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VULNERABILITY, ADAPTABILITY AND DISASTER RESILIENCE OF COMMUNITIES IN FIJI: A CASE STUDY OF CYCLONE AFFECTED COMMUNITIES IN KADAVU

by
Noa Tokavou

A thesis submitted in partial fulfilment of the requirements for the degree of Master of Arts in Development Studies

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School of Government, Development and International Affairs
Faculty of Business and Economics
The University of the South Pacific

August, 2016
DECLARATION

I, Noa Tokavou declare that this supervised research project is an original piece of work done by me. Where other sources have been used, these have been duly acknowledged. Any omission and error or otherwise is my own and the main content of this thesis has not been previously submitted for any degree in any other University.

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ID No: S88103460

A Statement by the Principal Supervisor

I confirm that this supervised research project was prepared under my supervision and it is the work of Noa Tokavou except where other sources used have been duly acknowledged.

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ACKNOWLEDGEMENTS

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ABSTRACT

Pacific Island countries are more vulnerable to both meteorological hazards like cyclones, floods, and droughts and geological hazards such as earthquake, tsunami, volcanism and landslides. The natural disasters are impacting the Pacific Island countries due to their geographic location that lie within the Pacific ‘Ring of Fire’ and the tropical cyclone belt in which cyclones develop and intensify. Cyclones had been the most frequent disaster in Fiji islands, accounting for 51 per cent of natural disasters.

The remoteness of an island generally delay the arrival of any assistance during a disaster but sound community adaptability skills, resilience-building and knowledge of the communities would help to cope well and reduce the impacts of a disaster. The objective of this research is to assess the vulnerability, adaptability and resilience of the cyclone affected communities in Kadavu Island in Fiji, a remote island province with a population of approximately 10,000 people.

The assessment of community vulnerability, adaptability and resilience was carried out through documentation analysis as well as field survey at the household level. The research methodology used was largely qualitative. A sample of 9 villages of 75 villages on Kadavu was included in the survey. The samples covered from each of the 9 tikina or district and 20 per cent households from each village were randomly selected.

The survey found that communities of Kadavu are aware of cyclone resistant crops and planting crops such as sweet potatoes, giant taro, yam, tivoli and cassava. Apart from the cropping patterns, the communities are using the cyclone resistant materials for housing. Strong community cohesiveness does exist in Kadavu which was evidenced by the support for shelter, food and clothing to affected people. The research recommends that planting of cyclone resistant crops need to be strongly advocated and monitored by government and civil society organisations. Community cohesiveness is to be nurtured through the traditional and religious leaderships to ensure that future generations can sustain them.
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<td>ADB</td>
<td>Asian Development Bank</td>
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<tr>
<td>ADPC</td>
<td>Asian Disaster Preparedness Centre</td>
</tr>
<tr>
<td>BC</td>
<td>Before Christ</td>
</tr>
<tr>
<td>CRED</td>
<td>Centre for Research on the Epidemiology of Disasters</td>
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<tr>
<td>HHD</td>
<td>High Human Development</td>
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<tr>
<td>MDH</td>
<td>Medium Human Development</td>
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<tr>
<td>LDH</td>
<td>Low Human Development</td>
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<tr>
<td>FBoS</td>
<td>Fiji Islands Bureau of Statistics</td>
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<tr>
<td>GDP</td>
<td>Gross Domestic Production</td>
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<tr>
<td>HDI</td>
<td>Human Development Index</td>
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<td>ILO</td>
<td>International Labour Organization</td>
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<tr>
<td>LDC</td>
<td>Least Developed Countries</td>
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<td>MDG</td>
<td>Millennium Development Goal</td>
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<tr>
<td>NCD</td>
<td>Non-Communicable Disease</td>
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<tr>
<td>NGO</td>
<td>Non-governmental Organization</td>
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<tr>
<td>SIDs</td>
<td>Small Island Developing Countries</td>
</tr>
<tr>
<td>SOPAC</td>
<td>South Pacific Applied Geoscience Commission</td>
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<tr>
<td>SPC</td>
<td>Secretariat of the Pacific Community</td>
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<tr>
<td>UN</td>
<td>United Nations</td>
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<tr>
<td>UNDP</td>
<td>United Nations Development Programme</td>
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<td>UNESCAP</td>
<td>United Nations Economic &amp; Social Commission for Asia &amp; Pacific</td>
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<td>UNESCO</td>
<td>United Nations Educational Scientific and Cultural Organization</td>
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<td>UNICEF</td>
<td>United Nations Children’s Fund</td>
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<td>UNISDR</td>
<td>United Nations International Strategy for Disaster Reduction</td>
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CHAPTER ONE

INTRODUCTION

1.1 Background

Societies have been exposed to natural hazards since time immemorial and in many cultures ‘natural disasters’ have been regarded as events of fate or attributed to ‘acts of God’ (UNISDR, 2005). In recent times people have become more aware of the sciences of natural hazards causing disasters hence moving away from believing that they are events of fate or attributed to ‘acts of God’.

Disasters, in the same way as other types of economic or social crises, have a life history. This includes the period of maturation in which the structural conditions for disaster are established, the period of onset and development of disaster conditions as such, and the subsequent responses of society during what are known as the relief, rehabilitation and reconstruction ‘phases’ (Cuny, 1993).

The World Health Organisation Centre for Research on the Epidemiology of Disasters (CRED, 2007)\(^1\) notes that natural hazards became natural disasters and can be grouped into two major categorises namely:

(i) Hydro-meteorological hazards that include floods, landslides, avalanches\(^2\), tidal waves, typhoons, hurricanes, cyclones, tornados\(^3\), droughts, extreme temperatures and wildfires.

(ii) Geological hazards that include earthquakes, volcanic eruptions and tsunamis.

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\(^1\) World Health Organisation Centre for Research on the Epidemiology of Disasters (CRED) established in 1973 as a non-profit institution. CRED is based at the School of Public Health of the Catholic University of Louvain in Belgium. Although CRED’s main focus is on public health, the centre also studies the socio-economic and long-term effects of large-scale disasters (CRED, 2007).

\(^2\) Avalanches – downhill movement or falling of heavy snow causing damages to vegetation, properties and infrastructure development

\(^3\) Tornados – localised and violently windstorm occurring over land.
The hydro-meteorological hazards are slow on set hazards which mean that their development phases can be clearly identified and tracked before they are fully developed and impacts a place (UNESCAP, 2008). The general public can therefore take adequate measures to protect their lives and properties.

The geological hazards on the other hand, are largely unpredictable since they are fast onset and it makes impossible to clearly distinguish the phases where people can prepare themselves before their impact (Gusiakov, 2009). There are several human induced hazards that can cause human induced disasters for example, chemical spill (e.g. Japan nuclear plant), plane crash and fire. This research is limited to natural disasters.

Advancements in science, technology and early warning systems have helped monitoring closely of the development of slow onset disasters thus giving adequate time for issuance of warnings of the threat. However, even with such systems in place, the impacts of natural disasters are still enormous; in terms of loss of life, damages to property, lifelines, economy and the environment (UNESCAP and UNISDR, 2010).

The world is experiencing increased frequency and intensity of natural disasters that had inflicted massive damages. According to the International Disaster Database\(^4\) (EM-DAT) maintained by the CRED, between 1980-1989 and 1999-2009, the number of disaster events has increased from 1,690 to 3,886 globally (UNESCAP and UNISDR, 2010).

Mani, Keen and Freeman (2003) have reported that between 1992–2001, losses stemming from natural disasters have averaged about $65 billion a year—more than a sevenfold real increase since the 1960s and they are expected to increase

---

\(^4\) EM–DAT - a worldwide database on disasters. Maintained at CRED from 1988, it contains essential core data on the occurrence and effects of over 14,000 disasters in the world from 1900 to the present. The database is compiled from various sources, including UN agencies, NGOs, insurance companies, research institutes and press agencies (CRED, 2007)
another five-fold over the next 50 years. They further estimated that the global direct costs of natural disasters will be $300 billion annually by 2050, about 750 per cent increase in real terms, of current levels and the average losses will be substantial and some countries, especially small island states, could face losses exceeding 10 per cent of GDP.

Some researchers (Knutson and Tuleya, 2004; Emanuel, 2005 and Webster, Curry and Chang, 2005) have agreed that increased sea surface temperature (SST) is responsible for the increasing intensity and severity of extreme weather events like floods and windstorms. While few places will be spared, the developing and least developed countries (LDCs) will be the worst hit. According to the World Development Report (2000 to 2001) ninety four (94) per cent of the world’s major disasters in 1990–98 were in developing countries (World Bank, 2001). These countries have made fewer efforts than developed countries to adapt their physical environments to reduce the impact of natural disasters or to insure themselves against disaster risk, partly because of the so called “Samaritan’s dilemma 5” (World Bank, 2009 and Freeman, Keen and Mani, 2003).

Adaptation is a Latin word, “aptus”, meaning “fit” or “suitable”. To adapt means to change in order to fit a situation better. The third assessment report of the Intergovernmental Panel for Climate Change IPCC (2001) had defined adaptations as:

> “Adjustments in ecological, social, or economic systems in response to actual or expected climatic stimuli and their effects or impacts. It refers to changes in processes, practices, and structures to moderate potential damages or to benefit from opportunities associated with climate change”

The United Nation International Strategy for Disaster Reduction (UNISDR) (2009) defined adaptation as:

5 Samaritan’s dilemma - The dilemma arises whenever those potentially to be affected will expect to receive support if disaster strikes and therefore under invest in protective measures—physical and financial—to reduce the costs they will incur when it does strike (Buchanan, 1975 and Mani, Keen, and Freeman, 2003).
“The adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploit beneficial opportunities”

When countries fail to adapt, it means that they are not carrying out adjustments to their ecological, social or economic systems to suit the prevailing weather conditions, leaving their communities vulnerable to the threats posed by natural disasters (World Bank, 2012).

Gero, Meheux and Howes (2009) stated that Pacific people have been adapting to disasters but no-one has ever called it adaptation because it is seen as indigenous and not scientifically researched. Increasingly, indigenous strategies have fallen into disrepair or are no longer considered viable whereas scientific strategies may be more applicable to some level, given that indigenous communities in Small Islands Developing States (SIDS) are faced with a rapid rate of change as a result of global pressures (Pelling and Uitto, 2001). It must be pointed out that indigenous strategies used in the past are still relevant today (Mercer et al., 2009; Veitayaki, 2009 and Resture, 2009).

Adaptations are commonly distinguished as either tangible6 or intangible7 (Nhan, 2006). The traditional adaptations include traditional warning signs and coping skills that fall into the intangible group which are fairly cheaper and can be afforded by developing countries. The challenge lies in implementing the tangible adaptations such as river dykes, river revetment, and foreshore protection. Due to their high costs the communities become more vulnerable.

Vulnerability derives from the Latin word ‘vulnerare’ (to be wounded) and describes the potential to be harmed physically and/or psychologically

---

6 Tangible adaptations includes infrastructure such as river bank walls, dykes, seawalls, housing, and other physical ones that is visible and can be touched (Nhan, 2006).
7 Intangible adaptation includes traditional knowledge about weather forecast, disasters, self-management ability of local people in disaster prevention; participation of concerned individuals, organizations, which affect the process of disaster happening (Nhan, 2006).
The concept of vulnerability is linked closely to the concepts of adaptability and exposure.

Vulnerability is defined by the United Nation International Strategy for Disaster Reduction UNISDR (2009) as:

“The characteristics and circumstances of a community, system or asset that make it vulnerable to the damaging effects of a hazard”

IPCC (2001) defines vulnerability as:

“The degree to which a system is susceptible to, or unable to cope with, adverse effects of climate change, including climate variability and extremes. Vulnerability is a function of the character, magnitude, and rate of climate variation to which a system is exposed, its sensitivity, and its adaptive capacity”.

According to Turner et al. (2003), vulnerability is the degree to which a system, subsystem, or system component is likely to experience harm due to exposure to a hazard, either a perturbation or stress/stressor. The impact of a hazard is therefore a function of exposure to the hazard event and the dose–response (sensitivity) of the entity exposed (ibid.). The word ‘exposure’ is a critical issue in the adaptability-vulnerability framework. UNISDR (2009) defined exposure as:

“People, property, systems, or other elements present in hazard zones that are thereby subject to potential losses”.

In simple term, the United Nations (2014) define exposure as entities (population, conditions of built-up areas, infrastructure component, environmental area) being exposed to the impacts of one or more natural hazards (earthquakes, cyclones, droughts, floods and sea level rise).

For example, those living along the river bank are more exposed to floods than those living upland. The city of New Orleans for example, which is located alongside the Mississippi River was more exposed to floods waters than other areas that were also hit by the Category 4 Hurricane Katrina in 2005 resulting in
flood waters inundating the city inflicting substantial damages estimated over $81.2 billion and death toll was over 1,836 (CRED, 2007).

Similarly, for tsunami waves, those living along the coasts are more exposed to tsunami waves than those living upland. Since tsunami waves are caused by earthquakes, countries within the subduction zones where most earthquakes originates are more exposed than those further away (Bernard and Robinson, 2009). The Pacific subduction zones or so called “Ring of Fire” is the most active zone and countries located in this zone are more exposed than those away from it (ibid.) Out of the 2,130 tsunami events that have been recorded since 2000 BC, 1,226 occurred along the Pacific Ring of Fire, 263 in the Atlantic, 125 in the Indian Ocean and 545 in the Mediterranean region (ibid.).

Map 1.1: Pacific Ring of Fire

Typhoons or tropical cyclones develop in latitudes 5 to 20 degrees South and North of the equator and intensify as it proceeds south and north due to supply of warmth at the sea surface, supply of moisture at the sea surface, release of latent heat through condensation in the mid temperature, and removal of air aloft by upper level divergence as they move south and north (Terry, 2007). In the Pacific ocean the absence of very large land masses greater than 30,000 km² beyond 20 degree south and north of the equator plus the vast ocean which surrounds, helps cyclones or typhoons to remain active long enough to move over a number of the island countries before they die out (ibid.). Tropical cyclones are also known to
produce torrential rainfall which can generate coastal floods, river floods and landslides (ibid.).

Sensitivity is a component of vulnerability. To determine the degree of vulnerability of a community, one has to consider both the exposure and sensitivity (World Bank, 2014). Sensitivity is the conditions of the system and elements at risk to be able to sustain the impact of the hazards (Turner et al., 2003). The sensitivity therefore is a crucial element in the determination of vulnerability since a wide geographical area will be exposed to the hazards but those only with more sensitive will be severely impacted. The examples of parameters influencing sensitivity include the construction types of houses, the design of infrastructure development to withstand severe impact situation, sustainable and high sources of income, the human knowledge and skills to respond to any disaster and the social networks that enable the victims to assist and support each other (ibid.).

The sensitivity of a system or community is dependent on capacity. Capacity is the combination of all the strengths, attributes and resources available within a community, society or organization that can be used to achieve agreed goals (UNISDR, 2009). The agreed goal in this context is to reduce the level of risk so that one can withstand the shocks caused by natural disasters and to improve their life. Where there is high capacity communities are able to construct houses in safe locations away from areas that can be easily impacted by hazards such as river banks from floods or near coastline from tsunami.

Disaster risk and vulnerability increase with more exposure and sensitivity. Disaster Risk is defined by UNISDR (2009) as the potential disaster losses, in lives, health status, livelihoods, assets and services, which could occur to a particular community or a society over some specified future time period. It is often expressed as a product of hazard and vulnerability and reduced by the level of capacity (ibid.). At a local level disaster risk is easily understood as the likelihood of a particular hazard occurrence and its probable damaging consequences for the elements at risk. Vulnerability is the sum total of exposure
and sensitivity. Generally speaking, the greater the vulnerability, more is the disaster risks and the larger the capacity, the smaller the risks.

The global concern today is to build community disaster resilience in order to reduce vulnerability and the impact of natural disasters. Community disaster resilience is simply referred to the capacity or ability of a community to anticipate, prepare for, respond to and recover quickly from impacts of disasters by means of its own resources (Twigg, 2007; Mayunga, 2007; Mohanty, 2006 and 2008; Cutter, Burton, and Emrich, 2010; UNESCAP and UNISDR, 2010). Adaptability and resilience are closely linked and are often used interchangeably.

Cutter, Burton and Emrich (2010) in developing disaster resilience indicators for benchmarking baseline condition in the United States stated that if communities can increase their resilience then they are in a much better position to withstand adversity or to recover quickly from the impacts of natural disasters.

Mayunga (2007) pointed out that resilience was first used in ecological systems where it is referred to as a buffer capacity or the ability of a system to absorb the magnitude of the disturbance that can be absorbed before a system changes its structure. He further argued that capital based approach is one of the frameworks that can be used to assess disaster resilience.

Twigg (2007) suggested some indicators of disaster community resilience that are grouped into five main categories such as (a) governance, (b) risk assessment, (c) knowledge and education, (d) risk management and vulnerability reduction and (e) disaster preparedness and responses.

