditional knowledge, especially as it relates to tropical cyclones - a high threat hazard in the Cook Islands and one that has occurred regularly over generations. Section 4.3 noted that all disaster risk reduction plans must take into account all available facts and knowledge. As noted above, traditional knowledge may have a role to play, in particular in the event of tropical cyclone (Emergency Management Cook Islands, 2017, p.28)

The ultimate purpose of this Plan is “to ensure it properly protects life, property and essential infrastructure from the potential or actual impact of an Emergency or Disaster”.

5.7.9 Disaster Risk Management Act, 2007

All government ministries are required to develop their own DRM plans for their internal responsibilities to their staffing, properties, equipment as required during an emergency or a disaster. Secondly, they also need to come up with a plan of their national responsibilities as a responding agency to any emergency and a disaster. All of the *Pa Enua* Island Council are required to develop their own DRM Plans including the 10 *Puna* (villages) on Rarotonga as required by the DRM Act 2007 (Government of the Cook Islands, 2007b). Unfortunately, the DRM Act 2007 does not mention anything about traditional knowledge. It is important to note that this was also developed during the same time as the NSDP 2007-2010 which did not mention anything about traditional knowledge as previously discussed. However, it is possible that traditional knowledge will be included during the DRM Act 2007 review.

5.8 Summary

Importantly, traditional knowledge and practices have already been introduced and discussed at the international level since the launch of the *Yokohama Strategy 1994*. This has influenced the Government of the Cook Islands policy makers who now recognise the importance of traditional knowledge in planning and government policies. Nearly all Cook Island national frameworks mention the importance of including traditional knowledge and practices inside national planning and policies. The full richness of tradition is diminished because some of it has not been passed on. It is important therefore to find ways of preserving this knowledge. One of the most effective ways to embody it in the decisions about projects that affect the communities (Cochrane, 1994). Therefore Traditional knowledge must be at the forefront of our implementation strategies to strengthen resilience in the Cook Islands. Planning and polices must be followed by action plans that can actually be implemented across all sectors and the wider community.

CHAPTER 6

TRADITIONAL KNOWLEDGE AND SCIENCE

6.1 Introduction

Science is critical to establishing the credibility of integrating and mainstreaming traditional knowledge into government policies and across all sector plans. This chapter will discuss how traditional knowledge and science can work and complement each other to strengthen our resilience toward a safe, secure and sustainable future. Some may argue whether we really need science to confirm traditional knowledge is credible or not after all traditional knowledge and proven practices has been passed down for many generations (Carlson & Shedden, 2010b). Traditional knowledge and indigenous knowledge is used interchangeably within the context of this chapter. Ryser (2011) argues that the expressions 'indigenous knowledge', and local knowledge are often equated with the expression 'traditional knowledge', and indeed they are regularly used interchangeably.

Some practitioners believe that local and Indigenous knowledge need to be integrated with science before it can be used in policies, education, and actions related to disaster risk reduction and climate change (Hiwasaki, Luna, Syamsidik & Shaw, 2014). However, one can argue that these are proven knowledge and practices passed down for many generations. Local and Indigenous knowledge that help communities build their resilience but cannot be explained or integrated with science are categorised separately. Such knowledge would continue to be practised by communities, away from scrutiny of scientists, policy-makers and practitioner's. Cook Islands local scientist Dr. Teina Rongo (2014) argues that today, local knowledge offers valuable insight that complements scientific data essential for verifying climate models. This can assist in evaluating climate change scenarios developed by scientists at much broader spatial and temporal scales, and can assist in the design of mitigation and adaptation measures to address climate change.

A scientist considers their laboratory a place equipped for experimental study in science or for testing and analysis or a place providing opportunity for experimentation, observation, or practice in a field of study (Merriam-Webster, 1982). A *ta'unga* will consider the land, the forest, the sea, the sky and the surrounding environment as their laboratory where they observe, experiment and practice new or improved knowledge, generally for subsistence purposes (e.g., fishing and agriculture).

Stephen Brush defined Indigenous knowledge as, “the systematic information that remains in the informal sector, usually unwritten and preserved in oral tradition rather than texts” (Brush & Stabinsky, 1996, no page numbers).

Traditional knowledge, as a way of knowing, is similar to Western science in that it is based on an accumulation of observations, but it is different from science in some fundamental ways. According to Berkes, Colding & Folke (2000) the anthropologist, Claude Levi-Strauss claimed that these two ways of knowing are two parallel modes of acquiring knowledge about the universe; the two sciences were fundamentally distinct in that “the physical world is approached from opposite ends in the two cases: one is supremely concrete, the other supremely abstract” (p.1251).

Similarly, the philosopher Paul Feyerabend (1987) distinguished between two different traditions of thought: abstract traditions (to which scientific ecology belongs) and historical traditions, which include systems of knowledge possessed by people outside Western science; knowledge that often becomes encoded in rituals and in the cultural practices of everyday life. Other scholars have cautioned against overemphasising the differences between Western science and traditional knowledge and question if the dichotomy is real (Agrawal, 1995).

The integration of local and Indigenous knowledge with science is an important process which enables practitioners and scientists to implement activities and research to increase resilience in coastal and small island communities. This integration makes it possible for decision makers to put into practice policies that support such activities. Science is but a small part of non-indigenous knowledge. Similarly, to suggest that traditional knowledge is only the equivalent of science is to diminish incorrectly the strength and breadth of traditional knowledge. Thus, the suggestion that traditional knowledge should be characterized as traditional science diminishes its breadth and value (Cochrane, 1994).

In the Cook Islands, elders in the community are primarily the keepers of local knowledge. However, the shift towards a more Westernised lifestyle is far more desirable today and has resulted in Cook Islanders relying less on their environment, thus the transfer of this knowledge to younger generations has been compromised (Rongo & Dyer, 2014).

6.2 Traditional Knowledge

"Traditional knowledge is a cumulative body of knowledge, know-how, practices and representations maintained and developed by peoples with extended histories of interaction with the natural environment" (UNESCO, 2005). These sophisticated sets of understandings, interpretations and meanings are part and parcel of a cultural complex that encompasses language, naming and classification systems, resource use practices, ritual, spirituality and worldview. The the former Director General of UNESCO, Frederico Mayor defines traditional knowledge as:

The indigenous people of the world possess an immense knowledge of their environments, based on centuries of living close to nature. Living in and from the richness and variety of complex ecosystems, they have an understanding of the properties of plants and animals, the functioning of ecosystems and the techniques for using and managing them that is particular and often detailed. In rural communities in developing countries, locally occurring species are relied on for many - sometimes all - foods, medicines, fuel, building materials and other products. Equally, people's knowledge and perceptions of the environment, and their relationships with it, are often important elements of cultural identity (Alaska Native Science , 1994, no page number)

Most Indigenous people have traditional songs, stories, legends, dreams, methods and practices as means of transmitting specific human elements of traditional knowledge. Sometimes it is preserved in artifacts, weaving or carvings handed from father to son or mother to daughter. In Indigenous knowledge systems, there is usually no real separation between secular and sacred knowledge and practice - they are one and the same. In virtually all of these systems, knowledge is transmitted directly from individual to individual (Cochrane, 1994).