The natural hazards are not uncommon in the Pacific Island countries. These countries are within the belt of ‘Ring of fire’ hence they are highly exposed to earthquake, volcano and tsunami hazards. The earthquakes and tsunamis that had impacted the region in 1998 were severe and over 2,000 people were killed at Aitape, Papua New Guinea (Gusiakov, 2009). The tsunami in 2007 along the
coasts of Western province in the Solomon Islands claimed lives of over 52 people (26 children and 26 adults) from 10 villages (ibid.). In September 2009 tsunami waves hit the coasts of Tonga and Samoa causing deaths and severe damages to houses, roads, water supply systems and foods gardens. In Tonga, there were 9 deaths and the total damages were estimated to be around $US9m while in Samoa there were 143 deaths and the total estimated cost was around $US39m (Government of Samoa, 2009). In 2010, a 7.5 magnitude earthquake shook Port Vila in Vanuatu and caused infrastructure damages especially buildings. Vanuatu has some active volcanos in Mount Yasur spewing ash, affecting 33 villages with an estimate population of 29,160 (Government of Vanuatu, 2009).

The Pacific Island countries are highly exposed to cyclones and floods. Table 1.1 shows that in 30 year period from 1971 to 2000, 306 cyclones had been experienced in the PICs. These indicate that there was an average of 10 cyclones experienced annually in the region.

Table 1.1: Cyclonic activities in the Pacific from 1970 to 2000

<table>
<thead>
<tr>
<th>Decade</th>
<th>Gale (34 – 47 knots: 62 – 88 km/hr)</th>
<th>Storm (48 – 63 knots: 89 – 117 km/hr)</th>
<th>Hurricane (&gt; 64 knots: &gt; 118 km.hr)</th>
<th>Number of Events</th>
</tr>
</thead>
<tbody>
<tr>
<td>1971 - 1980</td>
<td>36</td>
<td>38</td>
<td>38</td>
<td>112</td>
</tr>
<tr>
<td>1981 - 1990</td>
<td>25</td>
<td>23</td>
<td>48</td>
<td>96</td>
</tr>
<tr>
<td>1991 - 2000</td>
<td>30</td>
<td>17</td>
<td>51</td>
<td>98</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>91</strong></td>
<td><strong>78</strong></td>
<td><strong>137</strong></td>
<td><strong>306</strong></td>
</tr>
</tbody>
</table>


The damages sustained from the impacts of earthquake, volcano, tsunami, cyclones and floods were high due the high sensitivity of the elements at risk such as properties, economy, society and environment. In a recent study by the United Nations (2014) in 171 countries in which ‘Risk Index’ was determined, five Pacific Island countries (Table 1.2) were amongst the top of 16 highly rated ones.

The ‘risk index’ is a tool used to assess and estimate the disaster risks of a country (United Nations, 2014). It takes into consideration the exposure of countries to
natural hazards, the sensitivity of the social, economic and ecological conditions within those countries, coping capacity and adaptive capacity. In the Pacific, Vanuatu ranked 1st in the global risk index, while Tonga ranked 3rd, Solomon Islands 6th, Papua New Guinea 10th and Fiji ranked 16th (Table 1.2).

### Table 1.2 Risk Index value and rank of Pacific Island Countries

<table>
<thead>
<tr>
<th>Country</th>
<th>Risk %</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vanuatu</td>
<td>36.50</td>
<td>1</td>
</tr>
<tr>
<td>Tonga</td>
<td>28.23</td>
<td>3</td>
</tr>
<tr>
<td>Solomon Islands</td>
<td>19.10</td>
<td>6</td>
</tr>
<tr>
<td>Papua New Guinea</td>
<td>16.24</td>
<td>10</td>
</tr>
<tr>
<td>Fiji</td>
<td>13.65</td>
<td>16</td>
</tr>
</tbody>
</table>


In 1953, Fiji was impacted by tsunami waves, causing 9 deaths and damages to costal infrastructure in the capital city of Suva. Major damages occurred in Fiji due to cyclone, flood and drought during 1970 to 2007 (Table 1.3). Tropical cyclone is the most damaging natural disaster in Fiji followed by flood. Out of the 124 disasters that had occurred in Fiji between 1970 to 2007, 63 were tropical cyclones that caused 309 deaths and damages over F$500 million of during the period (Table 1.3).

The islands in Fiji that were mostly impacted include Yasawa, Mamanuca, South Western Viti Levu and Kadavu. Kadavu is worse off than the other islands since it is the farthest from the capital city of Suva where the Headquarter of the disaster management is located (Game, 1974).

### Table 1.3 Summary of Disasters in Fiji, 1970 to 2007

<table>
<thead>
<tr>
<th>Disaster</th>
<th>Number of events</th>
<th>Number of people affected</th>
<th>Number of people killed</th>
<th>Cost of damage (US$ million)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flood</td>
<td>41</td>
<td>221,724</td>
<td>88</td>
<td>100.00</td>
</tr>
<tr>
<td>Tropical cyclone</td>
<td>63</td>
<td>791,653</td>
<td>309</td>
<td>500.00</td>
</tr>
<tr>
<td>Earthquake</td>
<td>10</td>
<td>0</td>
<td>5</td>
<td>0.00</td>
</tr>
<tr>
<td>Drought</td>
<td>6</td>
<td>840,857</td>
<td>0</td>
<td>100.00</td>
</tr>
<tr>
<td>Tsunami</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0.00</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>124</strong></td>
<td><strong>1,862,603</strong></td>
<td><strong>419</strong></td>
<td><strong>700.50</strong></td>
</tr>
</tbody>
</table>

The high exposure of the outer Fiji islands to cyclones coupled with predominantly subsistence income increases their vulnerability. The high vulnerability is indicated by the massive damage costs mostly by a cyclone impact. However, despite these high costs of damage, the communities are able to cope and continue to live normal life in short period of time due to their high coping and adaptive capacity.

1.1.1 Research problem statement

The long-term impact of cyclones on the living conditions, livelihoods, economic performance and environmental assets is much more severe in remote small island communities mainly due to their small population, narrow based economies and small land areas (McKenzie, Prasad and Kaloumaira, 2005). In countries where there is high rate of unemployment, it makes people poorer and vulnerable because they have little ability to respond to and cope with the effects of disaster, or to quickly recover from them. At the same time, if they do not have access to proper infrastructure, they are trapped in disaster prone areas, adding to their vulnerability to disasters (Lal, Singh and Holland, 2009)

The increased dependence on government assistance by the local communities is a worrying trend thus the need to conduct a systematic study to capture and document the adaptation measures and coping mechanisms that can enhance community resilience (Twigg, 2007). Well documented adaptation and coping mechanism that can be shared in community meetings and schools which will have lasting effects.

Kadavu in Fiji is most affected by cyclones and communities have developed resilience to cope with the cyclonic events. The present study focuses on the adaptability and community resilience building on the island towards such events.

1.1.2 Rationale

The importance of studying the adaptability and resilience to cyclones is attributed to several factors. Firstly, the threat of natural disasters in the Pacific Island
countries will not decrease since the island states lay within the Pacific ‘Ring of Fire’ where geological hazards originates from and are also located within the latitudes where cyclones and associated hydro-meteorological hazards develop and intensify. The identification of adaptability skills is therefore crucial to help prepare the less fortunate population that live in remote islands and cannot be easily reached when there is an impact of natural disaster.

Secondly, the ability of the states to quickly mobilise humanitarian assistance is limited due to scarcity in resources hence the adaptability skills must be documented and shared to others who do not possess them to help them sustain their needs while assistance is delayed for weeks and may be even months.

Thirdly, the assessment and documentation of the adaptability skills will ensure the productive use of natural resources that are rarely available in small island communities.

Fourthly, there is a need to assess resilience in Small Island communities separated by thousands of miles of ocean since the focus so far is on communities connected to urban centres.

Fifthly the study is important to measure the resilience of a Pacific community after the Pacific leaders have committed themselves to the Global and Regional Framework for Action on Enhancing Resilience to disasters.

Lastly, the study derives from the author’s first-hand experience of cyclone impact as a victim while living in Kadavu Island, as a damage assessment official while working as a civil servant in the Government of Fiji and now a disaster policy developer while working in a regional organisation.
1.2 Research Questions

The central research question that the study seeks to answer is what are some of the adaptability skills developed by the people of Kadavu, Fiji on cyclones and how resilient are they to such events? Several subsidiary research questions this study attempts to answer are:

- What are the adaptability skills to cyclones developed by the people of Kadavu that had ensure their survival in past cyclones?
- What type of cyclone tolerant crops is planted by the people of Kadavu?
- What is the method of community mobilisation to respond to a cyclone?

1.3 Objectives

The general objective of the study is to assess the community adaptability and resilience to cyclone in Kadavu Island, Fiji.

The specific objectives are:

- To identify the adaptability skills to cyclones that are being developed by the people of Kadavu.
- To determine the types of cyclone tolerant crops that is being planted by the people of Kadavu.
- To recommend sound community adaptation and resilience building measures based on research findings.

1.4 Sources of Data and Methodology

Sources of data of the study were derived from primary and secondary means. The primary source includes field work that was undertaken by the researcher in selected villages on the island of Kadavu, Fiji. The field work involves the use of a questionnaire drawing samples from household heads in selected villages and focus group discussions on cyclone preparedness, response and recovery. Secondary data was obtained from government and non-governmental organisation

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8 A detailed description of the methodology is given in Chapter Three.
and international agencies’ reports of cyclone damages and assistance. The research method is mostly qualitative. However quantitative data are gathered and analysed in this thesis.

1.5 Significance of Research

The research will document cyclone adaptability skills that had been developed by the people of Kadavu over the years. These adaptability skills can then be shared with other island communities to enhance their safety during a cyclone. Further the identification of such skills will assist the disaster management officials in developing programs for their replication. The research identifies indicators of resilience in island community that had enable them to absorb the shock caused by cyclones and are able to bounce back and continue to live normally in a short period of time.

1.6 Organisation of Thesis

This thesis is divided into five chapters. Chapter one is the introductory sections dealing with the background of the study, statement of the problem, rationale, research question, objectives and a brief methodology.

Chapter Two provides a conceptual framework of the key concepts is being studied. The chapter provides a synopsis of the approaches, models and theoretical debates on disaster adaptability and resilience particularly cyclones.

Chapter Three discusses the research methodology that was employed to gather data from the selected community. These include the types of research methods, sources of data, rationale of the selection of the study site, determination of the sample size and the means of obtaining information from the samples and finally the ethical limitations of the research that can be covered in future research.

Chapter Four provides the detail description of the study area starting with Fiji as a country and then Kadavu as one of the 14 provinces in the country. The description
covers the geographical location, the physical composition, the political evolution, the economic development, the population composition and growth, cultural and religious dynamics and the various natural hazards that had impacted in the past and have potential to affect in the future.

Chapter Five presents the findings of the research. Responses are summarised into categories to provide answers to the questions adopted in the study.

Chapter Six deals with the conclusion and recommendations based on the findings. It also provides some recommendations for future studies that can enhance the knowledge on cyclone adaptations and resilience to cyclones in small island communities.
CHAPTER TWO

VULNERABILITY, ADAPTABILITY AND COMMUNITY DISASTER RESILIENCE: A CONCEPTUAL FRAMEWORK

2.1 Introduction

This chapter deals with the conceptual framework linking the concepts of natural disasters, risks, vulnerability, exposure and sensitivity, adaptability and resilience.

The chapter is divided into two parts. In part one, it provides the conceptual framework and linkages of the concepts, and various approaches relating to vulnerability and adaptability and the second part is a review of previous works done in the Pacific and Fiji.

2.2 Conceptual Framework and Literature Review

Various concepts and their relationships are established in the following sections:

2.2.1 Natural Disasters

Natural disasters result from events of natural hazards occurring in a geographical area. A community is a social group of people of any size whose members reside in a specific locality, share same governance arrangements and often have a common cultural and historical heritage (Dhamotharan, 2002). Unless the event impacts a community or infrastructure, it is not regarded as a natural disaster. For example, a category 5 cyclones occurring in the middle of the ocean is not regarded as a natural disaster but only a natural hazard.

A natural hazard is a condition, event or phenomena that can cause the loss of life or injury, damages to property, disruption to social, economic conditions and environment degradation (UNISDR, 2011). Similarly, World Bank (2006) defined
a natural hazard as a geophysical, atmospheric, or hydrological event, or series of events, that has the potential to cause significant harm or loss.

Hazards are classified into two main categories such as natural or anthropogenic. Most hazards are dormant or potential, with only a theoretical threat of harm; however, once a hazard becomes "active", it may be resulted into a natural disaster. Hydro-meteorological hazards are processes or phenomenon of atmospheric, hydrological or oceanographic nature (UNISDR, 2007). This research is limited to natural disasters especially caused by cyclones.

The concept of tropical cyclone and its origins are widely studied. A cyclone originates when low level winds flows into a group of thunderstorm or “tropical disturbance” over warm tropical waters and evaporate water from the ocean surface transferring energy to the atmosphere as they form clouds and precipitation (Australian Bureau of Meteorology 2011). When the air moves towards the centre of the disturbance it curves or spirals and not in a straight line (Figure 2.1). The spiral effect comes from the rotations of the earth underneath it. When atmospheric and ocean conditions continue to be favourable, the energy brought in by the air accumulates in the centre of the disturbance leading to drop in atmospheric pressure. As this continues it increases the speed of the wind and also drawing more and more energy leading to continue drop in pressure and due to the spiral movement the centre is clearly formed which is usually called the “eye” (ibid.). In the eye of the cyclone, the wind is usually light with clear skies.

**Figure 2.1 Structure of a Cyclone**

![Figure 2.1 Structure of a Cyclone](image)

Source: Australian Bureau of Meteorology, 2011.
Once the wind speed reaches a certain threshold the disturbance is called tropical cyclone. As it proceeds south and north of the equator it will intensify due to continued supply of warmth and moisture at the sea surface, release of latent heat through condensation in the mid temperature, and removal of air aloft by upper level divergence (Terry, 2007). Cyclones weakens when they reach cooler waters or a large land mass since the supply of warm air and moisture from sea surfaces are no longer made available (ibid.). The occurrences of hydro meteorological hazards are often slow and the phases from their development can be monitored before it impacts a community.

World Bank (2006) defined disaster as a severe disruption to a community’s survival and livelihood, loss of life and property resulting from a natural hazard event. This is further clarified by UNISDR (2009) which say disaster is a serious disruption of the functioning of a community or a society involving widespread human, material, economic or environmental losses and impacts, which exceeds the ability of the affected community or society to cope using its own resources.

As confirmed by the Centre for Research on the Epidemiology of Disasters (CRED) (2007) for an impact to be called a disaster, it must overwhelm the local capacity, necessitating a request to a national or international level for external assistance.

A disaster happens when a hazard impacts on human population, whose capacity is inadequate to withstand or cope with its adverse effects, resulting in damages, loss and disruption in community/society functioning (Asia Disaster Preparedness Centre, 2015).

2.2.2 Natural Disaster and Risks

Disasters are often described as a result of the combination of: the vulnerability comprising of exposure to a hazard and the conditions or sensitivity that are present; and insufficient capacity or measures to reduce or cope with the potential
negative consequences (UNISDR, 2009). This is measured by the level of disaster risk which is the potential disaster losses, in lives, health status, livelihoods, assets and services, which could occur to a particular community or a society over some specified future time period (ibid.). At a local level disaster risk is easily understood as the likelihood of a particular hazard occurrence and its probable damaging consequences to the elements at risk. This can be expressed mathematically as shown in Figure 2.2. The level of risk is determined by the level of vulnerability (exposure + sensitivity) divided by the level of capacity. A number of scenarios can happen for example, when the vulnerability is high and the capacity is low, the disaster risk is high. Another one, when the vulnerability is still high and the capacity is high, the disaster risk is low.

**Figure 2.2 Risk, Hazard and Vulnerability Linkages**

\[
\text{Risk} = \frac{\text{Hazard} \times \text{Vulnerability} (\text{exposure} + \text{sensitivity})}{\text{Capacity}}
\]

Source: Asia Disaster Preparedness Centre, 2015.

### 2.2.3 Concept of Vulnerability

Vulnerability is a concept that links the relationship that people have with their environment and social forces and institutions and the cultural values that sustain and contest them.

The concept of vulnerability expresses the multidimensionality of disasters by focusing attention on the totality of relationships in a given social situation which constitute a condition that, in combination with environmental forces (Villagran, de León, 2006).

Taking a structuralist view, Hewitt (1997) states vulnerability as being:

“...essentially about the human ecology of endangerment...and is embedded in the social geography of settlements and lands uses, and the space of distribution of influence in communities and political organisation”.

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This is further elaborated from a more socially focused view by Blaikie et al. (1994) who viewed vulnerability as the:

“...set of characteristics of a group or individual in terms of their capacity to anticipate, cope with, resist and recover from the impact of a natural hazard. It involves a combination of factors that determine the degree to which someone's life and livelihood is at risk by a discrete and identifiable event in nature or society”.

The concept of vulnerability emphasizes two central themes:

1. Both the causes and the phenomenon of disasters are defined by social processes and structures. Thus it is not only a geo- or biophysical hazard, but rather its combination with social context that is taken into account to understand disasters (Hewitt, 1983).
2. Although different groups of a society may share a similar exposure to a natural hazard, the hazard has varying consequences for these groups, since they have diverging capacities and abilities to handle the impact of a hazard which contributes to sensitivity (Turner et al., 2003).

2.2.3.1 Models of Understanding Vulnerabilities

There emerge two different models of understanding vulnerabilities. The first being the Risk Hazard (RH) model introduced by Turner et al. (2003), showing the impact of a hazard as a function of exposure and sensitivity as shown in Figure 2.3. The second model is the Pressure and Release (PAR) model developed by Blaikie, Cannon, Davis and Wisner (1994).

(a). Risk Hazard (RH) model

According to Risk Hazard model, vulnerability is a product of hazard event, degree of exposure, sensitivity and impacts (Figure 2.3).
Sensitivity is the conditions of the system and elements at risk to be able to sustain the impact of the hazards (Turner et al., 2003). Lal, Singh and Holland (2009) stated ‘sensitivity’ as:

“individuals’ and communities’ conditions that particularly have the potential to magnify the effect of disaster”.

While a wide area is highly exposed to cyclones as shown in Map 2.1, the impact will be determined by the sensitivity of the elements at risk. In a country they can all be exposed to cyclones but the damages will be severe to buildings that are not constructed to such standards that can withstand strong winds. The houses that are being constructed according to standards do not suffer any damage. In that instance, while the exposure to cyclone was high the sensitivity of the houses built to standards was low hence the disaster risk is lower.

**(b) Pressure and Release (PAR) Model**

The second model called the Pressure and Release (PAR) model (Blaikie, Cannon, Davis and Wisner, 1994) shows the progression of vulnerability as shown in Figure 2.4. The PAR model understands a disaster as the intersection between physical exposure and socio-economic pressure which determines the sensitivity of a community.
The model distinguishes between three components of the progression of vulnerability namely root causes, dynamic processes and unsafe conditions (Blaikie, Cannon, Davis and Wisner, 1994).

The root causes of vulnerability include access to power, structure and access to resources. This is mostly driven by the ideologies on which the political and socio-economic systems are based upon (Blaikie, Cannon, Davis and Wisner, 1994). In a democratic system, citizens have equal opportunity and free to access power and resources for their survival. When that does not exist, citizens will be deprived from selecting their leaders and accessing resources that is necessary to support their livelihood. Even in some democratic system, resources are communally owned, limiting individuals to explore opportunity to generate wealth (ibid.).

Dynamic processes include training, investment and press freedom. Economists and demographers agree that important ingredients of improved living standards, such as urbanization, industrialization and rising opportunities for non-agrarian employment, improved educational levels, and better health all lead to a stronger family and community (Sinding, 2008). It is then clear that when that is weak, the communities are more vulnerable to natural disasters. That is because they do not have the capacity to develop their own adaptation actions nor be able to pay for...
them. Without knowledge about the types of shocks that are possible and the nature of the vulnerability associated with these shocks, little effective action can be taken. In addition, knowledge of measures to reduce vulnerability and the capacity to assess and implement these measures is needed. For example, across the Pacific, only about half of households have access to improved (protected and sanitized) drinking water, putting populations at risk for a range of diseases and even death, particularly for young children (WHO, 2008).

According to Blaikie, Cannon, Davis and Wisner (1994), unsafe conditions are the end result of the root causes and the dynamic processes in which vulnerability is expressed in time and space such as those induced by the physical environment, local economy or social relations. The unsafe conditions determine the level of sensitivity as a component of vulnerability.

Vulnerability is therefore a product of sensitivity and capacity. The sensitivity of a system or community is directly related to the capacity. Social capacity is the combination of all the strengths, attributes and resources available within a community, society or organization that can be used to achieve agreed goals (UNISDR, 2009).

Social capacity focuses on social relations that have productive benefits. It is in simple terms the value of social networks, bonding similar people and bridging between diverse people, with norms of reciprocity (Robison, Schmid and Siles, 2002; Dekker and Uslaner, 2001; Uslaner, 2001).

Sander (2002) and Adler and Kwon (2002) identified that the core intuition guiding social capacity is the goodwill that a person have toward another. The communities that have a strong internal and external relationship will have low vulnerability (Woolcock 1998; Oh, Kilduff, and Brass. 1999). That is the ability to support each other when there is a natural disaster. Support for each other can be physical by sharing clothing, food or shelter or psychological by comforting and counselling them to improve their emotions (ibid.).
The physical environment comprises of all the outdoor and indoor surroundings such as terrestrial fauna and flora (trees, shrubs, soil, birds) aquatic fauna and flora (fish – fresh water and sea, fresh water and sea weeds, reefs, sand, gravel, seawater, river water), air, buildings, furniture, people etc.

The sensitivity of our physical environment is determined by the way people manage their physical environment especially through development activities such as road construction, logging, mining, construction of water catchment dams, construction of water hydroelectricity dams, land reclamation along the coast, irrigation schemes, land clearing and ploughing for agriculture, beach and river mining of aggregates for building construction (Hewitt 1983, 2007; Lewis 1999; and Wisner, Blaikie, Cannon and Davis. 2004). When these development activities are not managed properly, wholesale modification of natural ecosystems are made and will result in the creation of hazards and will make damaging effects on the community. Upland forestation and land clearing usually results in soil erosion and sediments are washed down the river affecting the depth of the river. When a heavy rain occurs the river cannot cater for the volume of water due to the shallowness hence will overflow and cause floods.

The Pressure and Release model clearly exhibits that the vulnerability of the poor and other marginalized groups will increase unless attention is paid to the drivers of vulnerability (UNISDR, 2010). Addressing drivers of vulnerability are being termed as Disaster Risk Reduction or Adaptation (ibid.).

The Pressure and Release model was further refined by Wisner et al. (2004) to show the linkages to the actions that can potentially be undertaken to reduce the levels of vulnerability as shown in Figure 2.5.
2.2.4 Sensitivity, Poverty and Vulnerability

At the household level, sensitivity can be viewed in terms of livelihoods, food and nutritional status. They all depend on household income, access to water and sanitation, maternal and child mortality, and education. The poorer the economic and social wellbeing at the household level, the more sensitive the household is to the impact of hazards. This is because it has a low threshold for withstanding external shocks and the less able it is to respond to, cope with and adapt to disasters since they do not have much, if any, capital reserve on which to draw from (Lal, Singh and Holland, 2009).

The emergence of relationship between sensitivity and poverty is becoming clear where poverty is usually considered an important factor for determining household sensitivity to hazards because household income level determines people’s coping and adaptation capacities (Lal, Singh and Holland, 2009).

World Summit on Social Development in Copenhagen in 1995 (UNDP, 1995) defined poverty as:
"a condition characterised by severe deprivation of basic human needs, including food, safe drinking water, sanitation facilities, health, shelter, education and information. It depends not only on income but also on access to services."

Abbott and Pollard (2004) attempted to clarify this definition in rural communities as an inadequate level of sustainable human development manifested by:

(i) a lack of access to basic services such as primary health care, education and potable water
(ii) a lack of opportunities to participate fully in the socioeconomic life of the community
(iii) a lack of adequate resources (including cash) to meet the basic needs of the household or the customary obligations to the extended family, village community, and/or the church.

While the lack of material is the base, it must also be noted as Chambers (1983) stated that poverty can be described in many other ways such as a lack of psychological well-being, a lack of security or freedom and a lack of opportunities. Barr (1991) stated that poverty includes the economically disadvantaged who, as a consequence of their status, often suffer hardship, dependence, oppression and powerlessness.

Poverty therefore is an ambiguous concept in that the baseline constantly shifts as people’s attitudes as to what are acceptable standards of living change over time, whether income level be accepted as the standard or other such as limited access to power, resource, information, education, structures, press freedom, and development opportunities. These conditions are the conditions that will increase sensitivity as advocated by Blaikie et al. (1994), in the Pressure and Release (PAR) model. When those below the poverty line are exposed to such condition they cannot release the pressure hence will suffer more as compared to those who do not face those conditions and are able to release the pressure that may be caused by shocks of a natural hazard such as cyclone.
A considerable evidence has demonstrated a direct and significant relationship between disasters, sensitivity and economic wellbeing and poverty (World Bank, 2014; and Lal, Singh and Holland, 2009). Poor often live on marginal lands and in poorly constructed houses, and often have poor access to water and sanitation and characterised by poor productivity. People living in such conditions generate a range of immediate ‘unsafe conditions’. Such conditions make the poor more sensitive to disasters and exacerbate their poor economic status.

2.2.5 Sustainable Livelihood Framework

In an effort to address the unsafe conditions that was threatening the globe, the United Nations convened the Advisory Panel for World Commission on Environment and Development and in their 1987 Report of the Brundtland Commission\(^9\) they put forward the concept sustainable livelihood as a way of linking socio-economic and ecological considerations in development (WCED, 1987). They defined sustainable livelihood as adequate stocks and flows of food and cash to meet basic needs now and for future generations.

This was adopted and advocated during the 1992 United Nations Conference on Environment and Development as a mechanism to realise sustainable development. Sustainable development requires meeting the basic needs of all and extending to all the opportunity to satisfy their aspirations for a better life (United Nations, 1992).

\(^9\) Convened by the United Nations, the Brundtland Commission released a “unanimous report”, entitled Our Common Future. The document was the culmination of a “900 day” international-exercise which catalogued, analysed, and synthesised: written submissions and expert testimony from “senior government representatives, scientists and experts, research institutes, industrialists, representatives of non-governmental organizations, and the general public” held at public hearings throughout the world (World Commission on Environment and Development, 1987) The Brundtland Commission’s mandate was to: “[1] re-examine the critical issues of environment and development and to formulate innovative, concrete, and realistic action proposals to deal with them; [2] strengthen international cooperation on environment and development and to assess and propose new forms of cooperation that can break out of existing patterns and influence policies and events in the direction of needed change; and [3] raise the level of understanding and commitment to action on the part of individuals, voluntary organizations, businesses, institutes, and governments” (ibid.).
Chambers and Conway (1991) and Singh and Titi (1995) expanded the concept of sustainable development definition as people's capacities to generate and maintain their means of living, enhance their well-being and that of future generations. These capacities are contingent upon the availability of and accessibility to options which are ecological, socio-cultural, economic and political and are predicated on equity, ownership of resources and participatory decision-making.

A livelihood is sustainable when it can cope with and recover from stresses and shocks and maintain or enhance its capabilities and assets both now and in the future, while not undermining the natural resource base.

The Sustainable Livelihood framework provides a broad and systematic view of the factors that cause poverty-whether these are shocks and adverse trends, a basic lack of assets or poorly functioning institutions and policies and also investigate the relations between them.

Benson and Twigg (2007) reported that the concept of sustainable livelihood was used to develop the Disaster Resistant Sustainable Livelihoods (DRSL) focussing on disaster risk and poverty reduction. The reduction of poverty would certainly reduce the level of disaster sensitivity in a community.

The vulnerability of communities, economies and countries is thus a result of the interaction of hazards exposure, the economic status of households, the sensitivity of the environment and economy to hazards, the state of infrastructure, and the ability to respond to and cope with disaster events (Lal, Singh and Holland, 2009).

2.2.6 Vulnerabilities to Cyclone

Exposure to cyclones would include all countries that are located between 5 degree South and North of the equator since this is the zone where cyclones develop and intensify.
Garschagen et al. (2014) argued that the level of exposure of a country can be determined by the frequency of cyclones impacting that particular country and be classified as very low, low, medium, high and very high as shown in Map 2.1. Similar scenario can be seen within a country to identify areas which are more exposed to cyclones than others.

**Map 2.1 Exposure to cyclones by countries**

Source: Garschagen et al., 2014.

Vulnerability of a community to cyclones is determined by their exposure to cyclone as the hazard and the sensitivity of the elements at risk including people themselves, their properties, environment and their social systems (Turner et al., 2003). When a cyclone occurs it will shock all those elements at risk and only those that are better prepared will suffer fewer damages (World Bank, 2014). The poor are more likely to suffer than the rich (Freeman, Keen and Mani, 2003). They often live in areas which are more exposed to cyclones and accompanying floods and landslides. Cyclones can severely depress the food production and livelihoods of the poor since they would depend on what they grow as compared to the rich who can afford alternatives (ibid.). The poor are less likely to have huge savings nor able to afford insurance, thus more vulnerable.

### 2.2.7 Concept of Adaptability

The community’s ability to cope with the challenges increases after they adapt to the changing physical, social and economic conditions. The term ‘adapt’, refers to the various processes, policies and actions designed to limit the potential impacts
of climate change, climate variability, extreme events (World Bank, 2012). When countries fail to adapt, it means that they are not carrying out actions to suit the prevailing weather conditions, leaving their communities vulnerable to the threats posed by natural disasters (ibid.). Adaptation need to focus on future climate projections. Adaptation is dependent on factors such as knowledge, skills, resources, willingness and leadership by community leaders to accept that responsibility (World Bank, 2006).

Adapting to changes in the environment settings is not a new concept and has been seen with history of mankind. Various stories of adaptability in ancient times exemplify this. Biblically the Israelites’ adapt to wherever they settle like Abraham did when called in Haran to leave his country and family to a place he had never been to, Canaan (Genesis 12:1–3). He left with his wife Sarah, and brother’s son Lot with all their wealth and people and settled in Shechem in Canaan. They thrived and later build his Empire. He was able to thrive and build his Empire because he had adapted to the physical, social and economic environment.

Another prominent story of ancient times on adaptability is the story on Jacob and his sons who were living in Canaan. They were relocated to Egypt due to famine and temporarily settled there before they returned to their homeland when the drought had cleared (Genesis 45 and 46).

Adaptation may refer to a trait that is important for an organism’s survival. Charles Darwin (1859) in his theory on human evolution wrote:

"...Natural selection acts only by taking advantage of slight successive variations; she can never take a great and sudden leap, but must advance by short and sure, though slow steps."

UNISDR (2009) explained adaptation as the adjustment in natural or human systems in response to actual or expected climatic stimuli and their effects. This was further expanded by World Bank (2012) to include various processes, policies and actions designed to limit the potential impacts of climate change, climate variability, and extreme events.
Sun (2006) had a more practical expression for adaptation as making changes in order to reduce the vulnerability of a community, society or system to the negative effects of climate change and includes building skills and knowledge as well as making doing practical activities such as strengthening coastal infrastructure, adjusting farming systems, retrofitting houses and improving water management.

The countries which regularly face natural disasters, usually shock the physical environment, local communities have to develop adaptation strategies independently of higher authorities so that such strategies can be sustained and adapted when there is an impact (Huq, 2008). For example, in Vietnam, temporary houses are built with cheap material like bamboo, corrugated iron roof. When a storm comes, people store their household items and valuables with their relatives’ who have houses on high foundation (ibid.). The Thao Long dam was built at Dien Truong village with the purpose of preventing salt in the lagoon from penetrating into rice fields and Huong River. Besides, this dam is also used for leaving water in inundation season (Sun, 2006). In other sunken areas or areas near the river, the lagoon or the sea in Vietnam, houses are firmly built with high foundation, with ferro-concrete (ibid.). Besides, most of households have boats and lifebuoys.

Adaptation is not surrender, but a wise, pragmatic leadership which is required to ensure continued survival (World Bank, 2006). Communities have adapted to cyclones by incorporating traditional early warning signs with the new high technology ones where one can see the movement of the eye and predicting the direction and intensity over time. Changing construction materials of houses from predominantly locally available thatch materials to concrete and wooden with reinforcements and braces is an important adaptation measure. Cultivation of cyclone resistant crops is an example of cyclone adaptation that has been implemented (Sun, 2006; Huq, 2008).
2.2.8 Community Disaster Resilience to cyclones

According to numerous authors community disaster resilience is simply referred to as the capacity or ability of a community to recover quickly from impacts of disasters by means of its own resources (Twigg, 2007, Mayunga, 2007, Mohanty, 2006 and 2008, Cutter, Burton, and Emrich, 2010, UNESCAP and UNISDR, 2010). Adaptability and resilience are closely linked and are often used interchangeably which this thesis wishes to clearly define.

The term resilience is used in the same manner as the notion of “bouncing back”, linking to its Latin root “resiliere” meaning “to jump back” (Klein et al., 2003; Paton & Johnston, 2006).

Holling (1973) pointed out that the concept of resilience originates from the field of ecology and means the ability of an ecosystem to absorb changes and still persist. Later he compared the concept of resilience with the notion of stability, which he defined as the ability of a system to return quickly to its equilibrium after a temporary disturbance from pollutants. He concluded that resilience and stability are both two important properties of an ecological system. Therefore, a system can be very resilient but still with low stability.

In his work two decades later, Holling revisited his definition, and strengthened it to mean a buffer capacity or the ability of a system to absorb perturbation, or the magnitude of the disturbance that can be absorbed before a system changes its structure by changing the variables (Holling et al., 1995). Several others also attempted to clarify the definition of the term resilience looking at it from different perspectives.10

10 “Resilience is the speed with which a system returns to its original state following a perturbation” Holling et al (1995).

Alwang et al. (2001) defined “resilience is the ability to resist downwards pressures and to recover from a shock. From the ecological literature - property that allows a system to absorb and use even benefit change. Where resilience is high; it requires major disturbance to overcome the limits to qualitative change in a system and allow it to be transformed rapidly into another condition”. Walkers et al. (2006) said it is “potential of a system to remain in a particular configuration and to maintain its
The notion of resilience is growing as a concept for understanding and managing complex linked systems of people and nature (Klein, Nichols and Thomalla, 2003; Walker et al., 2006). Generally speaking, all ecological definitions place emphasis on the ability of a system to absorb disturbances without a change in its state. It is also clear that they focus more on stability and stress resistance to a disturbance and the speed of return to the equilibrium point (Adger, 2000). Although there are significant differences between social and ecological systems, the ecological theory on resilience concept is applicable to social systems as a way of conceptualizing hazards and their consequences.