6.3 Scientific knowledge

The Merriam-Webster (1982) dictionary defines a scientist's laboratory as a confined space equipped for experimental study in a science or for testing and analysis. A research laboratory broadly, is a place providing opportunity for experimentation, observation, or practice in a field of study. This includes Medical laboratory, clinical laboratories at hospitals, reference labs, biotechnology labs and non-clinical industrial labs.

A local ta'unga will describe their laboratory as the natural environment they live in and accumulate this wealth of local knowledge of the sky, land, sea, trees, animals and the surrounding environment. In general, traditional knowledge systems adopt a more holistic

approach, and do not separate observations into different disciplines as do Western science (Iaccarino, 2003). Moreover, many traditional knowledge systems do not interpret reality on the basis of a linear conception of cause and effect, but rather as a world made up of constantly forming multi-dimensional cycles in which all elements are part of an entangled and complex web of interactions (Freeman, 1992).

Of course, there is always the risk of oversimplifying by reducing the things of interest to essentials and/or dichotomies. However, from this brief overview of the dissimilarities, we can gain an understanding of how hard it is to compare two systems of knowledge that are so profoundly different. Trying to analyse and validate traditional knowledge systems by using external (scientific) criteria carries the risk of distorting such systems in the process. At the same time, we cannot extract just those parts of traditional knowledge that seem to measure up to scientific criteria and ignore the rest. This process of cognitive mining would atomise the overall system and threaten traditional knowledge with dispossession (Nakashima & Roué, 2002). It is therefore critical to take a holistic approach to analyse and validate traditional knowledge systems instead of using selective scientific criteria and ignore the rest.

Recently, however, there has emerged a movement to recover the Indigenous, or "traditional", knowledge systems pushed aside by Western science. The empowerment of aboriginal or native peoples through land claims and self-government initiatives has made possible the re-emergence of ancient ideas and beliefs capable of enriching the body of human knowledge. George Hobson (1991) argues that traditional knowledge is science, and the sooner southern scientists make use of that traditional knowledge, the better it will be for their research. Aboriginal or native people wish to be involved in science and they will be involved in research whether through legislation, the permit process, or voluntary action. Partnerships are a vital part of the strategy we must adopt in together seeking imaginative, innovative, and perhaps unexpected, solutions.

Table 1 & 2 below developed by the Alaska Native Science Commission (ANSC) group based in Alaska describes Indigenous knowledge to scientific knowledge which really challenges the claim by the scientific academics that traditional knowledge must be proven by science to be accepted as a true source of information (Alaska Native Science, 1994).

TABLE 1: COMPARISONS BETWEEN TRADITIONAL AND SCIENTIFIC KNOWLEDGE STYLES

Indigenous Knowledge	Scientific Knowledge
assumed to be the truth	assumed to be a best approximation
sacred and secular together	secular only
teaching through storytelling	Didactic (instruct)
learning by doing and experiencing	learning by formal education
oral or visual	written
integrated, based on a whole system	analytical, based on subsets of the whole
Intuitive (feelings-instinct)	model- or hypothesis-based
holistic	reductionist
subjective	objective
experiential	positivist

(Adapted from Alaska Native Science, 1994)

TABLE 2: COMPARISONS BETWEEN TRADITIONAL AND SCIENTIFIC KNOWLEDGE IN USE

Indigenous Knowledge	Scientific Knowledge
lengthy acquisition	rapid acquisition
long-term wisdom	short-term prediction
powerful prediction in local areas	powerful predictability in natural principles
weak in predictive principles in distant areas	weak in local areas of knowledge
models based on cycles	linear modeling as first approximation
explanations based on examples, anecdotes, parables	explanations bases on hypothesis, theories, laws
Classification: <ul style="list-style-type: none"> • a mix of ecological and use • non-hierachical differentiation • includes everything natural and supernatural 	Classification: <ul style="list-style-type: none"> • based on phylogenic relationships • hierarchical differentiation • excludes the supernatural

(Adapted from Alaska Native Science, 1994)

6.4 Integration

A study for integrating local and Indigenous knowledge related to hydro-meteorological hazards with science and technology was developed through a project led by the United Nations Educational, Scientific and Cultural Organization (UNESCO) Jakarta Office and was implemented in Indonesia, the Philippines and Timor-Leste. In this project, local and Indigenous knowledge related to hydro-meteorological hazards was observed, documented

and validated, and then integrated with science, through action research. The aim was to promote the use of local and Indigenous knowledge to enable communities in other areas and countries to increase their resilience against the impacts of climate change and disasters.

Researchers involved with the project agreed that the term local and Indigenous knowledge is analogous to local knowledge, Indigenous knowledge, traditional ecological knowledge, traditional knowledge, Indigenous technical knowledge, and endogenous knowledge. Indonesia, the Philippines and Timor-Leste were chosen for their particular vulnerability to the impacts of hydro-meteorological hazards and climate change, as well as their rich cultural and biological diversity. Focus group discussions and workshops were organised for community validation and to establish scientific bases for the local and Indigenous knowledge. Action research in the Filipino sites found that the primary hydro-meteorological hazards facing the communities are typhoons, storms and heavy rainfall, and the resulting floods and landslides.

In the Indonesian sites, monsoons, tropical cyclones, coastal erosion, and land subsistence were particularly noticed, with climate change impacts such as sea level rise also being observed, resulting in saltwater intrusion. The primary problems in Timorese sites were tropical cyclones with heavy rainfall, and prolonged dry and extended rainy seasons resulting in floods, landslides and droughts.

The country is also affected by El Niño Southern Oscillation (ENSO) climate variability, which changes the timing and volume of rain- fall. Hydro-meteorological hazards often lead to food shortages in all sites, which are particularly serious for small island communities that become isolated when communication and transportation with the mainland is disrupted.

This is a scientific explanation of selected local and Indigenous knowledge documented in Indonesia, Philippines and Timor-Leste (Hiwasaki, Luna, Syamsidik & Shaw, 2014). Some of these explanations can be related to Cook Islands experiences.