This means that a resilient social system can absorb shocks and rebuild so that the community remains on the same functioning state. The social system with high resilience can be able to reconfigure itself without significant decline in the crucial functions in relation to primary productivity and economic prosperity (Pendall, Foster and Cowell, 2007).

Timmerman (1981) is probably the first to use the concept of resilience in relation to hazard and disaster and defined resilience as the measure of a system’s or part of the system’s capacity to absorb and recover from hazardous event. This can be viewed as resilience was the ability of a community to recover by means of its own resources.

Norris et al. (2008) also focus on community resilience and view it as a process linking the myriad of adaptive capacities (such as social capital and economic development) to responses and changes after adverse events. Here resilience is as a set of capacities that can be fostered through interventions and policies, which in turn help build and enhance a community’s ability to respond and recover from disasters.

feedbacks and functions, and involves the ability of the system to reorganize following the disturbance driven change.”
The concept of community resilience is shared by many disciplines hence makes it difficult to have a common definition. The concept of community disaster resilience is referred to as the capacity or ability of a community to prepare for, respond to, and recover quickly from impacts of disaster.

Ironically community resilience is not only the measure of how quickly the community can recover from the disasters’ impacts, but also the ability to understand, cope with or adapt to hazards. Thus, resilient communities should be able to minimise the effects of a disaster and be able to recover quickly.

Figure 2.6 shows the hypothetical line of transition of two communities; (1) a more resilient community (solid line) and (2) a less resilient community (dotted line).

**Figure 2.6 Hypothetical line of transition of resilient community**

![Image of two lines representing the transition of two communities over time through four phases: pre-disaster, disaster, restoration, and long-term recovery. The more resilient community (solid line) recovers more quickly, while the less resilient community (dotted line) suffers more damage and recovers more slowly.](image)


These two lines of transition represent a sequential change of communities over time through four phases, pre-disaster, disaster, restoration, and long-term recovery. Figure 2.3 shows that the more resilient community will suffer less shock from the disaster and will be able to bounce back over a short period of time. The less resilient community will incur more damages and will take longer to
bounce back and to reach the state of living they were before the disaster.

Both communities will receive and feel the shock over time but the difference is the ability to bounce back and continue to live normally before the disaster which had shock their system.

The resilient community will have a safe and stable physical environment, strong and vibrant local economy, strong social relations and active public actions on preparing for disasters (Walker et al., 2006). When these conditions are in order they will release the pressure caused by the natural disaster and they had adapted to the event.

2.2.9 Previous works in the Pacific and Fiji

The Pacific Island leaders had on October 2005 adopted the Regional Framework for Action on Building the Resilience of Nations and Communities to Disasters 2005 – 2015\(^{11}\) (SOPAC, 2005a). This Framework outlines national and regional activities to guide the reduction of vulnerabilities across the Pacific and the results of the study on impacts of disasters on the development efforts was used to influence leaders to adopt the framework (McKenzie, Prasad, Kaloumaira, 2005).

The Framework attracted funding support from traditional donors such as Australia\(^{12}\), World Bank and European Union\(^{13}\) to implement the activities especially research and initiatives across the region to better inform the levels of vulnerabilities. Once the levels of vulnerabilities were determined countries then commenced in implementing actions to reduce them.

\(^{11}\) The Regional Framework for Action (RFA) had adapted the Hyogo Framework for Action for DRR and DRM adopted by World Leaders in March 2005 (SOPAC,2005a). The RFA have 5 Themes which itemises national and regional activities. Theme 1 – Governance; Theme 2 – Knowledge, Information, public awareness and education; Theme 3 – Analysis and evaluation of hazards, vulnerabilities and elements at risk, Theme 4 – Effective preparedness, response and recover; Theme 5 – Early warning systems

\(^{12}\) AUSAID support for 14 countries to conduct National Tsunami Capacity Assessments: tsunami warning and mitigations system (Australian Bureau of Meteorology, 2008); AUSAID support for the Kiribati Water and Sanitation project which had conduct underground water assessment for all islands in Kiribati

\(^{13}\) EU funded (€1.868 million) Natural Disaster Facility for 14 countries; EU funded (€3,725,451) B envelope for 14 countries for Disaster Preparedness and Resilience; EU funded (€19,600) BSRP for 15 countries to Build Safety and Resilience.
In an effort to better understand the linkages between natural disaster and poverty, a study was commissioned by the UNISDR and SOPAC in 2009 focussing on Fiji as the case study (Lal, Singh and Holland, 2009). The study concluded that increased disaster risks are expected to exacerbate poverty (ibid.). The effects of disaster on the poor will be different, however, across regions and between the two ethnic communities because the poor are differently distributed across regions and ethnic groups. ADB (2004), in a study on hardships in Fiji found that major hardship is attributed to low income and that is even worse when calamities such as cyclones and floods impacted the country.

World Bank (2014) stated that family and community networks are central to life in most Pacific Island Countries, providing critical support to members in need and acting as safety nets when individuals or households experience losses from shocks. This is similar to arguments presented by Veitayaki (2009) that indigenous knowledge and practices had been cushioning the shocks caused by natural disasters in outer islands of Fiji. Knowledge on traditional warning signs such as bees having their nests at ground level immediately alert the communities that cyclone will come their way hence crops that can withstand strong winds such as sweet potatoes and giant taro are not used to await the arrival of the cyclone. Such capacity had enabled the communities to adapt and is able to bounce back very quickly after a cyclone.

2.3 Conclusion

The occurrence of natural disasters especially cyclone on any community is dependent on the various factors starting with the existence of the natural hazards. Due to changes that are now happening in the atmosphere, climate as well is changing rapidly causing high frequency and intensity of climate related hazards such as cyclones, floods and drought. When the natural hazard exists, the way it will affect a community is determined by their level of vulnerability. Vulnerability depends on exposure and sensitivity. Exposure is living in an area where hazard have potential to impact while sensitivity is the conditions of the system and
elements at risk to be able to sustain the impact of the hazards. Poorer communities are more sensitive since they cannot afford to buy lands away from the high risk areas and as well as the ability to build proper reinforced houses.

However it must be noted that communities with high capacity are able to cope with disasters and return to a normal life very quickly even though they may be poor. Such communities have adapted to the situation and have developed some form of coping mechanism after being exposed to such condition. This is evident in less death occurring, less damages to houses, continuous supply of food even when assistance is slow or not given at all.

The linkage on adaptability and resilience is when a community can adapt itself well it is also resilient or be able to recover quickly after an impact of disaster.

Theoretically, the community resilience is low and should take longer to recover from disasters but because of their strong adaptability capacity they are able to recover quickly and can continue with their daily routine days after an impact.
CHAPTER THREE
RESEARCH METHODOLOGY

3.1 Introduction

This chapter deals with the sources of data, research methodology and methods that were adopted in this research as well as the limitations and ethical considerations.

The chapter is divided into two main parts. The first part discusses the various research methodological approaches. The second part discusses the research design including sampling and research analysis that was adopted in the present study.

3.2 Research Methodological Approaches

A research methodology is guided by the research philosophy or the way in which the phenomenon selected to be studied should be gathered, analysed and used. The term epistemology (what is known to be true) as opposed to doxology (what is believed to be true) would dictate the philosophy of the research. Two major research philosophies that are often adopted in a research are either positivist (sometimes called scientific) or interpretivist (also known as anti-positivist) (Robson, 1993, and Green and Browne, 2006).

3.2.1 Positivism and Interpretivism

Positivists believe that reality is stable and can be observed and described from an objective viewpoint (Walsh, 2005), i.e. without interfering with the phenomena being studied. They contend that phenomena should be isolated and that observations should be repeatable. Predictions can be made on the basis of the previously observed and explained realities and their inter-relationships. It is so
embedded in our society that knowledge claims not grounded in positivist thought are simply dismissed as scientific and therefore invalid (Robson, 1993). Positivism has also had a successful association with the physical and natural sciences.

Interpretivists or anti-positivism means that only through the subjective interpretation and intervention reality can be fully understood (Robson, 1993). The study of phenomena in their natural environment is key to the interpretivist philosophy, together with the acknowledgement that scientists cannot avoid affecting those phenomena they study. They admit that there may be many interpretations of reality, but maintain that these interpretations are in themselves a part of the scientific knowledge they are pursuing (ibid.).

The phenomena that are being studied in either types of philosophies can be collected two main types of methodology namely; qualitative or quantitative.

3.2.2 Quantitative and Qualitative methodology

A quantitative method is best used for research that relates to counting or measuring phenomena (Green and Browne, 2006). It involves the use of standardised and scheduled questionnaire instead of the more open methods. The method of analysis will be more on manipulation of numerical data instead of the textual analysis in order to answer questions such as: “How much is the researched subject in the population?”, “Is there more subject x than subject y?”, “To what extent is subject x larger than subject y?”

The measurement scales on the manipulation of data are conventionally divided into four kinds depending on the relationships that are intended to be established (Green and Browne, 2006): (i) Nominal – this is the most basic level of measurement and involves classifying or labelling two or more categories such as employed or unemployed, age, gender etc.; (ii) Ordinal – this does not only labels the categories but ranks them in an order such as those employed by type etc.; (iii)
Interval – more information is added especially by providing more known differences between them such as employment type by salary scale 10,000 to 20,000; 21,000 to 30,000 etc. and (iv) Ratio – this is the strongest measurement scale with an absolute starting point (zero). This ensures that not only the distances between the points on the scale are compared but the proportion or ratio as well is compared. Price of an apple is $2 while price of an orange is 50 cents, it is possible to say that the price of an apple is four times as much as the price of an orange.

Quantitative research is based on statistics whether existing or collected by the researcher based on a sample of the population. Primary data in qualitative research are the original information collected by the researcher through field observations, interviews and questionnaires (Walsh, 2005; Green and Browne, 2006).

Qualitative methods explore meaning and findings not arrived at by means of quantification and will attempt to answer questions starting with where, what, why and how (Walsh, 2005; Green and Browne, 2006; Berglund, 2001; Robson, 1993). Qualitative method attempts to explore the underlying meanings and deeper causation of people's attitudes, perceptions, behaviours, value systems, motivations, aspirations and lifestyles (Walsh, 2005). These phenomena cannot be observed physically but can only be revealed through in depth interview with respondents over a period of time (Robson, 1993).

The data collection method commonly associated with qualitative methods that include participant observation, in-depth interview and focus group discussions. The qualitative method can also generate quantitative data. A qualitative method is characterised by not the data collection strategy used but by the aim of the study, and how the data produced are analysed (Green and Browne, 2006).

Qualitative methods will enquire on multiple realities to avoid assuming one viewpoint as the only valid and rational one. What appears common sense to one may not be true to another. This is called interpretative approach which starts from
the assumption that if you come to understand how the respondents see the world then you will understand the logic and rationale of what initially seem meaningless. This assumption is best described by Goffman (1961) as:

“any group of persons develop a life of their own that becomes meaningful, reasonable and normal once you get close to it and a good way to learn about any of those worlds is to submit oneself in the company of the members to the daily round of petty contingencies to which they are subject”.

Qualitative method also commits to naturalism which is to conduct study in its natural context (Denscombe, 2004). What the respondents say and do are being observed and recorded. The researcher can relate their responses to the environment that they live in and do their business.

Qualitative method also adopts a flexible and open strategy whereby the research question may be informed by the priorities and experiences of participants and become refined as a result of early data collection and analysis (Robson, 1993).

3.2.3 Population Sample

When conducting research, one must often use a sample of the population as opposed to using the entire population (Walsh, 2005). A population can be defined as any set of persons/subjects having a common observable characteristic. A sample is subset of the population or only a selected few within that entire population.

Robson (1993) point out three major reasons to sample as it is usually too costly to test the entire population; impossible to test the entire population, high chances of producing error, and make the research unreliable and useless. Walsh (2005), Robson (1993), Green and Browne (2006) described five types of sampling namely: (a) Convenience sample - Volunteers, members of a class, individual’s specific diagnosis being studied are examples of often used convenience samples. It is by far the most biased sampling procedure as it is not random (not everyone in
the population has an equal chance of being selected to participate in the study). (b) Simple random - All subject or elements have an equal probability of being selected. There are two major ways of conducting a random sample. The first is to consult a random number table, and the second is to have the computer select a random sample. (c) Systematic sample- As is conducted by randomly selecting a first case on a list of the population and then preceding every Nth case until your sample is selected. This is particularly useful if the list of the population is long. For example, if the list was the phone book, it would be easiest to start at perhaps the 17th person, and then select every 50th person from that point on. (d) Stratified sampling- we sample either proportionately or equally to represent various strata or subpopulations. For example, if our strata were states, provinces or islands we would make sure and sample from each of the states, provinces and islands. If our strata were religious affiliation, stratified sampling would ensure sampling from every religious block or grouping. If our strata were gender, we would sample both men and women (e) Cluster sampling- we take a random sample of strata and then survey every member of the group. For example, if our strata were individual schools, we would randomly select perhaps 20 schools and then test all of the students within those schools.

3.3 Sources of Data

As Walsh (2005) stated that the best sources of data are collected by the researcher in the field since it truly represents the views of those studied and it also allow the researcher to experience people’s living conditions. Such first-hand experience greatly assists in contextualising the data that will be collected.

Secondary data is gathered from unpublished and published material such as government reports, non-government organisation’s research, regional and international agencies’ reports and work of individual researcher (Walsh, 2005, and Green and Browne, 2006). Analysis of secondary data on cyclone adaptability and resilience that are analysed includes government reports, newspapers, magazines and work of other researchers.
3.4 Research Design

The philosophy adopted in this research was positivism hence the adoption of the methodology was based on the assumption that adaptation and resilience to cyclones can be determined from the actions that were taken by the people living in the study area.

3.4.1 Data Collection Methods

The recording of responses was done through note taking and digital rerecording. The consent of the respondents was obtained prior to the commencement of the interview. The use of both methods of recording the answers was adopted as a vital ingredient in the sharing of accurate information and renders the research more realistic. A number of methods that were employed in collecting information are discussed below.

3.4.1.1 Questionnaire

A questionnaire was developed as shown in Appendix 1 to guide the interview and was administered by the researcher. This was adopted to ensure that the same set of questions was asked in the same order and in the same way so that there is consistency in the information gathered. Popper (1959) and Ackroyd and Hughes (1981) pointed out that having too many questions would tire the respondents and the responses would not be as correct. The number of questions was therefore carefully selected to only obtain responses that will answer the research question.

3.4.1.2 Interview

Interviews was carried for the selected household head in the community with the guide of the questionnaire or with key questions only and followed up when the respondents start answering questions (Walsh, 2005; Green and Browne, 2006; Berglund, 2001 and Robson, 1993). This was adopted to ensure that there is no misinterpretation of the questions and the responses clarified. The interview was
carried out in a setting where other members of the community were also present to assist in clarifying the questions to the respondents and also to allow triangulation of the responses.

3.4.1.3 Observation

Observation had been a hallmark of both anthropological and sociological studies. Marshall and Rossman (1989) defined observation as "the systematic description of events, behaviours, and artefacts in the social setting chosen for study". Observations enabled the researcher to describe existing situations using the five senses, providing a "written photograph" of the situation under observation (Demunck and Sobo, 1998). This was adopted so that some of the issues such as the quality of house can be better described since each respondent would have their own different description.

3.4.1.4 Focus group discussion

Focus group discussions were also adopted where the researcher poses question to a small group of key informants to focus on the types of cyclone adaptability they had developed over the years (Green and Browne, 2006). The strength of focus group discussion is the validation process which usually takes place at the same time that the data collection is being conducted.

3.5 Sampling

Stratified sampling was employed where the target population of Kadavu Island was divided into suitable, non-overlapping sub-populations (strata) which were the existing Tikina boundaries. Each Tikina (stratum) have its clear boundary of demarcation and there is no overlap. A village from each of the nine Tikina in the province namely Ono, Nakasaleka, Yale, Naceva, Sanima, Ravitaki, Tavuki, Yawe and Nabukelevu was selected in the sample. Each of the Tikina had their own dialect, culture and even traditional leadership. This technique was adopted to ensure that the whole province of Kadavu was represented in the sample.
A sample size of 20 per cent was drawn from the households in the selected villages. This was done randomly and the distribution of samples in each village is given in Table 3.1. A total of 35 households were interviewed out of the 176 households that exist in the selected 9 villages.

<table>
<thead>
<tr>
<th>Tikina</th>
<th>Village</th>
<th>Total No of households</th>
<th>20% sample household selected</th>
<th>Total population covered</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ono</td>
<td>Dravuni</td>
<td>12</td>
<td>2</td>
<td>64</td>
</tr>
<tr>
<td>Nakasaleka</td>
<td>Kavala</td>
<td>21</td>
<td>4</td>
<td>96</td>
</tr>
<tr>
<td>Yale</td>
<td>Levuka</td>
<td>6</td>
<td>1</td>
<td>27</td>
</tr>
<tr>
<td>Naceva</td>
<td>Muanisolo</td>
<td>15</td>
<td>3</td>
<td>80</td>
</tr>
<tr>
<td>Sanima</td>
<td>Mataso</td>
<td>14</td>
<td>3</td>
<td>76</td>
</tr>
<tr>
<td>Ravitaki</td>
<td>Ravitaki</td>
<td>29</td>
<td>6</td>
<td>141</td>
</tr>
<tr>
<td>Tavuki</td>
<td>Namuana</td>
<td>32</td>
<td>6</td>
<td>156</td>
</tr>
<tr>
<td>Yawe</td>
<td>Nalotu</td>
<td>28</td>
<td>6</td>
<td>126</td>
</tr>
<tr>
<td>Nabukelevu</td>
<td>Kabariki</td>
<td>19</td>
<td>4</td>
<td>97</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>-</td>
<td><strong>176</strong></td>
<td><strong>35</strong></td>
<td><strong>863</strong></td>
</tr>
</tbody>
</table>

3.6 Research analysis

Data analysis can be carried in a number of ways and the objective is to make sense of the data being collected and be able to answer the research questions. In almost all research, the first step in data analysis would be data preparation which involves checking the data for accuracy; entering the data into the computer; transforming the data; and developing a database structure that integrates the various phenomena being studied (Walsh, 2005).

The interpretations of the data can be either descriptive or inferential. In descriptive type, researcher simply describes what the data shows. On the other hand, in inferential category, the researcher would infer from the sample data what the population thinks or make judgments about the general conditions.

The analysis of the data collected was carried out using excel spreadsheet. Firstly the data was prepared where accuracy was determined and each of the completed
questionnaire was assigned a number from 1 to 35. In this way the anonymity of the respondents are completely protected.

A table was created for each of the question in the questionnaire. The first column of the table created then has the number from 1 to 35 and the response to the question became the title of subsequent column. The number “1” was entered in the cell corresponding to the responses from the interviewees.

Once all the data have been entered then the totals are determined to show which response is more common and which is least common. These comparisons are illustrated through bar graph and histogram.

3.7 Study area

The study area of this research was the province of Kadavu the southernmost island of the Fiji group. Kadavu is one of the 14 provinces in Fiji and has been impacted by a number of tropical cyclones during the 1970’s and 1980’s. Detail description of the study area is provided in Chapter Four.

3.8 Study Limitations

The research was limited by a number of reasons but primary are resources and time. The research was undertaken by the researcher who was on fulltime employment with the Secretariat of the Pacific Community.

The resources for the study were provided by the University of the South Pacific and adequate to cover transportation to Kadavu and within to the villages that have been selected. There was no other support for additional research assistant.

Field work was carried out during leave which does not allow for more time to administer the questionnaire. The researcher had to limit the time in a village to a day to be able to cover all the selected 9 villages.
Secondary constraints were the weather and tide which was beyond the researcher’s control. Since the majority of the villages in Kadavu can only be accessed by sea, the researcher had to be mindful of the tide since at low tides some of the villages cannot be accessed. In a number of occasions when the tide was high, the sea was so rough with strong winds and heavy rain but the researcher had to endure those conditions in order to complete the research.

A primary consideration in the study is to conduct it in an ethical manner which is to let the community know the purpose of the research, seek their permission to participate and to honestly maintain the information obtained for the research purpose (Dewalt and Dewalt (2002). Some of the information obtained was quite critical with certain aspects of the Disaster Management system such as lateness in provision of early warning, but that information cannot be shared since they were provided for the research purpose. Sharing the information with authorities would result in the community being victimised.

3.9 Conclusion

Literature was researched adequately to determine the most appropriate method for this research. This is necessary to ensure credibility on the results that can be generalised for the population. A well founded methodology will enhance the credibility of the overall research and conclusion can be applied to improve the living standard.

The methodology adopted in this research was simple and clear and can be replicated at any place by any researcher. With more resources and time the sample could be increased which will give some strong inferences of the findings.
CHAPTER FOUR

BACKGROUND OF FIJI AND KADAVU ISLAND

4.1 Introduction

This chapter deals with the background of Fiji and the study area which is the island of Kadavu. The chapter is divided into two main parts and the first deals with background of Fiji covering the geography, climate, history, demographics, economy and past disasters. The second part describes the study area in detail looking at physical setting, demography, economy, social setting and disaster management.

4.2 Fiji context

Fiji is one of the 193 members of the United Nations that gained independence from Great Britain on 10th October, 1970 and is classified as a developing nation. Fiji is a middle income developing country with a medium Human Development Index value and is located in the South Pacific region.

4.2.1 Geography

Fiji is located in the western South Pacific Ocean between 177 degree East to 178 degree West and 16 degree South to 20 degree South and has 322 islands of which 110 are inhabited and a total land area of 18,333 km² as shown in Map 4.1.

The two major islands of Viti Levu and Vanua Levu had a land area of 10,429 and 5,556 square kilometre, respectively which is approximately 87% of the total land mass (Government of Fiji, 2005). Land areas of other smaller islands and the type of islands is presented in Table 4.1. The total Exclusive Economic Zone (EEZ) of Fiji covers an area of 1.3 million square kilometre.
The highlands are volcanic in origin and the last active volcano was estimated to have erupted in the 1400s (SOPAC, 1999). The Taveuni volcanic study conducted by Shane Cronin suggests that the return period of volcanoes during the active years was 60 years. Given the last eruption was well over 600 years ago, an estimation of the next eruption cannot be easily determined (SOPAC, 1999).

Table 4.1  Characteristics of Fiji’s Bigger Islands

<table>
<thead>
<tr>
<th>Island</th>
<th>Land area (km²)</th>
<th>Height above sea level (m)</th>
<th>Origin</th>
</tr>
</thead>
<tbody>
<tr>
<td>Viti Levu</td>
<td>10,429</td>
<td>1324</td>
<td>Volcanic</td>
</tr>
<tr>
<td>Vanua Levu</td>
<td>5,556</td>
<td>1111</td>
<td>Volcanic</td>
</tr>
<tr>
<td>Taveuni</td>
<td>470</td>
<td>1241</td>
<td>Volcanic</td>
</tr>
<tr>
<td>Kadavu</td>
<td>411</td>
<td>822</td>
<td>Volcanic</td>
</tr>
<tr>
<td>Gau</td>
<td>140</td>
<td>738</td>
<td>Volcanic</td>
</tr>
<tr>
<td>Ovalau</td>
<td>106</td>
<td>625</td>
<td>Volcanic</td>
</tr>
<tr>
<td>Koro</td>
<td>105</td>
<td>520</td>
<td>Volcanic</td>
</tr>
<tr>
<td>Moala</td>
<td>62</td>
<td>468</td>
<td>Volcanic</td>
</tr>
<tr>
<td>Lakeba</td>
<td>60</td>
<td>219</td>
<td>Volcanic</td>
</tr>
<tr>
<td>Matuku</td>
<td>57</td>
<td>385</td>
<td>Volcanic</td>
</tr>
<tr>
<td>Vatuabalavu</td>
<td>53</td>
<td>283</td>
<td>Volcanic</td>
</tr>
</tbody>
</table>

4.2.1.1 Climate

The seasonal cycle is strongly affected by the South Pacific Convergence Zone (SPCZ) (Map 4.2). The SPCZ is a band of low-level wind convergence, cloud and precipitation extending from the Western Pacific Warm Pool at the maritime continent south-eastwards towards French Polynesia and as far as the Cook Islands (160W, 20S). SPCZ can change its location and orientation during summer and winter (Australian Bureau of Meteorology (ABoM) and Commonwealth Scientific and Industrial Research Organisation (CSIRO), 2011).

Map 4.2 Positions of climate features of Pacific region, November to April


The areas exposed to the trade winds like the eastern parts of the main islands receive mean annual rainfall in excess of 4000 mm, while the leeward side like the western side receive on an average less than 2000 mm annually. This is confirmed by the analysis of the rainfall patterns from 1961 – 1990 as shown in Figure 4.1. Suva located in the on the east, windward side, receives on average more rainfall than Lautoka and Nadi who are both located on the leeward side of Viti Levu.
Fiji’s weather is divided into two seasons; winter from November to April and summer from May to October. The winter season is associated with more rainfall which is depicted in Figure 4.2 below for the 30 year monthly rainfall from 1961 to 1990.

The winter season is associated with the cyclone season. Majority of the cyclones that had impacted Fiji occurs during those months while a few had happened outside. During the drier season, drought is experienced due to low rainfall as shown in Figure 4.2. In El Nino year prolonged drought may be experienced.
Fiji is located in the areas where the cyclones develop and intensify hence in any cyclone season the country is impacted either from cyclone winds, storm surges or high rainfall resulting in flood (Mohanty 2015). The country is therefore highly exposed to cyclone, flood and drought.

4.2.2 Brief History

Fiji is known to have been settled by different groups of migrants from 2000 BC through 830 BC who settled in different parts of the country and form up into tribes (Derrick, 1948). Different tribes had to defend their land boundaries and leadership which often resulted in tribal war and captives were a delicacy for the winning tribes. Communalism were a strong element of survival combined with strong division of labour where men were expected to collect food and defend the tribe while women were required to care for the children and attend to other household chores such as cooking food, washing clothes and cleaning the house.

Cannibalism and tribal wars were common when the islands was discovered by Dutch explorer Abel Tasman in 1643 followed by English navigator James Cook in 1774 and by Captain William Bligh, who sailed through Fiji in 1789 and 1792 following the mutiny on the H.M.S. Bounty (Derrick, 1948 and Ravuvu, 1988). All these captains avoided landing due to fear of being attacked by habitants which was experienced by Abel Tasman when in New Zealand during his first trip down south in 1642 (Ravuvu, 1988).

Explorers and traders from Europe, New England and Australia continued to increase since sandalwood and beche-de-mer were two most sought commodity. Gains from the two trades went directly into the hands of shipowners and traders (Narayan, 1984). This continued into 19th century and they brought ammunition which was exchanged for such commodities and these weapons were used to reinforce the powers of chiefs such as Ratu Epenisa Seru Cakobau of Bau Island (ibid.).
The arrival of the missionaries in 1835 brought significant changes to the social dimensions and tribal relationship in Fiji. They endured the sights of people being slaughtered, cut into pieces, cooked and eaten as they spread the gospel and converting them to Christianity (Nayacakalou, 1957). By 1861 they had converted 60,000 to Christianity after Cakobau accepted Christianity in 1854 and other chiefs follow suit thus lowering the number of tribal wars as more and more people were converted (Narayan, 1984).

Stability was slowly realised and in 1865 a confederacy of native kingdoms was established and Fiji’s first constitution was drawn up and signed by seven independent chiefs of which Cakobau was elected president for two years in a row. The confederacy collapsed in 1867 due to a number of reasons one of which was the murder of missionary Rev Thomas Baker in the highlands of Navosa as there were rumours of conspiracy from prominent chiefs (Ravuvu, 1988).

Western influence continued to grow stronger and in 1871, with the support of approximately 2000 Europeans, a national government was formed led by Cakobau setting the platform for the powerful chiefs to collectively agree to cede Fiji to United Kingdom on October 10, 1874. The decision to cede Fiji to United Kingdom was based on inability of Cakobau to pay debts owed to American citizens (Derrick, 1948).

The social structures and political landscape closely resembled the existing set up since Sir Arthur Gordon, the first Governor did not wish to bring about sweeping changes but to work with chiefs so that colonial government could maintain order and stability. All policies being introduced reinforced the powers of the chiefs and constraining individualism, and innovation of the indigenous population (Ravuvu 1988). The creation of the Native Affairs Regulations in 1877 had spearheaded that control. The Native Regulations established the Fijian Administration having jurisdiction over Fijians, with the Provincial Council headed by a “Roko Tui” and at district and villages levels the Fijians were administered by the “Buli “and Turaga ni koro respectively both of whom were traditional leaders (Derrick, 1948).
The regulations demanded that a person who wanted to visit a different district had to seek permission. A man who wished to marry a woman from another province had to obtain approval from their Provincial Councils. Participation of men in communal activities such as house construction, garden preparation, village cleaning were mandatory whenever required by the “Turaga ni koro” and those in defiance could be fined or sent to prison (ibid.).

The Legislative Council in 1913 endorsed the nature of the Fijian social structures as shown in Figure 4.3. G. V. Maxwell was appointed to supervise the Native Lands Commission in 1912 and only after 6 months of field work had submitted that proposal to the Legislative Council and after the adoption shaped what exists today (Ravuvu, 1988).

**Figure 4.3. Fijian social structure**

![Diagram of Fijian social structure](image)


Narayan (1984) stated that the social status of the Fijian men are determined by their birth and sex which had reinforced the division of labour adopted in the early days of settlement being dominated by tribal war and cannibalism.

Fijians were then registered with Native Lands Commission in a register which is now called “Vola ni Kawa Bula”. The Lands Claim Commission established in 1875 had determined classes of land ownership; Freehold, Crown Land and Native Land. Ownership of freehold and crown land has been determined while the challenge was for the native lands.
The “Vola ni kawa bula” was then used as the native lands ownership register since the Fijians were registered to each mataqali. The colonial government was eager to promote more economic activities but the native land administration was still a stumbling block since there were challenges in obtaining endorsements for all members of the mataqali.

In its effort to manage that challenge, the Native Lands Trust Board (NLTB) was established in 1940 to manage all native lands, especially the non reserved to be leased out for agricultural and commercial purposes while the reserved ones were left for Fijians to use for their daily sustenance. However, the sharing of land rentals were still favoring the traditional leaders who are allocated 5 per cent outright from the proceeds 10 per cent retained by the NLTB for their administration costs leaving the 85 per cent to be shared by other members of the mataqali (Ravuvu, 1988). This increases the vulnerability of the indigenous population when they have limited access to land ownership. They cannot invest in their land since it is communally owned.

The restriction on the movement of Fijians out of the villages under the Native Affairs Regulations and the perception that would be able to work on sugar cane fields owned by the Australian based Colonial Sugar Refinery (CSR) Limited prompted Sir Arthur to consider obtaining labour from the crown colony of India where he had worked before (Naidu, 2004). The first group of 463 laborers arrived in 1879 and recruitment continued on until 1916. Majority of laborers opted to stay on in Fiji and their descendants made a lot of impacts on the shaping of the social, economic and political developments of the country (Naidu, 2004).

The political system from the late 1800s until the 1960s, remained a racially divided where Fijians, Indians and Europeans all elected or nominated their own representatives to the legislative council. This continued on to independence on October 10, 1970 and to the subsequent governments after the coups in 1987, 2000 and 2006. Fiji had adopted the Westminster system, where there is house of elected members and a house of nominated members called the senate. The current
constitution had finally changed that arrangement where representation in Parliament is not divided on racial line but one person one vote where all are equal. The Westminster system has been modified now with only the house of elected members as the law making institution. The executive and the judiciary remain the same being led by the Prime Minister and the Chief Justice respectively.

The indigenous population in the 1700s changed when traders start arriving in the 1800s and then the arrival of labourers from India added another group. Labourers as well were recruited in cotton plantations from Pacific Island countries especially Solomon Island and Vanuatu. They also remained and call Fiji home until today. Asian traders especially Chinese came and settled in Fiji in the early 1900s and the country have a multi ethnic, multicultural population.

4.2.3 Demographic and Household Growth

The census data from 1956 is presented in Table 4.2 while Figure 4.4 shows the population composition by ethnicity during 1881-2007.

Table 4.2 Fiji Population Composition by Ethnicity, 1956 to 2007

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Chinese</td>
<td>4,155</td>
<td>5,149</td>
<td>4,652</td>
<td>4,784</td>
<td>4,939</td>
<td>4,704</td>
</tr>
<tr>
<td>European</td>
<td>6,402</td>
<td>6,590</td>
<td>4,929</td>
<td>4,196</td>
<td>3,103</td>
<td>2,953</td>
</tr>
<tr>
<td>Fijians</td>
<td>148,134</td>
<td>202,176</td>
<td>259,932</td>
<td>329,305</td>
<td>393,575</td>
<td>475,739</td>
</tr>
<tr>
<td>Indian</td>
<td>169,403</td>
<td>240,960</td>
<td>292,896</td>
<td>348,704</td>
<td>338,818</td>
<td>313,798</td>
</tr>
<tr>
<td>Part European</td>
<td>7,810</td>
<td>9,687</td>
<td>10,276</td>
<td>10,297</td>
<td>11,685</td>
<td>10,771</td>
</tr>
<tr>
<td>Rotuman</td>
<td>4,422</td>
<td>5,797</td>
<td>7,291</td>
<td>8,652</td>
<td>9,727</td>
<td>10,335</td>
</tr>
<tr>
<td>Other Pacific Islanders</td>
<td>5,320</td>
<td>6,095</td>
<td>6,822</td>
<td>8,627</td>
<td>10,463</td>
<td>15,311</td>
</tr>
<tr>
<td>All others</td>
<td>91</td>
<td>273</td>
<td>1,270</td>
<td>810</td>
<td>2,767</td>
<td>3,660</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>345,737</td>
<td>476,727</td>
<td>588,068</td>
<td>715,375</td>
<td>775,077</td>
<td>837,271</td>
</tr>
</tbody>
</table>

Figure 4.4 shows Fiji’s Population Composition by Ethnicity during 1881 – 2007.