TABLE 3: LOCAL AND INDIGENOUS KNOWLEDGE VS. SCIENTIFIC EXPLANATION

Local and Indigenous Knowledge	Description	Scientific Explanation
Observation of the sky and the environment to predict <i>Angeen Badee</i> (strong winds and high waves)	Observing of the dark towering clouds at the horizon and the upward movement from winds in combination with position of beehive in a tree, calm sea	The cloud formation and movement is <i>Cumulus nimbus (Cb)</i> cloud type. This cloud is also part of indication of cyclone effects

Documented in Ache, Indonesia	weather during transition period (according to the traditional calendar) and rancid smell from the sea	generated around the Indian Ocean and the Adaman Sea.
<i>These observations are also experienced by fishermen in the Cook Islands</i>		
Observation of the environment to predict landslides (Documented in Covalina, Liquica and Viqueque, Timor-Leste)	When sacred trees such as teak, bamboo, beachwood and sacred stones are destroyed and removed there will be landslides	When forest are destroyed or stones removed springs will dry up from evaporation because there are no leaves (canopy strata) to cover the spring. When in rainy season there is no infiltration of water into the land, the physical structure of the soil is fragile when there is no stones and tree roots to secure ground thus landslides will occur
Observation of the environment to predict typhoons (cyclones) Documented in Rapu-rapu Island, Phillipines	Branches of trees (such as tamarind and banana leaves fall to the ground even when there is no strong wind. Two days after such observation is made, heavy rains, storm surges or strong winds will hit the community.	The banana is characterised as having the weakest structure. As the temperature decreases, the plants ability to make <u>chlorophyll</u> stops. Further the synthesis of a plant hormone called <u>auxin</u> also stops. This causes the cells at the junction of the petiole and the twig to weaken and sooner or later the joints break and leaves fall to the ground. Cold, salt, biotic stresses and osmotic stresses on banana trees
<i>These observations were also described in Chapter 3 by Marurai from the island of Mangaia observed bunches of bananas fallen to the ground before it is due to harvest.</i>		
Food preservation mechanism to prepare for long periods of storms (Documented in Rapu-rapu, Islands Phillipines)	Dig a hole in the ground and place root crops such as cassava inside the whole and fill it with soil. The stored root crop is prevented from rotting and can last up to a month thus providing food security during long periods of storm.	Root crops grow underground and this practice is a natural way of preservation.
<i>On the Islands of Mitiaro, they bury breadfruit during the cyclone season as part of their food security and these breadfruit can last for many months underground (Carlson & Shedden, 2010b).</i>		

(Adapted from Hiwasaki, Luna, Syamsidik & Shaw, 2014)

In Tripura, India, (Acharya, 2011) describes the movement of dragonflies moving in swarms and normally low to the ground. This behaviour is attributed to when humidity reaches saturation, a couple of hours before dragonflies move in swarms indicating rain is coming. Dr K Ravi Shankar, senior scientist, Agriculture Extension and Transfer of Technology section at

the Central Institute for Dryland Research in Agriculture, Hyderabad, India has spent three years in the villages of Anantapur, Vishakapatnam and Ranga Reddy districts of Andhra Pradesh to gather information on folk wisdom. He confirms that dragon flies swarming couple of hours before rainfall, are commonly known factors for rain prediction across the country (Shankar, 2013).

The behaviour of the dragonfly is common knowledge in the Cook Islands. In the island of Mangaia, the behaviour of the dragonfly is described by their Kavana (Governor) Tuaiva Mautairi as also a sign for strong wind and rain (Carlson & Shedden, 2011a). The Researcher recalls growing up in the 60s and the early 70s where dragonflies were abundant. Today, their numbers have declined which according to Rongo (2014), is likely attributed to the predominant drought conditions over the last 30 years in the southern group.

6.5 Drought and Science

The years of 1982-1983 was considered to be one of the worse drought to ever affect the Cook Islands. It was reported that pigs on the island of Atiu died not from the drought but such was the outbreak in mosquitos that pigs could not breathe because their snout was blocked by mosquitos (Carlson & Shedden, 2010b).

On the island of Mangaia, the introduced pine forest to stop erosion on the hills was blamed for the drought on the island. Much of the island's pine forests came about when significant portions of land were abandoned after the collapse of a once-thriving pineapple growing industry. As a result, soil was exposed to the elements, making the land susceptible to erosion. Although this pine forest can provide many benefits to the island such as minimising soil erosion, maintain soil moisture, provide habitat for various fauna and economic opportunities through timber production (Jahn, 2001). it is likely that this dense pine forest is drawing a considerate amount of water through evapotranspiration from the ground. Tree canopies reduce groundwater and As both natural and human-established forests use more water than most replacement land cover (i.e., agriculture and forage), there is no question that forest removal (even partial) increases downstream water yields (Calder, 2007). Government Officials and farmers on Mangaia have claimed that the pine forest has contributed to some of the islands past water shortages and bush fires. While this may be the case, to what extent is a question that needs to be addressed through research. Nevertheless, the contribution of

natural phenomena such as the El Niño Southern Oscillation that can influence the distribution of rainfall in the region also needs to be considered.

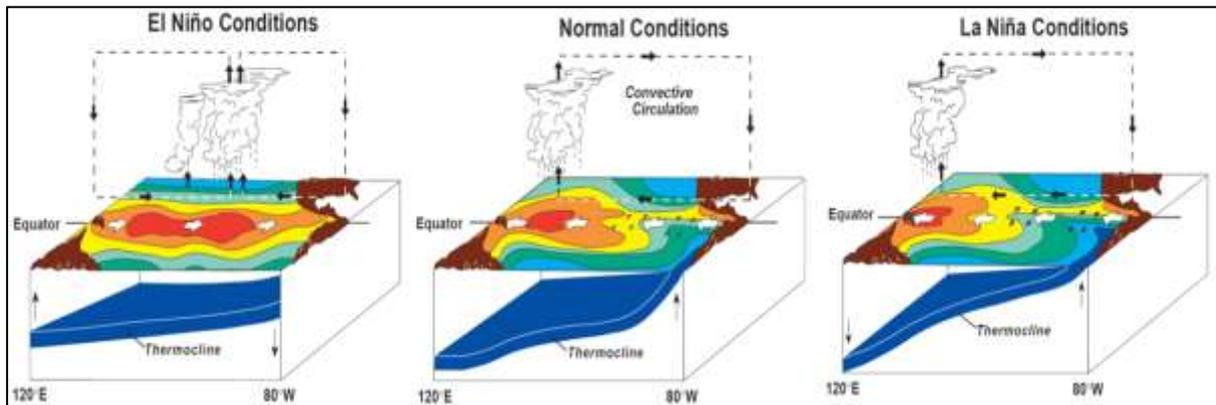
6.6 El Niño Southern Oscillation

It has become clear that drought conditions experienced throughout the southern Cook Islands in the last 30 years are the result of the phenomena identified as the El Niño Southern Oscillation (ENSO). ENSO fluctuates between an unusually warm (El Niño) and cold (La Niña) conditions in the tropical Pacific, and is the most prominent year-to-year climate variation on Earth. El Niño and La Niña typically recur every 2 to 7 years and develop in association with swings in the Southern Oscillation, an atmospheric pressure pattern spanning the tropical Indian and Pacific Oceans that is intimately related to the strength of the Pacific trade winds. Both can influence rainfall patterns, ocean temperatures, ocean currents, and cyclone frequency in the region (Rongo & Dyer, 2014).

El Niño events were first recognised by Peruvian fisherman in the 19th century who noticed that warm water would sometimes arrive off the coast of South America around Christmas time. Because of the timing they called this phenomenon El Niño, meaning “boy child”, after Jesus. La Niña, being the opposite, is the “girl child” (Brown, 2014).

The El Niño Southern Oscillation (ENSO) climate variability certainly had an impact in the Cook Islands during that period of 1982-1983. El Niño/La Niña is a major source of climate variability in the Pacific influences rainfall patterns, sea surface temperatures, tropical cyclones. It happens every two to seven years on average and tends to develop during April to June and reach their maximum strength during October – February. N. Fedaeff (personal communication, June 22, 2017) suggested that it typically persists for nine to 12 months, though occasionally persisting for up to two years.

FIGURE 17: EL NIÑO-SOUTHERN OSCILLATION (ENSO)

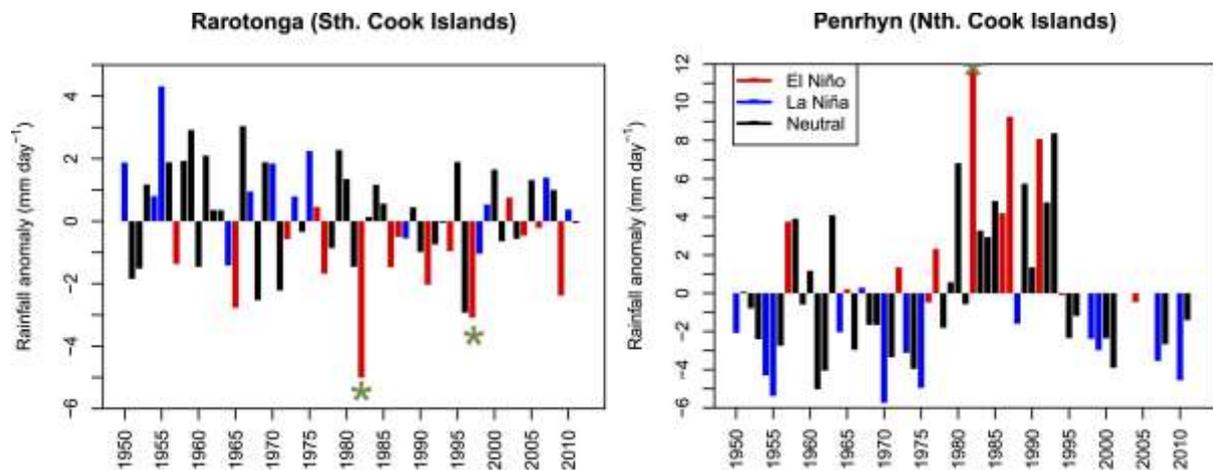


(Source: Fedaeff, 2017)

6.7 ENSO and Rainfall

Graphs show rainfall anomalies from November- April, El Nino (red), La Nina (blue), Normal conditions (black). The Asterisk shows years when previous cold tongue El Nino’s occurred. In Rarotonga, the driest November-April periods were recorded during these events (since 1950). The 1982/83 El Nino brought the wettest conditions to Penrhyn since 1950. Lack of data during the 1997/98 El Nino prevents it from being analysed.

FIGURE 18: ENSO AND RAINFALL – COOK ISLANDS



(Source: Murphy & Power, 2014)

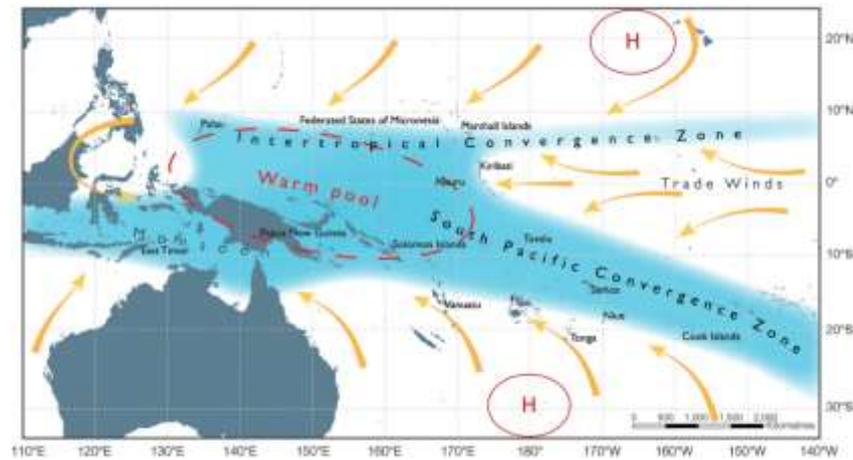
This El Niño event was among the four strongest events since 1950 (1972-73, 1982-83, 1997-98).

6.8 South Pacific Convergence Zone

The South Pacific Convergence Zone (SPCZ) is an important climatic feature not only in the Cook Islands, but also for the tropical southwest Pacific because it determines the long-term distribution of rainfall in this region. On average, for the Cook Islands, the SPCZ lies to the west and south of the northern islands group, but north of the southern group stretching in a northwest to southeast orientation as shown in Figure 19. During the wet season (November to April), the SPCZ is active, bringing unsettled weather and rain over the Cook Islands. However, during the dry season (May to October), the SPCZ is weak and roughly lies to the north of the southern group bringing dry southeast trades winds over the group (Rongo & Dyer, 2014).

Winds over the tropical Pacific, known as the trade winds, blow from east to west piling the warm top layer water against the east coast of Australia and Indonesia. Indeed, the sea level near Australia can be one metre higher than at South America. In a La Niña event, the trade winds strengthen bringing more warm water to Australia and increasing our rainfall totals. In an El Niño the trade winds weaken, so some of the warm water flows back toward the east towards the Americas. The relocating warm water takes some of the rainfall with it which is why on average Australia will have a dry year. Figure 19 below shows typical low-level wind flows over the southwest Pacific during summer. Where the trade winds come together there is a zone of convergence called the Inter Tropical Convergence Zone (ITCZ). A secondary zone of convergence runs from near Vanuatu east-south eastwards through the Cook Islands, and is called the South Pacific Convergence Zone (SPCZ).