**Figure 4.4 Fiji Population Composition by Ethnicity, 1881 to 2007**

Table 4.2 and Figure 4.4 display demographic trends especially between the two major ethnic groups: the Fijian and Indians. Fijian numbers had decreased proportionally from 1881 to 1966 and then increased after 1986. The Indian population had continuously increased from 1881 to 1986 and then records a decrease. There may be a number of contributing factors to this trend but one that is quite strong as the political upheavals in 1987, 2000 and 2006. There was a mass exodus of the Indian population to countries like Australia, New Zealand, United States and Canada to name a few after those events. Majority fled for the safety of their families given the events that had ensued after the coups in 1987 and 2000. Other vital statistics in Fiji during the period 1986 to 2007 are shown in Table 4.3.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Rural pop (% of total pop)</td>
<td>58</td>
<td>51</td>
<td>47</td>
</tr>
<tr>
<td>Urban pop (% of total pop)</td>
<td>42</td>
<td>49</td>
<td>53</td>
</tr>
<tr>
<td>Literacy rate (%)</td>
<td>95</td>
<td>95</td>
<td>98</td>
</tr>
<tr>
<td>Life expectancy at birth (year)</td>
<td>67</td>
<td>68</td>
<td>68</td>
</tr>
<tr>
<td>Infant Mortality rate per 1000 live birth</td>
<td>22</td>
<td>21</td>
<td>20</td>
</tr>
<tr>
<td>Birth rate (%)</td>
<td>21</td>
<td>22</td>
<td>20</td>
</tr>
</tbody>
</table>

The trend in rural and urban population shows that while rural population is decreasing, urban population is increasing. In 1970 only 30 per cent of population were in urban areas (United Nations, 2004). By 2007, the majority of population resided in towns and cities which have limited land area and natural resources as compared to the rural areas. This exerts enormous pressure on the town and city councils services which are designed to suit their respective ratepayers. Services such as water supply and sewerage systems had to be provided through central government support to cater for the increase in population.

The influx of people especially to Suva and Nausori resulted in growth of Suva’s peri-urban areas and consequently, the birth of Nasinu as a town. The declaration of Nasinu town was intended to relieve the Suva City Council. Nausori Town Council is responsible for providing basic services such as garbage collections, street lights, drainage clearing, roadside grass cutting and street cleaning.

There are a number of factors to the increase in rural to urban migration. One of them is the expiration of land leases for cane farms forcing them to leave their land. While some had earlier made investments in purchasing properties in urban centres the majority were forced to relocate and reside in informal settlements called “squatter settlements” (Mohanty, 2006).

4.2.4 Economy

Fiji’s economy has been dependent on a few exports such as sugar, garments, gold, fish and light manufactures before shifting in 1980s to an important policy shift toward a more market-oriented, outward-looking development strategy (ADB, 2012). In this context, Fiji gradually liberalized its trade and reduced import restrictions in favour of export promotion; these measures increased the volumes of exports and imports. This open trading approach created jobs in industries like textiles and tourism (ibid.).
The economy was recording an average growth rate of 3.4 per cent between 1971 to 1986 (Gounder 2008; ADB, 2012). From 1987 to 2007 this fell to 2.4 per cent and then from 2008 – 2011 this fell even further to -0.34 per cent (ibid.). This is attributed to the limited natural resources, political instability, environmental vulnerability and limited access to global markets (Gounder, 2002; ADB, 2012).

Fiji’s real gross domestic product (GDP) per person has increased over time, reaching F$3,722 in 2006, however this value has not been equitably distributed across all community resulting in differential levels of poverty across geographical regions, ethnicity and between rural and urban areas (Lal, Singh and Holland, 2009). Poverty was measured in Fiji using the income level to be able to meet basic which was regarded as the Basic Needs Poverty Line (BNPL) or the monetary value of goods and services that a household needs to consume as a minimum, so as to ensure what society agrees to represent a “minimum decent standard of living” (Narsey, 2008). The basic needs poverty line in Fiji was estimated at F$33 per week or F$132 per month or F$1,584 per year. About 35 per cent of the households were under poverty (ibid.).

When a disaster happens the poor households are affected more due to their low income to purchase alternative sources of food when their crops are damaged or to be able to repair their houses (Lal, Singh and Holland, 2009).

McKenzie, Prasad and Kaloumaira (2005) reported that cyclone Ami resulted decline in different sectors of the economy. Exports had declined meaning worsening balance of payments. Other key indicators, such as private consumption, income, investment and savings declined, leading to a reduction in real GDP which eventually led to declining levels of welfare for the people of Fiji (ibid.). In the agriculture sector, the direct impacts on subsistence crops were estimated at a cost of FJS$921,000 while the estimates to damages on commercial crops such as dalo, yaqona, and copra was FJS$39.3 million. The sugar industry suffered total direct damage estimated at FJS$13.6 million (ibid.).
4.2.5 Disasters

Tropical cyclones continue to dominate the type of disasters that had impacted Fiji since Independence in 1970 till today (World Bank, 2006; Terry, 2007). The last major catastrophic tropical cyclone was in 1952 before Cyclone Bebe that stroke in 1972 (Table 4.4). Table 4.4 shows the frequency of tropical cyclones in Fiji.

Table 4.4  Fiji Cyclone events, 1931 to 2014

<table>
<thead>
<tr>
<th>Date of impact</th>
<th>Name of Cyclone</th>
<th>Area impacted</th>
<th>No of people killed</th>
<th>Estimated cost of damage (000 FJD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1931</td>
<td></td>
<td>Whole of Fiji</td>
<td>200</td>
<td>-</td>
</tr>
<tr>
<td>1952</td>
<td></td>
<td>Whole of Fiji</td>
<td>23</td>
<td>-</td>
</tr>
<tr>
<td>October, 1972</td>
<td>Bebe</td>
<td>Whole of Fiji</td>
<td>20</td>
<td>28,000</td>
</tr>
<tr>
<td>1973</td>
<td>3 small cyclones</td>
<td>Northern</td>
<td>80</td>
<td>5,000</td>
</tr>
<tr>
<td>1977</td>
<td></td>
<td>Kadavu and Lau</td>
<td>0</td>
<td>870</td>
</tr>
<tr>
<td>March, 1979</td>
<td>Meli</td>
<td>Kadavu, Lau</td>
<td>53</td>
<td>3,800</td>
</tr>
<tr>
<td>1980</td>
<td></td>
<td>Central, Northern</td>
<td>22</td>
<td>6,900</td>
</tr>
<tr>
<td>1981</td>
<td></td>
<td>Central, Northern</td>
<td>5</td>
<td>7,800</td>
</tr>
<tr>
<td>March, 1983</td>
<td></td>
<td>Western, Kadavu</td>
<td>3</td>
<td>79</td>
</tr>
<tr>
<td>January, 1985</td>
<td>Eric</td>
<td>Western, Kadavu</td>
<td>26</td>
<td>70,000</td>
</tr>
<tr>
<td>January, 1985</td>
<td>Nigel</td>
<td>Western, Kadavu</td>
<td>0</td>
<td>30,000</td>
</tr>
<tr>
<td>1986</td>
<td>Raja</td>
<td>Northern, Central</td>
<td>1</td>
<td>28,000</td>
</tr>
<tr>
<td>1990</td>
<td>Sina</td>
<td>Western, Central</td>
<td>0</td>
<td>72,000</td>
</tr>
<tr>
<td>March, 1992</td>
<td>Fran</td>
<td>Western, Kadavu</td>
<td>0</td>
<td>1,600</td>
</tr>
<tr>
<td>January, 1993</td>
<td>Kina</td>
<td>Whole of Fiji</td>
<td>23</td>
<td>200,000</td>
</tr>
<tr>
<td>1995</td>
<td></td>
<td>Whole of Fiji</td>
<td>25</td>
<td>26,000</td>
</tr>
<tr>
<td>March, 1997</td>
<td>Gavin</td>
<td>Northern</td>
<td>0</td>
<td>27,000</td>
</tr>
<tr>
<td>June, 1997</td>
<td>Keli</td>
<td>Northern</td>
<td>0</td>
<td>25,000</td>
</tr>
<tr>
<td>January, 1999</td>
<td>Susan</td>
<td>Western, Kadavu</td>
<td>12</td>
<td>4,000</td>
</tr>
<tr>
<td>February, 2001</td>
<td>Paula</td>
<td>Western, Kadavu</td>
<td>0</td>
<td>1,600</td>
</tr>
<tr>
<td>December, 2002</td>
<td>Zoe</td>
<td>Western, Kadavu</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>January, 2003</td>
<td>Ami</td>
<td>Northern, Lau, Lomaiviti</td>
<td>19</td>
<td>44,000</td>
</tr>
<tr>
<td>January, 2006</td>
<td>Raja</td>
<td>Northern, Lomaiviti, Lau</td>
<td>0</td>
<td>2,000</td>
</tr>
<tr>
<td>April, 2007</td>
<td>Cliff</td>
<td>Northern</td>
<td>0</td>
<td>4,000</td>
</tr>
<tr>
<td>December, 2007</td>
<td>Darman</td>
<td>Northern</td>
<td>0</td>
<td>10,000</td>
</tr>
<tr>
<td>January, 2008</td>
<td>Gene</td>
<td>Northern, Eastern</td>
<td>0</td>
<td>2,000</td>
</tr>
<tr>
<td>December, 2009</td>
<td>Mick</td>
<td>Western, Kadavu</td>
<td>0</td>
<td>6,000</td>
</tr>
<tr>
<td>March, 2010</td>
<td>Tomas</td>
<td>Northern, Eastern</td>
<td>0</td>
<td>39,000</td>
</tr>
<tr>
<td>January, 2011</td>
<td>Wilma</td>
<td>Eastern</td>
<td>0</td>
<td>12,000</td>
</tr>
<tr>
<td>June, 2011</td>
<td>Vania</td>
<td>Western, Kadavu</td>
<td>0</td>
<td>23,000</td>
</tr>
<tr>
<td>December 2012</td>
<td>Evan</td>
<td>Western, Kadavu</td>
<td>0</td>
<td>100,000</td>
</tr>
<tr>
<td>January, 2014</td>
<td>Ian</td>
<td>Eastern</td>
<td>0</td>
<td>5,000</td>
</tr>
</tbody>
</table>

Source: SOPAC, 2011.
There is a strong link between cyclone and floods. As more and more evaporation takes place, precipitation increases resulting in heavy rain which causes floods along river banks (Australian Bureau of Meteorology and Commonwealth Scientific and Industrial Research Organisation, 2011). Almost all cyclones are followed by floods while some depressions which do not fully develop to cyclones also bring substantial rain which causes flash floods as presented in Table 4.5.

Table 4.5 Floods Associated with Tropical Depressions 1986 to 2009

<table>
<thead>
<tr>
<th>Date of impact</th>
<th>Area impacted</th>
<th>No of people killed</th>
<th>Estimated damage cost (F$ million)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1986</td>
<td>Northern division</td>
<td>19</td>
<td>215.0</td>
</tr>
<tr>
<td>2004</td>
<td>Central &amp; Western division</td>
<td>11</td>
<td>12.6</td>
</tr>
<tr>
<td>2009</td>
<td>Western division</td>
<td>11</td>
<td>113.0</td>
</tr>
</tbody>
</table>

Source: SOPAC, 2011.

Relative to the positioning of the South Pacific Convergence Zone (SPCZ), Fiji is also prone to El-Nino events (Australian Bureau of Meteorology and Commonwealth Scientific and Industrial Research Organisation, 2011). During an El-Nino event, weather conditions are drier and hotter than normal. This results in drought which is devastating in small islands with limited ground water. Table 4.6 shows three extreme drought events that have been recorded in Fiji.

Table 4.6 Fiji Drought Events 1983 to 1998

<table>
<thead>
<tr>
<th>Date of impact</th>
<th>Area impacted</th>
<th>Estimated damage cost (F$ million)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1983</td>
<td>Whole of Fiji</td>
<td>31.0</td>
</tr>
<tr>
<td>1993</td>
<td>Whole of Fiji</td>
<td>30.0</td>
</tr>
<tr>
<td>1997/98</td>
<td>Whole of Fiji</td>
<td>60.0</td>
</tr>
</tbody>
</table>

Source: SOPAC, 2011.

Fiji also lies within the active Pacific subduction zone also called the “Ring of Fire”. The subduction zone as presented in Figure 1.1 is where earthquakes take place and generate tsunami waves. As discussed in Chapter 1, approximately 57 per cent of the tsunamis that had impacted the world since 2,000 B.C, were caused by the earthquake that occurs in the Ring of Fire (Bernard and Robinson, 2009).
Fault lines within the subduction zone runs across the Fiji islands and earthquake is often felt as shown in Table 4.7. The only known earthquake that had generated tsunami waves was in 1953 which had impacted the capital city of Suva resulting in 8 deaths (Houtz, 1962). The earthquake and tsunami threat in Fiji is real and should not be ignored or undermined.

Table 4.7 Fiji Earthquake and Tsunami Events, 1928 to 2001

<table>
<thead>
<tr>
<th>Year</th>
<th>Magnitude (MS)</th>
<th>Epicentre</th>
<th>Location Place Felt</th>
<th>Death / Injury</th>
</tr>
</thead>
<tbody>
<tr>
<td>1928</td>
<td>7.0</td>
<td>17.0S 179.5W</td>
<td>Taveuni</td>
<td>None reported</td>
</tr>
<tr>
<td>1932</td>
<td>6.6</td>
<td>16.2S 179.7W</td>
<td>Rabi, Tunuloa</td>
<td>None reported</td>
</tr>
<tr>
<td>1932</td>
<td>6.5</td>
<td>17.5S 179.6E</td>
<td>Koro, Ovalau, Savusavu, Rabi, and northern Taveuni</td>
<td>None reported</td>
</tr>
<tr>
<td>1950</td>
<td>6.5</td>
<td>18.9S 177.8E</td>
<td>Kadavu</td>
<td>None reported</td>
</tr>
<tr>
<td>1953</td>
<td>6.8</td>
<td>18.25S 178.25E</td>
<td>Suva, Navua, Kadavu</td>
<td>8 deaths</td>
</tr>
<tr>
<td>1957</td>
<td>5.0</td>
<td>16.7S 179.8E</td>
<td>Taveuni</td>
<td>None reported</td>
</tr>
<tr>
<td>1979</td>
<td>6.9</td>
<td>16.5S 179.75W</td>
<td>Taveuni</td>
<td>None reported</td>
</tr>
<tr>
<td>1983</td>
<td>4.8</td>
<td>19.06S 177.77E</td>
<td>Kadavu</td>
<td>None reported</td>
</tr>
<tr>
<td>1984</td>
<td>6.1</td>
<td>16.79S 177.3E</td>
<td>Yasawa</td>
<td>None reported</td>
</tr>
<tr>
<td>1998</td>
<td>6.0</td>
<td>19.4S 177.5E</td>
<td>Kadavu</td>
<td>None reported</td>
</tr>
<tr>
<td>2001</td>
<td>5.8</td>
<td>19.0S 177.4E</td>
<td>Kadavu</td>
<td>None reported</td>
</tr>
</tbody>
</table>

Source: SOPAC, 2011.

4.3 Kadavu

Kadavu is the southernmost inhabited island of Fiji and is approximately 50 miles from the capital Suva. It is conveniently situated and easily accessible along the great ocean highway between Australia and San Francisco (Thomson, 1881).
4.3.1 Physical Setting

The Kadavu island group centred around 19°S 178°20'E in southern Fiji as shown in Map 4.1. The island is 60 km long, with a width varying from 365 metres to 13 kilometres at Namalata which separates Namalata Bay on the northern coast from Galoa Harbour on the southern coast. The island is characterized by its rugged and mountainous terrain with the highest peak being 822 meters above sea level known as Mount Washington on the western end of the island.

The main island of Kadavu and the small ones adjacent to it like Nagigia, Ono, Buliya, Dravuni, Yaukuve were formed as the result of coalescence of a number of volcanoes that were active over two million years ago (Nunn, 2000).

Kadavu is blessed with fertile soil and combined with tropical climate presents ideal conditions for the growth of a variety of fruit trees and root crops. The island has a thick rainforest cover which is home of a rich bird diversity, including four species endemic to the island, the velvet dove, the crimson shining-parrot, the Kadavu honeyeater and the Kadavu fantail (Thomson, 1881). Offshore, stringing around the Island, is the Great Astrolabe Reef, a large barrier reef that provides support to a rich marine ecosystem.

4.3.2 Demography

The population of the island of Kadavu was 10,167 which is 1.2 per cent of the overall national population (Fiji Islands Bureau of Statistics, 2008). Majority of the population was below 20 years of age (43 per cent) followed by those between 21 to 40 years of age (28 per cent), between 21 to 60 years of age (20 per cent) and those above 60 were the least (10 per cent) as shown in Figure 4.5 below. 53 per cent of the population were males and 47 per cent are females.
Household composition is similar to many other rural traditional households around Fiji which are patrilineal extended families (Cook, 1974). The Kadavu traditional households live together in villages and only a few had settled in their leaseholds. Those living in villages may have different sleeping houses but have common cooking places. This means that a family with three or four brothers may have their own families but are sharing that cooking place and often would be eating together with their parents. This implies that in the event of a disaster they would automatically share their food and even support each other should one of houses is being blown down.

4.3.3 Economy

The Kadavu is one of the least developed areas of Fiji with only few roads and the majority rely on outboard punts as their means mobility. Kadavu’s economy is dominated by subsistence farming and the most common cash crop is kava which has a reputation of its exceptional quality (Cook, 1974). There is neither bank nor town on the islands and the government station does have shops which is the main centre for business activities. The only airport and seaport are also located within the government station.

Tourism is becoming popular with snorkelling and diving are among the major attractions. A total of 11 tourism properties are now established on the island and
provides 161 beds. These tourism properties are spread throughout the island and provide employment to members of the village that are close by (Kuilamu, 2012).