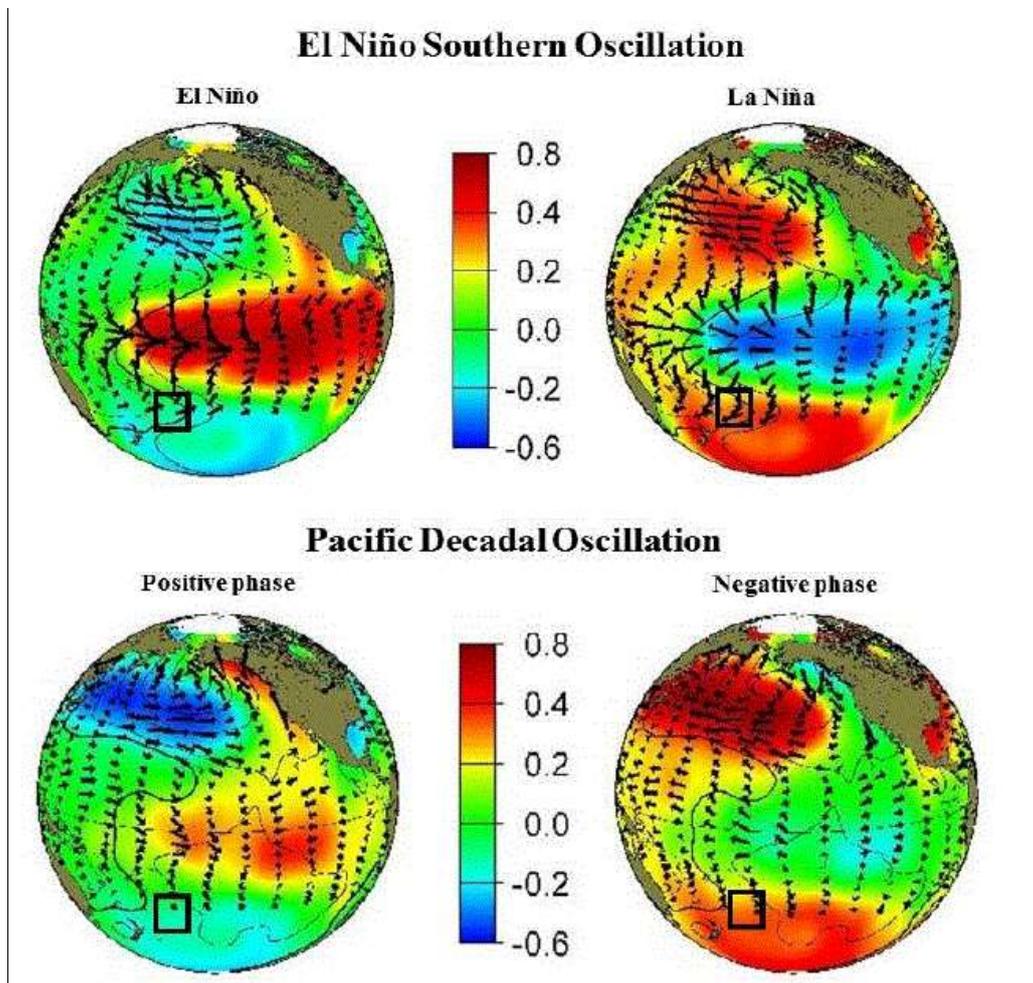
FIGURE 19: THE SOUTH PACIFIC CONVERGENCE ZONE



(Source: Pacific Climate Change Science Programme, 2011)

The LaNina phase brings a lot of rain to the Southern islands group while the Northern islands group have the negative effect of less rainfall. During the negative Interdecadal Pacific Oscillation (IPO) and the Pacific Decadal Oscillation (PDO) phase and La Niña years, the southern Cook Islands experience warm and wet conditions, while the northern Cook Islands experience the opposite. On the contrary, the positive IPO/PDO phase and El Niño years tend to bring cool and dry conditions to the southern group, and warm and wet conditions to the northern group shown in Figure 20. The black box indicates the southern Cook Islands region (Rongo & Dyer, 2014).

FIGURE 20: SEA SURFACE TEMPERATURE ANOMALIES IN THE PACIFIC WITH REGARDS TO THE EL NIÑO SOUTHERN OSCILLATION AND THE PACIFIC DECADAL OSCILLATION.



(Adapted from Rongo & Dyer, 2014)

6.9 Summary

It is critical that both traditional knowledge and science work together and complement each other to strengthen our resilience toward a safe, secure and sustainable future. Through this research it is maintained that we do not need science to confirm traditional knowledge is credible or not. The Native Science Group based in Alaska describes Indigenous knowledge to scientific knowledge which really challenges the claim by the scientific academics that traditional knowledge must be proven by science to be accepted as a true source of information. Traditional knowledge and science should not be separated as scientific explanation of selected local and Indigenous knowledge can only be beneficial to both parties.

The naturally occurring phenomena of the El Nino and La Nina conditions resulting from the interactions between the ocean surface and the atmosphere over the tropical Pacific provides a better understanding of this phenomena, and its impact in the Cook Islands and the Pacific region. Both these changes can influence rainfall patterns, ocean temperatures, ocean currents, and cyclone frequency in the region. It is therefore critical for a holistic approach to be implemented to determine strategies as this is the way to building resilience in the communities as opposed to claiming one is better over the other.

CHAPTER 7

TRADITIONAL KNOWLEDGE AND MODERN TECHNOLOGY

7.1. Introduction

This chapter will look at how technologies have evolved over the centuries and how modern technologies are now the driving force in our early warning systems and development across all sectors in the Cook Islands. It therefore questions or threatens the relevance of traditional knowledge and practices in this technological age. Most of us watch or listen to the daily weather forecasts provided by the media to see what the weather is going to be like for our particular area.

The technology used to collect the data that the forecast is based upon has become very sophisticated, with new technologies frequently applied by our meteorological scientists to enable a reliable weather forecast. Modern technology is based on early instruments such as basic temperature gauges and barometers that were used to collect the data. Here we examine some of those early instruments as well as new technology in collecting the weather data that our forecasters rely on. The equipment ranges from weather balloons, the oldest type, to modern equipment such as satellite images (Scott, 2011).

Effective response to a disaster includes timely information and early warnings of potential hazards. Therefore countries are continually improving their national emergency and early warning capabilities using modern technology. There is no doubt harnessing modern technology and increasing regional cooperation in disaster preparedness will save lives and help prevent some of the billions of dollars in property damage each year across Asian and the Pacific (WMO, 2011). Emergency Management organisations are now taking advantage of technology to communicate with citizens, using social media such as Facebook, Twitter, emails, voice, and text messages and other forms of communications. Other high-tech services such as GIS services, Google Maps services, space and satellite technology and GPS are being utilised to coordinate teams throughout response operations.

Kim Hak-Su, Executive Secretary of the UN Economic and Social Commission for Asia and the Pacific (UNESCAP), said in an opening address to the UN Regional Workshop on the Use of Space Technology for Disaster Management, “many lives could be saved and tragedy

mitigated, if effective disaster management measures are undertaken” (UNESCAP, 2002, no page numbers).

7.2. History

Weather observing started with simply stepping outside and noting what was seen, heard, touch and felt. In the Cook Islands, their forebearers were in tune with nature and were able to forecast future events by observing the behavior of birds, animals, plants, trees or by reading the signs of the stars, the movement of clouds, the moon and the sun.

Rainfall measurements were recorded as early as 3,000 years ago by the Chinese government during the Chou dynasty. The first instrument designed specifically to collect and measure rainfall was invented by King Sejong's son, King Munjong in Korea during the 1400s. King Sejong wished to improve the technology used in Korean agriculture, and some of the most accurately maintained rainfall records were recorded during this time (Bellis, 2018).