4.3.3.1 Poverty

The incidence of poverty on Kadavu was recorded at 27 per cent in the analysis of the 2002-2003 Household Income and Expenditure Survey (Narsey, 2008). This indicates that the income earned through sales of crops and marine resources were above the poverty line of $33 per week and the households were able to meet their basic needs. The incidence of poverty at Kadavu was the same as Naitasiri but below 11 other provinces such as Bua (63 per cent), Cakaudrove (51 per cent), Ra and Macuata (50 per cent), Lau (44 per cent), Nadroga (39 per cent), Serua (35 per cent), Ba and Namori (34 per cent), Lomaiviti (32 per cent), Tailevu (31 per cent) (ibid.). The only other province that had a lower incidence of poverty is Rewa at 19 per cent.

4.3.4 Social Characteristics

The chiefly system in Kadavu gives much greater authority to local chiefs than in most other areas in Fiji, where local chiefs are more often subservient to a few "paramount chiefs." Each of the nine Tikina are headed by a chief and each of them have equal status are not subservient on anyone. All of their decisions are based on consensus and this is often regarded as a limiting factor in making timely decisions of issues that are of importance to progress and prosperity. Kadavu is renowned of as a local “Manu Dui Tagi” meaning that each of the Tikina chefs can only rule within their boundaries.

The land tenure system in Kadavu is similar to other parts of Fiji where ownership is collective through landowning units called ‘Mataqali’. Only those that are registered in the “Vola ni Kawa Bula” are eligible members of the ‘Mataqali’ and subsequently can claim to have ownership right to land. Majority of the land in
Kadavu are Mataqali owned while there a few freehold owned by descendants of early settlers.

As for marine resources, landowning units only have rights of use but ownership right is vested with the government. In that respect, all those that intend to do commercial fishing must first obtain a licence from government which is limiting the ability of the people to freely fish in their fishing ground and gain some income.

The Kadavu culture is different to the rest of Fiji given its remoteness and the great difficulty in mobility in the early years of settlement. Each of the nine districts of Kadavu has their own dialect but they can understand each other while conversing. This then makes it easy for people to travel from one Tikina to another and engage in traditional and religious functions. The people of Kadavu are renowned for their unity which had been evidenced in their fundraising efforts for the purchase of their boat “Bulou ni Ceva” and their property in the centre of Suva known as “Kadavu House”.

Kadavu has three secondary schools and twenty primary schools hence indicating that there is easy access to education.

There is a sub-divisional hospital on the island which is the main referral hospital of the two health centres and four nursing stations. The health centres are manned by the medical practitioner and a nurse while the nursing station is manned by a nurse.

4.3.5 Disasters and disaster management arrangements

The vulnerability to cyclones at Kadavu is high given the high exposure since it is the southernmost island and all cyclones move from north to south given their characteristic of developing in hotter regions due to closeness to the equator and moving southwards towards the colder regions. As evident from Table 4.4, the
majority of the cyclones that had impacted Fiji would also impact Kadavu. Likewise, for the earthquakes and tsunamis that had impacted Fiji since 1928, Kadavu had also been impacted (Everingham, 1984).

Disaster arrangements in Kadavu follow the structure provided in the Natural Disaster Management Act, 1998. The District Officer who heads the government departments in the island is the disaster coordinator. His primary responsibility is to coordinate government departments in responding to disaster.

At the community level, the Turaga ni Koro or village headmen coordinate all response activities in their respective villages. When the warnings are issued from the National Meteorological Office as well as other agencies through the national radio the District Officer would also receive notification through fax or email. He would contact all Turaga ni koro by whatever means of communication is available and the Turaga ni koro would raise the alarm to supplement the radio messages. Local warning system includes the beating of “lali” and blowing of conch shell. “Lali” is a piece of wood carved with a hollow in the middle and used in villages to indicate time for church service. There are different ways of beating the “lali” to indicate normal church service, funeral service and emergency. A strong community connection would result in an effective end-to-end early warning system during disasters. A warning system can only be successful if the warnings it produces reach individuals at risk and are easy to understand, resulting in appropriate responses.

4.4 Conclusion

Fiji is located within the area where the climate is ideal for the development of cyclones and is accompanied by heavy rain causing floods and landslides. During El-Nino years, drought is usually experienced e.g. the 1997 and 1998 drought in Fiji which had severely affected Kadavu as well.
Fiji is also situated within the Pacific ‘ring of fire’ where earthquakes take place which generate tsunamis when they are located in the ocean as was the case in 1963. This confirmed that Fiji is exposed to a number of natural hazards hence it is one of the disaster prone areas in the world.

Fiji has a narrow resource based economy and always suffered major setbacks whenever there is a natural disaster. While tourism had picked up recently that as well have suffered major setback when tourist accommodations were damaged and flights disrupted during a disaster. The impact of disasters is worse for the 35 per cent living below the poverty line due to their inability to purchase alternatives when their resources are being damaged.

Kadavu is one of the least developed areas of Fiji, as affirmed by the absence of a commercial bank, major shopping outlet and limited road network. However the per cent of households living below the poverty line is 27 per cent which is lower than in 11 other provinces. This speaks volume of the inhabitants’ hard work and ability to generate acceptable levels of income from the sale of crops from their plantations as well from their marine resources. Majority of the lands are communally owned and majority live together in their villages hence they do a lot of their work collectively.

This indicates that the community had very strong social values which emphasized the sharing of material benefits with extended families which is usually beneficial during disasters in helping those affected to bounce back and continue to live their life normally. In fact this is the cornerstone of the adaptability to cyclones by the people of Kadavu.
CHAPTER FIVE

RESEARCH FINDINGS

5.1 Introduction

The present chapter deals with the research findings. The chapter is divided into two parts. The first part deals with the documentation analysis while the second part deals with the survey analysis based on field work.

5.2 Documentation analysis

Benson (1997) reported, the GDP data for the last 25 years that suggest that economic growth rates in Fiji were affected adversely in years where natural disasters occurred.

Narsey (2008) and Zann and Zann (2008) noted that the average monthly income per household was FJD 650, or FJD 3.60 per person a day (“moderate” poverty). The living standard of most households was considered low which in many cases is further worsened when a disaster strikes. Education levels were low and most household members did not proceed further from primary school. Employment opportunities were very scarce, subsistence farming and fishing, which require no formal education were the means of earning an income.

Indigenous communities owned resources communally hence there is a lot of mutual sharing of the benefits that may accrue from the productive use of such resources (Veitayaki, 2009). This is confirmed by the sharing of all monetary proceeds for the leasing of mataqali owned land through the ITaukei Land Trust Board (TLTB). This enforces the caring and sharing which are critical skills in disaster situations where there are high demand for sharing of food, shelter, clothing and even attending to the injured ones. Strong social relations are a fabric of life for such community which had sustained their security and their traditional hierarchal roles and responsibilities. While the communities are poor their strong
social relations had maintain stability and healthy living through supporting one another and the performance of their expected roles faithfully and the best of their ability (ibid.).

People prepare for disasters by their local knowledge of their environment especially where to collect their food when there is a disruption to their normal way of living (Veitayaki, 2009). In small islands such as Kadavu, the communities would know the locations where specific food types are growing wildly which they can rely on when their food gardens are being destroyed. This is coupled with their ability to prepare food using available natural resources to light fire and not relying on electricity and cooking gas. These knowledge and skills give better chance for the community to survive when assistance is prevented from reaching them for long period after a natural disaster (ibid.).

Indigenous communities like Kadavu have more respect for their environment than their contemporary counterparts who uses technology and equipment to plant root crops, fish and extract water for their survival (Veitayaki, 2009). When a disaster strikes and such technology and equipment are destroyed their survival are disrupted while the indigenous community can continue to plant and collect their food. For example, in the Nadi floods of 2009, contemporary farmers lost their tractors and could not plant their gardens while the indigenous farmers continued to use their fork and spade to plant their gardens (ibid.). The reliance on refrigerators to preserve food is another example, and when there is power outage during a disaster food can no longer be preserved. Indigenous communities preserve food using traditional methods such as smoking or sun drying fish and meat and burying of surplus breadfruit in pits and these are very useful after disasters to ensure that there is consistent supply of food until assistance arrives.

People in subsistence societies such as Kadavu plant a variety of crops and use a variety of farming techniques to ensure consistent and abundant food supply (Veitayaki, 2009). Having a wide variety of crops, the vulnerability of such community to cyclones reduces. Cyclones are known to have different impact on
different crops hence having a variety of crops especially root crops would ensure consistent supply of food. While taro and cassava are more affected by strong winds, sweet potato is not affected and will be available to the community on a sustained basis after a cyclone.

People in subsistence societies as well are known to have different methods of catching fish such as line, nets, spear and spear diving (Veitayaki, 2009). Such capacity reduces their vulnerability immediately after a cyclone since they still have the capacity to catch fish near the coastline even though the deep sea would still be rough.

The total number of houses surveyed in the 2007 Census was 174,423, of which, village housing accounted for 29 per cent or 50,583 (Government of Fiji, 2007). The three most common categories of construction materials used for rural houses are ‘Tin or corrugated iron’ (36 per cent), ‘Concrete’ (35 per cent), ‘Wood’ (26 per cent), “Thatch” (3 per cent) (ibid.). These indicate that the use of traditional materials such as thatch which is highly vulnerable to cyclones is of very minimal use. More people are adapting their housing structures to cyclones as evident during Tropical Cyclone Evan in late 2012. The number of houses destroyed during Tropical Cyclone Evan totalled 84,971 (representing approximately 5 per cent of country’s housing) (Government of Fiji, 2013). The impact could have been much higher had the communities not adapted proper housing structures.

5.3 Survey Analysis

5.3.1 Household sizes

The total number of household heads interviewed was 35 with 191 members meaning an average family size of 5 to 6. In a cyclone the lesser the number in a family the easier it will be for the family to evacuate and eat.
5.3.2 Education levels

As Figure 5.1 shows, the levels of education vary, with the majority of respondents having completed primary level (57 per cent) while 37 per cent completed secondary and 6 per cent completed tertiary level. This is encouraging since almost everyone is able to read, write and understand cyclone warnings when being aired on the radio or being announced by the “Turaga ni koro”.

![Figure 5.1 Education level](source)

Source: By the Researcher, 2015.

5.3.3 Types of income

Only 6 per cent have paid employment while the remaining 94 per cent are self-employed as shown in Figure 5.2. Those that do not have any paid income are subsistence farmers meaning that their income is not consistent and they depend on the local resources for their daily survival.

![Figure 5.2 Employment Patterns on Study Area](source)

Source: By the Researcher, 2015.
The reliance of resources for survival was confirmed when approximately 71 per cent indicated that they would go out fishing on a regular basis for their family food while the other 29 per cent indicated that they do not go out fishing but depend on land based resources to support their livelihood as shown in Figure 5.3.

**Figure 5.3 Fishing for food source**

![Fishing for food source](image)

Source: By the Researcher, 2015.

### 5.3.4 Land and fishing ground ownership

All the respondents indicated that they are members of their mataqali hence own land through the traditional communal system. Land leases are not common in Kadavu but each of the “tokatoka” is allocated different parcels of land for their use. These parcels of land cannot be mortgaged or sold.

Ownership of fishing ground as well is only through right of use while government has the ownership right. In simple terms, communities can gather marine resources from their demarcated fishing grounds for consumption only. For any economic activity, government approval must be sought and licences issued upon payment.

### 5.3.5 Food security

Consistent supply of food is a need for all human beings to survive whether be normal or disaster times. General awareness of the types of crops that can withstand cyclones is critical for rural and island communities such as on Kadavu given the remoteness from the capital where assistance will be provided from immediately after a cyclone. Sweet potato was the most common crop (63 per cent) that the respondents were aware of that can withstand cyclone, followed by
giant taro (20 per cent, yam (14 per cent), Tivoli (6 per cent) and cassava (6 per cent) (Figure 5.4).

**Figure 5.4 Crops that can withstand cyclones in the study area**

![Graph showing crops that can withstand cyclones](image)

Source: By the Researcher, 2015.

The respondents confirmed that all of them plant sweet patato and giant taro in their plantations as shown in Figure 5.5. The other crops that are common in their plantations are taro and cassava for 94 per cent and then their income generating crop kava at 69 per cent. This reaffirms the sustainable livelihood approach where communities would focus on crops that will support their daily living first and then to crops that can withstand disasters.

Only a few plant seasonal crops that are not consumed on daily basis. This includes yam (37 per cent), vudi (31 per cent), bele (20 per cent), banana (11 per cent) and tivoli (6 per cent).

**Figure 5.5 Types of crops planted in the study area**

![Graph showing types of crops planted](image)

Source: By the Researcher, 2015.
The respondents were clear about the actions they have to undertake to ensure they continue meeting food needs after a cyclone. Figure 5.6 shows that 60 per cent indicated they would first consume crops that can rot faster and then grating of cassava (14 per cent), followed closely at 9 per cent by burial of fallen breadfruit, cook crops in earth oven, plant crops that can mature quickly and search for crops that grow wildly. 6 per cent indicated that they would harvest mature crops. This is a strong indicator of a resilient community to cyclone that they will not await government assistance but able to utilise their resources and move on after a cyclone impact.

Figure 5.6 Actions take to continue meeting food supply in the study area

Source: By the Researcher, 2015.

5.3.6 Types of Houses

There are no more thatch houses on the island as indicated in Figure 5.7. The most common material was corrugate iron for walls and roof (46 per cent), wooden walls and corrugated tin roof (40 per cent) and concrete walls and corrugated iron roof (14 per cent). These shows that the communities are investing in constructing homes that are able to withstand strong winds.
5.3.7 Water supply

Water supply is always impacted by cyclones since it is exposed to heavy rain that accompanies cyclones. The actions that the community had adopted are to ensure that consistent supply of safe and wholesome water for consumption will continue
and will not cause diseases such as diarrhoea and dysentery. The most common action is to boil water (51 per cent), 34 per cent said they immediately repair water pipes and 14 per cent reported storing fresh water whenever available (Figure 5.9).

**Figure 5.9 Coping strategies for water supply during and after cyclone in the study area**

![Figure 5.9](image_url)

Source: By the Researcher, 2015.

### 5.3.8 Sanitation

Sanitation in all communities in the island is dominated by pour flush water seal which are detached from the main dwelling houses. The superstructure for such toilets is not fixed since the toilets can be shifted to a new site once the pits are filled up with faecal matters. Respondents indicated that in order to cope with sanitation after cyclones, their immediate action would be to repair blown down toilets (69 per cent) and 31 per cent would dig new pits as shown in Figure 5.10. Since the superstructure is not fixed, it is expected to be easily blown down after a cyclone and the quick repair would ensure that they are able to use them.

**Figure 5.10 Coping strategies with sanitation after cyclones in the Study Area**

![Figure 5.10](image_url)

Source: By the Researcher, 2015.
5.3.9 Control of vector borne diseases

Vector borne diseases such as dengue fever, typhoid fever and leptospirosis are always associated with cyclones due to availability of breeding places for mosquitoes. In a number of instances, lives were not lost during a cyclone but as a result of an outbreak of vector borne diseases immediately after cyclone. The respondents were well aware of the actions they have to do to control the spread of vector borne diseases with 60 per cent stating that they would clean their surroundings, 29 per cent would properly dump their waste and 11 per cent would destroy all potential breeding sites as shown in Figure 5.11.

**Figure 5.11 Actions to control vector borne disease in the study area**

Source: By the Researcher, 2015.

5.3.10 Actions taken when cyclone warning is issued

The respondents indicated that when a cyclone warning is issued, stocking of food from gardens is the most common action they would do (63 per cent), followed by stocking of water and securing of windows shutters and doors (43 per cent), changing of torch battery (23 per cent), cutting of tree branches around the house (20 per cent), evacuate to strong houses (11 per cent), stock dry rations and inform family members (9 per cent) and stock firewood (3 per cent) as shown in Figure 5.12.
5.3.11 Knowledge of evacuation shelters

All respondents were fully aware of their evacuation shelters when they are required to be evacuated from their homes, with 42 per cent going to the community hall, 29 per cent each to churches and stronger houses (Figure 5.13).

5.3.12 Support from family members after a cyclone

All of the respondents live in their villages where there is strong social bond between kinship of nuclear family. After a cyclone they identify that the most common support from family members were the sharing of food (74 per cent), sharing of clothing (46 per cent), sharing of shelter (29 per cent) and moral support (3 per cent) as shown in Figure 5.14. These indicated that tangible actions are
taken to support those that had been severely impacted by the cyclone. This is a strong indicator of resiliency building within the community in Kadavu.

Figure 5.14 Type of support from family members in Study Area

![Bar chart showing type of support from family members.]

Source: By the Researcher, 2015.

5.4 Institutional arrangement of disaster management

The Fiji Natural Disaster Management Act 1998 and the National Disaster Management Plan 1995 had created the National Disaster Committee chaired by the Minister for Real and Maritime development. The National Disaster Committee (NDC) had replaced the Emergency Services Committee (EMSEC) and is now being serviced by the National Disaster Management Office.

Figure 5.15 Fiji Disaster Management structure

![Diagram of Fiji Disaster Management structure.]

At the divisional level the Divisional Commissioners assumes the role of Divisional Disaster Coordinator while at the district level the District Officers are the District Disaster Coordinator.