Interesting to note that the role of the Meteorological Services actually provides more than just weather forecasting. They play a critical role across all sectors in predicting long term forecasting and the impact the weather will have on agriculture, water supply, marine, health and other sectors. This allows decision makers to plan ahead and implement preventative and mitigation measures for any potential disaster.

There is no doubt technology has improved and can predict tropical storms and hurricanes and give people time to prepare. However, the Metrological services have come under fire quite often for getting the weather wrong. Some will argue that we are still in a better position than we used to be even just a few years ago. It is not that the weather forecast was wrong, it is just that it was a few miles out (Adam, 2017). This is often experienced as observed in the Cook Islands. For example, when rain was forecasted, no rain fell on the island. However, a kilometer out to sea, you could see black clouds and heavy rain that never reached land. This is understandable because the island is so small and quite often the rain misses the island.

1n 2011, the Cook Islands Meteorological Services (CIMS) was part of an awareness exhibition by Government Ministries of their roles and responsibilities in the wider community. One particular setting that attracted the attention of many participants was this piece of rock tied to a tree hanging like a pendulum. This is one of the weather forecasting apparatus on display and everyone was very curious how a rock pendulum can predict the weather.

The CIMS Director A. Ngari (personal communication, October 13, 2011) provided a simple explanation to the apparatus;

If the rock is wet - it means it's raining

If the rock is warm - it means its sunny

If the rock is cool - it means its cold

If the rock is swinging side to side - it means it's windy

If the rock is still - it means there is no wind

If the rock is on the ground – it means there's a cyclone

Perhaps we have simply ignored these simple observation practices over time and rely heavily on technology for weather information which can be proven wrong at times.

7.3. Technology Evolution

Today, weather forecasts are becoming more detailed, more accurate and are extending further out in time providing the information needed to make sound decisions to protect life and property. Technological advances, such as apps, are making weather information more accessible and immediately alerting those in harm's way. Before a sun, cloud or rain icon is posted on a website or a text is sent to a mobile phone ahead of dangerous weather, a complex process takes place. It involves the collection and processing of data that yields an understandable and actionable forecast. Quantity and quality of observations have improved and computer modelling has become more detailed.

Supercomputing has become more powerful, and as researchers study the mysteries of our weather and climate, so too, have forecasts improved and will continue to improve with better observations, atmospheric computer modelling and the use of satellites that are a forecaster's "eye in the sky." The accuracy of the official National Hurricane Center tropical cyclone (TC) to track forecasts has improved over the past several decades. In part, this can be attributed to the general improvements in numerical weather prediction (NWP) models, such as increased resolution, improved methods of initialisation, more realistic physical parameterisations, and the availability of a greater number of skilful models for generating consensus forecasts.

Today's television weather systems are not only used to make and display weather graphics, but also to forecast weather by meteorologists. These advanced weather systems allow satellite, radar, and even forecast model information to be broadcast over the airwaves. The timing of these technologically advanced systems corresponded perfectly with the

development and use of the internet. Now a greater audience than ever before has access to weather information and forecasts. The weather news network WMTW even has a dedicated “weather app” for up to the minute information, conditions and forecasts (NOAA, 2016).

Scientists say weather systems are notoriously hard to predict because so many variables have to be taken into account. But increasingly sophisticated algorithms and accessibility to supercomputers are making weather prediction much easier. The U.S. National Oceanic and Atmospheric Administration (NOAA) says its new storm prediction system, called NEIS, collects millions of data points from all over the world to create a four-dimensional model of the world’s weather. Agency director Alexander MacDonald said the storms created by the computer model are very similar to real ones that have been observed in recent years. It shows the skill that are being developed, when we run a computer model and Mother Nature does the same thing with the real world and they are pretty alike (Putic, 2014).

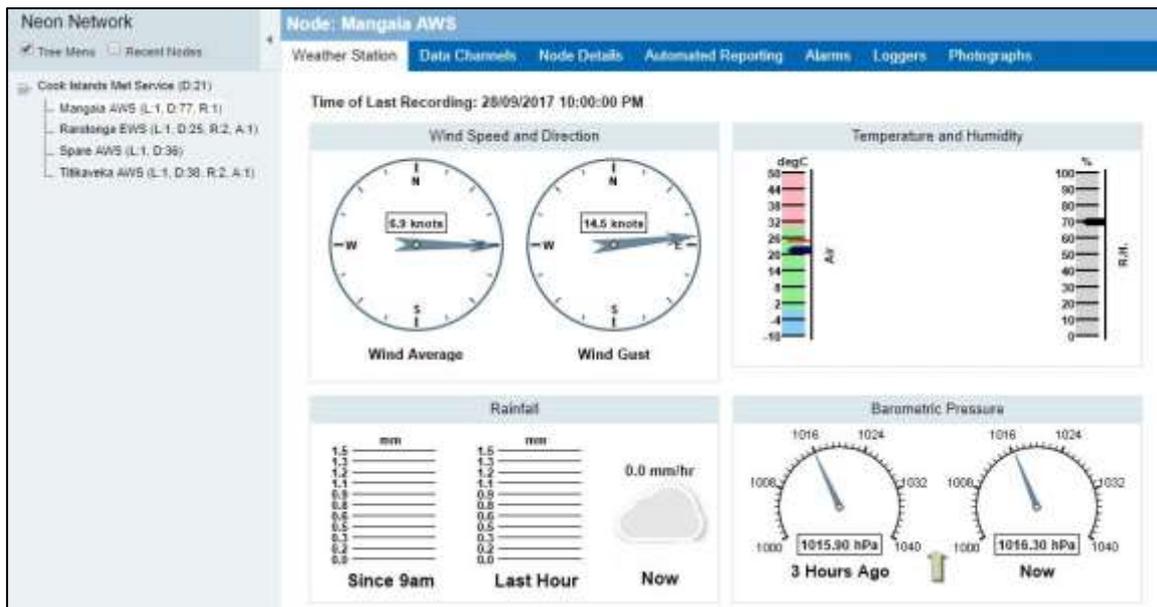
7.4. Cook Islands Setting

According to A. Ngari (personal communication, July 20, 2017), the Cook Islands Meteorological Services was set up a year after WWII in 1946 by Jim Harper and his father the late Arona Ngari at the request of the New Zealand govt. This was in support of the Coral Route of Solent Flying Boats across the Pacific. Weather balloons have been the backbone of the forecast process for decades, but now newer technology is helping to fill the gaps. It was common in the Cook Islands during the 1960s to the 1970s seeing weather balloons being released 4.00pm every day from the CIMS office.

CIMS is now installing automated weather stations (Figure 21) on ten of the inhabited islands of the Cook Islands. The data will be collected by this automated equipment and the information sent direct to the CIMS office in real time via satellite. This technology will replace the manual weather stations on each island which have been unreliable for collecting data pending on the availability or commitment of the person to collect data.