In Kadavu the District Officer liaises very closely with the “Turaga ni koro” in each of the 75 villages and settlements on disaster preparedness, mitigation, response and recovery.

5.4.1 Village disaster plans

The development of village disaster plan is mandated under clause VI-5 of the National Disaster Management Plan 1995 (Government of Fiji, 1995). The development of the Village Disaster Plan for Kadavu was carried out by the National Disaster Management Office from 2009 to 2012. Nearly 80 per cent of the respondents indicated that they were aware while 20 per cent are not aware of any such plan as shown in Figure 5.16. Those that were not aware of the existence of such plan may have been away from the village during its development.

Figure 5.16 Awareness of the village disaster plan in the Study Area

Source: By the Researcher, 2015.

Amazingly, 100 per cent of the respondents in the study area indicated that they had received cyclone warnings when is issued from the Fiji Meteorology Office who is the lead agency in detection, monitoring and issuance of warning for cyclones (Government of Fiji, 1995). The most common means of receiving such warning is through the radio (94 per cent) while the remainder indicated that they
would receive it from the Turga ni Koro (3 per cent) and from Government Official (3 per cent) as shown in Figure 5.17.

Figure 5.17 Means of receiving cyclone warning

<table>
<thead>
<tr>
<th></th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Radio</td>
<td>94</td>
</tr>
<tr>
<td>Turga ni Koro</td>
<td>3</td>
</tr>
<tr>
<td>Govt official</td>
<td>3</td>
</tr>
</tbody>
</table>

Source: By the Researcher, 2015.

5.5 Conclusion

The analysis of findings indicates that there is high literacy amongst respondents to receive warnings of a potential cyclone that is detected by the Fiji Meteorology Office who is the lead agency in detection and monitoring of cyclones. There is very little consistent source of income on the island and majority depend on local resources for their livelihoods. This therefore increases their sensitivity because whenever the resources are impacted by an event their source of livelihoods will be severely affected as well.

Through the years there is a huge adaptability to cyclone being made by the people of Kadavu as confirmed by their ability to ensure continued supply of food and water after a cyclone. Such knowledge increases their resilience and capacity to be able to bounce back after a shock from the negative impacts of a cyclone. Food and water are the two most important human needs and therefore, sound knowledge needed how to manage these basic needs after a cyclone occurs.

The prevention of occurrence of secondary hazards such as vector borne disease outbreak shows positive adaptability. The sound knowledge of the linkages between the primary and secondary hazards is beneficial to remote communities especially when health services required to treat those injured during disasters.
Strong community support exists on the island after a cyclone which will greatly decrease the pressure being imposed by those that had been severely impacted. While the villagers would live together in a village the impact of the cyclone on them would vary due to varying differences of income to be able to build stronger houses.

A proper institutional arrangement for disaster management is in place in the island that greatly enhance the dissemination of cyclone warning which had enable the communities to take appropriate actions. The actions include tying down houses, cutting down cassava stacks, filling up water containers and purchasing dry food rations.
CHAPTER SIX

CONCLUSION AND RECOMMENDATIONS

6.1 Conclusion

Fiji is located in a geographical area where the environmental conditions prompt for hydro-meteorological hazards such as cyclones, storm surges, flood and drought to develop and intensify. As reported by the Fiji Meteorological Services (2003), 306 cyclones developed in the region around Fiji from 1970 to 2000, averaging 10 cyclones per annum. 17 of those cyclones had directly impacted Fiji. The geographical location as well is in the Pacific subduction zone commonly known as the “Pacific Ring of Fire” where geological events such as earthquakes and tsunamis originate from. As reported by Bernard and Robinson (2009), out of the 2,130 tsunamis recorded since 2000 BC, 1,226 or 57 per cent occurred within the Pacific Ring of Fire. 11 were recorded to have their epicentres within the Fiji group. Fiji has been ranked 16 out of 171 countries on the world disaster risk index recently reported by the United Nations (2014).

Kadavu is one of the least developed areas in Fiji with no commercial bank or any major shopping outlet. The government station at Vunisea serves as the main commercial activity since it does host the main hospital, one of the secondary schools, post office, ice plant, police station and other government departments. The main means of transportation is by sea since there is limited road network servicing only the western end of the island with 4 out of the 9 tikina namely Tavuki, Ravitaki, Yawe and Nabukelevu.

The majority of the 10,167 people are subsistence farmers with a few having paid employment at the 11 tourist accommodation and at various government offices and schools. The research found that as high as 94 per cent are subsistence farmers and also 71 per cent indicated that they would go out fishing on a regular basis for their source of protein. The recent poverty study found that 27 per cent of the households are below the poverty line which indicates that those engaged in
subsistence farming are productive to be able to earn more than the $33 per week benchmark which determines the poverty level (Narsey, 2008). A contributing factor as well is the household sizes which the research found to be averaging 5 with 2 adults and 3 children. Having fewer number of family members means lesser cost of meeting their needs and easy to take care of them in times of disasters.

There are adequate number of primary (20) and secondary (3) schools on the island while tertiary education can only be accessed on Viti Levu. The research found that 57 per cent had completed primary education, 37 per cent secondary education and 6 per cent tertiary level education. This indicates that there is good rate of literacy which is valuable in disasters to be able to take the right action when the warning is issued. Literate individuals as well have high chances of survival after a disaster since they can manage the food stocks that are available and also be able to prioritise work that can assist in restoring their livelihoods and subsequently survival (UNDP, 2014).

The majority of the land on the island are owned by mataqali while a small portion is individually-owned. The individually owned ones were acquired by early settlers before the colonial government completely stopped land sales in the early 1900. The mataqali owned land cannot be used as security for bank loans hence it restricts individual entrepreneurship amongst the members. The marine resources are even worse when all fishing grounds are owned by government and the local people only have rights of use. Such limited access to resource ownership increases the vulnerability of the Kadavu since they cannot fully exploit them to increase their income.

The research found that all the subsistence farmers know and cultivate cyclone resistant crops. The crops include sweet potato, giant taro, yam, tivoli and cassava. They confirm the ability of these crops through the experiences in past cyclones. They are also well aware of the techniques to use when a warning issued so that the crops can stay longer after the cyclone impact, for example, cutting of cassava
stock. Further they also have the skills to preserve the crops to extend the time that such crops will not rot and can still be edible. Such knowledge and skills are the cornerstone of continuing to provide the required calories until the newly planted crops mature after a cyclone impact.

The housing type had completely changed from the traditional thatch ones to the more durable, strapped and reinforced ones like timber and concrete. These adaptations had been carried out to enhance their safety since the walls and roof materials of the thatched can be easily blown away by strong winds. They were also aware the actions that they need to take to enhance the ability of their houses to withstand the intensity of strong winds when a cyclone warning is issued. These actions include nailing of loose corrugated irons sheets, tying down with ropes nail shutters on windows and nailing of brace.

The people were well aware of the actions to take to properly manage water, sanitation and to prevent the occurrence of vector borne diseases. The outbreak of communicable diseases after a natural disease can take place if the underlying drives are not properly managed. The key of the underlying drives is water, sanitation and solid waste management especially eliminating breeding places for mosquitoes and flies. Common diseases that are associated with natural disasters are diarrhoea, typhoid, leptospirosis, dengue fever and zika.

The community members were able to outline the actions they would take when a cyclone is issued such as stocking food from gardens, stocking water, securing windows shutters and doors, changing torch battery, cutting tree branches around the house, evacuate to strong houses, stock dry rations, inform family members and stock firewood. All these actions would ensure that the community is ready to absorb the shock and then bounce back immediately to continue with their normal activities which is a strong indicator of resilience. The sound knowledge of the critical actions to take before the impact of the cyclone is complemented by the strong family support that exists after the impact.
The support that the families can provide includes sharing of food, sharing of clothing, sharing of shelter and moral support. This means that for those that may lose their houses they are guaranteed that support would be available. Such are the capacities that are available on the island that has been helping in reducing the impacts of cyclones and other natural disasters. Without such capacity the impacts on people’s life would have been far much worse as used to be in the 1970’s.

The villages have now developed evacuation shelters in all their villages and not only relying on schools as used to be in the past. The research found out when the community owned facilities like churches and hall are being rebuilt under the notion of build back better. Learning from past experiences, they had ensured that such public buildings are constructed to standards that can withstand strong winds in a cyclone and to be used an evacuation shelter for those whose houses are not so strong.

The development of Village Disaster Plans increases the capacity of villagers to access the early warning announcements since the turaga ni koro play an active role in announcing it in the village even though it has been announced in the radio networks. This ensures that those not listening to the radio airwaves would also receive the warning. The plan also outlines the actions that the communities have to take to reduce their vulnerability to the natural disaster and enhance their safety. This is confirmed that there has no life lost in recent cyclones on the island.

6.2 Linkages of Theoretical Approaches to Findings

The level of risk of a given location can be determined the presence of a hazard multiplied by the vulnerability and divided by the capacity that the people possess as shown in Figure 2.1.

Natural hazards develop as a result of interaction of the natural environment like sea surface temperature, prevailing winds and land surface temperature. One of the common hazards in the Pacific region is cyclone which develops and intensifies
between 5 to 20 degrees south and north of the equator. As a cyclone develops and progresses either south or north of the equator, it will increase its intensity and usually causes havoc to people, infrastructure, economy, environment and social structures. When a cyclone develops and intensifies in the middle of the ocean without impacting humans it is not regarded as a disaster.

The degree of damages is determined by the level of vulnerability and the coping capacity of the affected community. Vulnerability is combination of exposure and sensitivity. Exposure is simply to be in the area where natural hazard like cyclone will develop and intensity. Map 2.1 clearly shows the level of exposure across the globe and Fiji is in the region that is highly exposed.

Sensitivity is the socio-economic conditions, the built or natural environment that the community possess to be able to absorb, respond to and recover from the intensity of a cyclone. This is summarised by the Pressure and Release model that was developed by Blaikie et al. (1994) as presented in Figure 2.4. The model advocates that sensitivity is linked to access to power, structure and resources which are driven by the political ideologies and socio economical systems. In an ideal democratic environment, all citizens will have equal access to power, structures and resources. When these exist, citizens will be able to cope with vulnerability and will be able to generate income to afford decent meals, build structurally sound houses.

In countries where resources are communally owned, access to power, structures and resources is limited. This therefore results in high inequality where only the privileged ones would excel and less fortunate ones are left behind to struggle with life. The less fortunate ones would have low income, low education, inferior houses and unhealthy living conditions. They are therefore highly sensitive and are more likely to be severely impacted by natural disasters. The relationship between sensitivity and poverty is critical. People who face hardships to meet basic food and non-food needs are regarded to be poor that are living below the poverty line. These groups are more disadvantaged and are often found dwelling in high risk
areas such as near river banks that are prone to flooding, along the coastlines that are prone to sea inundation, steep slopes that are prone to landslides and live on unsecured land (Mohanty 2006).

While the majority of the population would be regarded as poor either already below the poverty line or are just above the poverty line the number of deaths as a result of cyclones is decreasing. This is attributed to the coping capacity that had been developed from past cyclone experiences. The majority of respondents were well aware of the potential impact that a cyclone would have on their properties hence they would either evacuate to safer places or quickly take actions that can help their houses withstand strong winds and heavy rain. Immediately after a cyclone event, they are well aware of the key actions to take to restore their blown down houses, secure food supply and minimise the occurrence of secondary hazards such as disease outbreak.

These strong coping capacities enhance their resilience to be able to bounce back from an event and continue to live normally. This is commonly true in areas that are frequently impacted by natural disasters.

6.3. Summary of Broad Findings

The research had found the following key broad findings,

1. Majority of the respondents were aware of the cyclone resistant crops and were planting them in their plantations.

2. Majority of the respondents were aware of the order in which crops would rot after a cyclone hence they knew the order they had to consume them.

3. Majority of the respondents had used durable materials that can withstand strong winds moving away from traditional thatch material.
4. Majority of the respondents were aware of basic methods to ensure their water supply were safe to consume after a cyclone.

5. Majority of the respondents were aware of the type of toilets to be used after a cyclone to ensure sanitation would be maintained and prevent disease outbreak.

6. Strong social cohesiveness exists in the study area which was vital after a cyclone especially in sharing of food, clothes and shelter with those being severely impacted.

7. Strong institutional disaster management exist in the study area which was used to disseminate the warnings complimenting the national warning being aired through the radio stations. Further the strong institutional mechanism was vital to evacuate those with not so strong houses to identified evacuation shelters in the communities.

6.4 Recommendations

The research had found some practical examples of adaptability that can enhance the safety and resilience of island communities to cyclones and therefore the following concerns are recommended for policy decisions.

(i) Agricultural insurance schemes to be encouraged especially to cover for damages to root crops that have high economic values.

(ii) Development of minimum building standards that can guide home owners that wish to construct concrete houses. This is to ensure that they are properly strapped and reinforced to enhance their ability to withstand string winds. This is due to the high number of people moving away from thatch houses.
(iii) Planting of cyclone resistant crops must be enforced through the rural development machinery. It must be mandatory that all households to at least have a few mounts of sweet potato, giant taro, yam, tivoli and cassava so that they can have food immediately after a cyclone and will not rely on government assistance.

(iv) Community bonding to be nurtured and promoted at monthly village meetings so that they can continue to support each other during and after a disaster. This can be promoted at their “tokatoka” level since they would already be working together to carry out community obligations and functions such as burials and marriages.

(v) Development of village disaster plan and formation of village disaster committees to be mandatory for all villages. This would ensure that the last person on the most remote part of the village, elderlies and persons with disabilities are informed of the threat. Timely evacuation can also be carried out to avoid the last minute rush which had often resulted in people been hit by flying debris.

(vi) National simulation exercise to be organised prior to the start of the cyclone season which is usually from November to April. This will ensure that the village disaster plans are tested and the disaster committees to be reminded of their roles and responsibilities.

(vii) Establishment of community disaster fund to be encouraged so that they are able to mobilise resources relevant to their specific needs immediately after a cyclone.

6.5 Future Research

The limitations and findings of the research had highlighted a number of areas for exploration and research.
Firstly, more resources and time can increase the sample size to increase the accuracy of inferences that can be made. Inclusion of other island can contribute to understanding better of the coping capacity that the communities had developed over the years. The sharing of different adaptability skills would enrich the knowledge which the communities can choose from.

Secondly, the research had only identified the types of houses being built but did not enquire on whether there was some approval obtained or supervision being provided by technical people during construction. This would then determine whether the construction methodology would also contribute to the ability of the houses to withstand cyclones.

Thirdly, a detailed counting of mounts of cyclone resistant crops would provide more powerful evidence of the degree at which the community had adopted that skill.

Fourthly, the verification of the types of assistance that the community had received in past disasters would consolidate the findings. The verification is to include whether the assistance had increased or decreased over the years and determination whether the community members were able to fulfilled their needs and aspirations.
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APPENDIX

Appendix 1: Questionnaire

Confidentiality: The responses to this questionnaire will be kept confidential and will be used for the study purposes only.

Name of village……………………….
Tikina: ...........
Date:..................

Part I – General

1. What is the total number of members in your household? ________

2. How many children in your household? ________

3. What is the highest level of education of household head? ________

4. Is the household head working? YES/NO

   (a) If yes, what is your occupation? _________________

   (b) How much do you earn in a month? ____________

5. Do you go out fishing for supplement you family’s food? YES/NO

   (a) If yes, how often do you go fishing in a month? ____________

   (b) If you are in sea and a storm occurs, then what do you do? ________

Part II Adaptability

6. What type of crops do you plant in your garden? _________________
7. Do you know crops/trees that can withstand cyclones? Yes/No

If Yes, what are the crops /trees that resist cyclones? ______________________
____________________________________________________________________

8. How do you adapt your crops in the garden during a cyclone? _________

9. How do you cope with meeting food needs after the cyclone?:__________

10. What type of house do you have?  a) thatched  b) wooden  c) concrete
d) corrugation iron wall.

11. Which cyclone affected you the most in the past and to what extent?
____________________________________________________________________
____________________________________________________________________

12. How did your house withstand past cyclones?:___________________

13. How do you cope with meeting your water needs after the cyclone?:____

14. How do you cope with sanitation provisions after the cyclone?:________

15. What type of precautions do you take after a cyclone to prevent vector
diseases?:__________

16. Do you know about first aid?   Yes/No
If Yes, please specify what you do with the following:

Broken arm____________________________________________________
Open cut______________________________________________________
Drowning child_____________________________________________
Part III  Resilience

17. Do you have any idea of the village disaster plan?  YES/NO
If Yes, do you take part in the village disaster plan design?  YES/NO

18. Is there any cyclone preparedness guidelines given to you?  YES/NO
If Yes, by whom?: __________________

19. Do you get warning before a cyclone comes?  YES/NO
If Yes, how do you receive your cyclone warning?:
(a) through radio (b) newspaper (c) village headman (d) government officials
(e) Others, specify: __________________

20. What precautionary measures do you and family take when there is a cyclone warning? ______________________________________

21. What do you and your community cope with after a cyclone occurs?
_______________________________________________________

22. Have you experienced any disaster evacuation in the past?  YES/NO
If Yes, where were you evacuated and how? __________________

23. Have you ever been supported by your relatives during a time of need?  YES/NO
If Yes, how? _______________________________________

24. How can your community build their resilience against natural hazard especially a cyclone? __________________

Thank you for your Cooperation