This information is also linked to the Emergency Management Cook Islands (EMCI) office who will have real time information of conditions in the Pa Enea without relying on CIMS anymore. In case of a cyclone to hit an island, the report from each island will be able to provide the exact wind speed, direction of the wind, rainfall, temperature and barometric pressure or the atmospheric pressure (Cook Islands Meteorological Services, 2017)

FIGURE: 21 AUTOMATED WEATHER STATIONS IN THE OUTER ISLANDS



(Source: Cook Islands Meterological Services, 2017)

7.5. EMCI Geo Portal

In 2014, Emergency Management Cook Islands developed a Disaster Risk Management (DRM) and Climate Change Cook Islands (CCCI) Geo Portal using GIS software to capture and access GIS datasets from other sources pertaining to hazard mapping, vulnerable assessment mapping and other DRM and CCCI related information. The Geo Portal has three parts;

7.5.1. EMCI WEBSITE

The EMCI Website in Figure 22 is designed as an information center for disaster risk response and management. It strives to foster collaboration and continual improvement of emergency response working in partnership with the public, government ministries and key stakeholders, to promote best practices before, during and after disasters. The website can be found at <http://www.emci.gov.ck/>, it provides a centralised database for all DRM related documents, videos and including documentaries on Traditional Knowledge of the Cook Islands (EMCI, 2017).

FIGURE 22: EMCI GEO PORTAL



(Source: EMCI Geo Portal , 2017)

7.5.2. EMCI GeoNode system

The EMCI GeoNode system linked to the EMCI Website is the online mapping and document catalogue to assist emergency response teams make better decisions in the event of a national emergency. Within this catalogue system, you will discover GIS maps and documents with related metadata. The metadata aspect will assist you in determining the origin, rights to use under license and amongst other information, validity of information being hosted. Although this system is focused primarily on Emergency Response, there is other information available to support decision making. The link is <http://geonode.emci.gov.ck/>.

7.5.3. EMCI GeoDatabase

The Geo Database seen on https://geodb.emci.gov.ck/Household_Viewlist.php# is the raw data collected through surveys and then entered into the EMCI Geo Database. The surveys are conducted using paper forms and then manually entered into the Geo Database. However, the Geo Portal team have developed an app for collecting data electronically using iPads and mobile phones.

The information gets uploaded automatically into the Geo Database therefore saving many many hours of data entry.

7.6. Teachers Resource Kit

In 2004 EMCI launched the Teachers Resource Kit (TRK) with the Ministry of Education (MOE). This TRK was developed with the purpose of creating awareness of the Disaster Risk Management materials in the schools. The response from MOE and the school principals were very positive (EMCI, 2017).

7.6.1. Project Rationale

The rationale was to increase the level of involvement of children and young people of the Cook Islands in identifying, evaluating and treating disaster risk within their schools, homes and communities. Secondly to empower children in matters that affect their own future relating to disasters. Thirdly to enable children to engage in real-world problems in their local communities. Fourth, to provide children with the opportunities to learn and problem solve about measures for disaster risk reduction. Finally, to enable children to become safety advocates for disaster risk in their homes and communities.

7.6.2. The Modules

The Modules covers various topics shown below in Figure. 22 and caters for the three levels K5, Y4 - Y8 and Y9 - Y13.

FIGURE 23: TEACHERS RESOURCE KIT



(Source: EMCI - Teachers Resource Kit for Disaster Risk Management & Climate Change, 2004)

7.6.3. The Resources

The TRK comes with its supportive resources for each module shown in Figure. 23, therefore the teachers will not have to seek out resources to teach the topic to students.

Figure 24: RESOURCES



(Source: EMCI - Teachers Resource Kit for Disaster Risk Management & Climate Change, 2004)

7.6.4. Traditional Knowledge

Traditional knowledge documentaries are included in the Resources Packs to ensure the knowledge is passed on to future generations.

7.7. Summary

There is no doubt that technology has advanced over the centuries in enhancing our Early Warning System and one could argue that our society has become totally dependent on new technology. This generation is consumed by technology and according to the Internet World Statistics (2017) the Cook Islands is one of the highest users of internet in the region. In 2000, Harvard Law School Professor Lawrence Lessig predicted that the internet would become an apparatus that tracks our every move, erasing important aspects of privacy and free speech in our social and political lives (Holmes, 2016).

Sixteen years later, it is clear that the digital world has evolved into a creature of control (Holmes, 2016). Mobile phones are no longer a high commodity reserved for the wealthy, it

is now made affordable and available to all age groups and across all sectors. Social media such as facebook have become a powerful information and communication tool that have captivated society especially the young people.

Society is so dependent on Technology and have become a threat to the existence of our traditional knowledge and practices. The challenge then is how do we ensure the survival of traditional knowledge when we are surrounded by new technology on a daily basis? Perhaps it is time to seriously consider that for its existence, traditional knowledge is integrated across all sector plans and be taught in schools as part of the curriculum for disaster risk management to enhancing our early warning system.

CHAPTER 8

CONCLUSION

Cook Island traditional knowledge and practices to prevent, mitigate and respond to disasters have been passed down for generations well before the arrival of missionaries to Cook Island shores. Our forebearers lived in oneness with nature and had a deep spiritual affiliation to the land, the sea and to their *Atua*. They were able to forecast future events by observing the behaviour of birds, animals, plants, trees or by reading the signs of the stars, the movement of clouds, the moon and the sun.

This exegesis has critically investigated the use of traditional knowledge and practices in responding to disasters in Cook Islands Disaster Risk Management (DRM). The fact that Cook Island traditional knowledge in response to natural disasters is now being recognised locally and globally as a critical tool to enhance DRM as part of government planning and preparedness shows alignment with the Yokohama Strategy 1994 which recognises the rights of traditional knowledge and practices.

Through the Carlson Kōkā Model, an Indigenous research methodology and *tuatua mai* (informal conversation) to gather the experiences and stories of the *aronga pakari* and *ta'unga* shows the strength of traditional knowledge and practices in the Cook Islands. This research provided a critique of several Cook Islands and Pacific ideological models to explain the Cook Islands Māori world view being used in conducting this research. The Kōkā Model has provided an Indigenous methodology as the framework for which the research has been undertaken.

The stories told in Chapter 3 shows the strength of traditional knowledge and practices in the Cook Islands among our *aronga pakari* particularly from the *Pa Enuā*. These practices continue to guide the communities they live in and inform their knowledge about how to read their natural environments especially in terms of anticipating natural disasters. These traditional knowledge and practices have been passed down for many generations and they are still being experienced and practiced today. Therefore by having these traditional knowledge, practices and experiences documented will preserve it for many more generations to come as an important resource to inform communities about how to be resilient in the face of natural disasters.

Traditional knowledge is now being recognised locally and globally as a critical tool to enhance Disaster Risk Management as part of Government of the Cook Islands planning and preparedness. It is important that this topic is now being widely discussed in public and getting more recognition by academics and scientists which increases the credibility of respecting Indigenous traditional knowledge and practices in DRM.

At the beginning of this research several questions were asked to help guide the direction of this thesis. The primary question is, does traditional knowledge enhance the prevention, mitigation, planning and preparedness for natural disasters across all sectors in government planning and policies?

- How can traditional Indigenous knowledge and science be integrated to strengthen Cook Island resilience toward a safe, secure and sustainable future?
- How do we bring traditional Knowledge to the forefront of our planning and implementation strategies to strengthen resilience in the Cook Islands?

As we come to the conclusion of this research, we find that traditional knowledge and practices have already been introduced and discussed at the international level since the launch of the Yokohama Strategy 1994. This has influenced the Cook Islands government policy makers who now recognise the importance of traditional knowledge in planning and government policies. Nearly all Cook Island national frameworks mention the importance of including traditional knowledge and practices inside national planning and policies. This certainly has been very encouraging, however, the challenge remains, how can traditional knowledge be brought to the forefront of our planning and policies across all sectors?

This exegesis is complemented by a 30 minutes documentary featuring the many *ta'unga* who are the traditional knowledge bearers associated with forecasting disasters across the Cook Islands and responding to the weather patterns to keep their communities safe.

The documentary is a visual collection of selected events discussed in Chapter 3. It reinforces how traditional knowledge enhances the prevention, mitigation, planning and preparedness for natural disasters across all sectors in government planning and policies, that traditional Indigenous knowledge and science be integrated to strengthen Cook Island resilience toward a safe, secure and sustainable future, and that traditional knowledge can be embedded into DRM planning and polices across all sectors to achieve the objectives of the Cook Islands

National Sustainable Development Goal 13 (NSDP), to strengthen resilience in combating the impact of climate change and natural disasters for a resilient Cook Islands.

Epeli Hau'ofa's (1973) article, *'Our Sea of Islands'* said that as people of the ocean, (in Epeli's words), "We should not be defined by the smallness of our islands but the greatness of our oceans. We are the sea, we are the ocean. Oceania is us." Hau'ofa's ideas calls for the emergence of a stronger and freer Oceania; and that the most important role that we the "people of the sea" can assume, as custodians of the Pacific, the vast area of the world's largest body of water covering more than 30 percent of the Earth's surface (Ka'ai, 2017).

Hau'ofa reminded us that our ancestors have a tradition of settlement in Oceania spanning over 2000 years, evidenced by their oral traditions, narratives and cosmologies and did not conceive of their world in such infinitesimal proportions (Ka'ai, 2017). As Hau'ofa said, 'Their world was anything but tiny'. They believed they were all connected and part of a larger sphere which included the ocean and the heavens. Their universe comprised not only of land surfaces but the surrounding ocean as far as they could exploit it, the ocean floor from which our islands emerged, and the heavens above with their star constellations that they used to navigate their way across the ocean. He argued that they saw their environment as a 'sea of islands' all connected and covering a huge expansive area (Ka'ai, 2017). Hau'ofa said, "Smallness is a state of mind. There is a world of difference between viewing the Pacific as 'islands in a far sea' and as 'a sea of islands'."

Therefore, the integration of traditional Indigenous knowledge and practices into policy in the Cook Islands is testimony to Hau'ofa's philosophical position.

Philosopher Paul Feyerabend (1987) differentiated between two different traditions of thought: abstract traditions (to which scientific ecology belongs) and historical traditions, which include systems of knowledge possessed by people outside Western science; knowledge that often becomes encoded in rituals and in the cultural practices of everyday life. Therefore, the integration of local and Indigenous knowledge with science is an important process which enables practitioners and scientists to implement activities and research to increase resilience in coastal and small island communities. This integration makes it possible for decision makers to put into practice policies that support such activities. As the elders die, a library burns, the full richness of tradition is diminished because some of it has not been

passed on and so is lost. It is important therefore to find ways of preserving this knowledge. One of the most effective ways is to embody it in the decisions about projects that affect the communities (Cochrane, 1994).

During the production of the Traditional Knowledge documentaries by Emergency Management Cook Islands, some of the *Pa Enua* did not have any *taunga* or elderlys still alive or living on the island therefore that library of knowledge was not captured. After nearly eight years of working in the field of Disaster Risk Management and documenting these traditional knowledge and practices, many of the *ta'unga* interviewed have since died but have left behind a wealth of knowledge for generations to come.

The development of modern technologies such as satellite images, GIS softwares and datasets and the respect from scientists that traditional knowledge and science are two ways of knowing, and are two parallel modes of acquiring knowledge about the universe, addresses the research questions. It is therefore critical that traditional knowledge, science and modern technology be brought together to enhance our early warning systems in building a resilient Cook Islands.

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GLOSSARY

The following words have multiple meanings in the context of this exegesis.

COOK ISLANDS MAŌRI

ENGLISH

āa	cry
āa meika	this is the bark of the banana tree that makes a lot of sound
Atua	God
Aka	roots
Akairi kite	shared vision
Akaputuputu	collaboration
Ākono'anga	tradition
Are korero	a place where repositories of knowledge meet
Ariki	paramount chief
Ariki tumu	chief, ruler
Aro'a	giving
Aronga pakari	elderly
Eeu ui tupuna	cultural traditions
Hopu	diving
Īrinaki'anga	belief
Karakia	prayer
Kai	food
Kāo	stalk
Kōa te meika	banana tree cries
Kōkā	banana tree

Kotaa	frigate bird
Kuru	breadfruit
Manu	birds
Marae	ceremonial dwelling site for a chief
Matangi	wind
Me kōa te meika	when the banana tree makes this sound as though it is crying
Meitaki maata	thank you
Metua āngai	feedings parents
Moa	chicken
Moana	ocean
Ōne	soil
Ōne tea	sand
Ngā pū toru	The three islands of Atiu, Mitiaro, and Mauke
Pa enua	outer islands
Papa	foundation
Papa'ā	European
Papa Māori	traditional beliefs and values
Pe'e	tribal chant
Peu	our culture and customs
Peu angaanga	cultural activity
Peu oire tangata	cultural community
Peu puapinga	cultural values
Pe'u Māori	Cook Islands Māori culture

Pe'u tupuna	culture
Porena	foreigner
Reo	language
Tamariki anga	feeding children
Tapu	sacred
Ta'unga	priest, orator, healer, expert, repository of traditional knowledge
Te reo Māori Kuki Airani	Cook Islands language
Tieni'anga rewa	climate change
Tiova	Jehovah
Tivaevae	quilt
Tivaevae manu	applique
Tivaevae taorei	piecework / patch work
Tivaevae tataura	applique and embroidery
Tivaevae tuitui tataura	embroidered squares of fabric joined together with crocheting or lace borders
Toko	prop
Tuatua mai	a rich conversation between two people on any topic of interest
Tui auri	sewing machine
Tuitui	craft
Tumu korero	orator
Tu akangateitei	respect
Tu inangaro	relationships
Ua te rākau	abundance

Uriuri kite

reciprocity

Ūtū

mountain banana *musa troglodytarum*

Vainetini

women

Vaka tangata

tribe

Vī

mango