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UNDERSTANDING ADAPTATION TO CLIMATE CHANGE IN MICRONESIA: A CASE STUDY OF THE MARSHALL ISLANDS

by
Ngedikes Olai Uludong

A thesis submitted in fulfillment of requirements for the degree of Master of Science in Climate Change

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Pacific Centre for Environment and Sustainable Development (PACE-SD)
The University of the South Pacific

January 2014
DECLARATION OF ORIGINALITY

Statement by Author
I, Ngedikes Olai Uludong, declare that hereby declare that this thesis is the result of my own work and that, to the best of my knowledge, it contains no material previously published or substantially overlapping with material submitted for the award of any other degree at any institution, except where due acknowledgement is made in the text.

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Student ID No.: S11070398

Statement by Supervisor
The research in this thesis was performed under my supervision and to my knowledge is the sole work of Ms Ngedikes Olai Uludong.

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Designation: Professor of Climate Change
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Born to a Palauan family, I have been raised in a hard-working environment and a product of a family passionate in protecting the environment. The passion that drove my parents and siblings to protect Palau’s environment has helped develop strengths in me as being passionate, observant and a quick learner with a persistent personality.

For my academic life, I was fortunate to study in institutions, which significantly enhanced my innovativeness, initiative, and leadership skills. For this reason, I would like to thank the University of the South Pacific (USP) and the Australian Agency for International Development (AusAID) for funding my research study of the Marshall Islands. Moreover, I would like to recognize and offer my heartfelt “thank you” to the USP Marshall Islands Campus for hosting me and providing me with unlimited resources to complete my research. Furthermore, I would like to thank the Republic of the Marshall Islands Environmental Protection Agency (RMIEPA) for providing me with unlimited access to their resources to assist me in fulfilling my research objectives, findings and concluding chapters.

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Kom kmal mesulang, kommol tata, vinaka vakalevu and thank you very much!
ABSTRACT

To develop and establish measures to “adapt” to the anticipated climate change effects on the Marshall Islands, it is important to understand the evolution of adaptation, its associated enabling environment and indirect factors of influence. Adaptation to climate change requires assessing the society’s institutional adaptive capacity. Notwithstanding the adverse effects of climate change: institutional capacity such as governance, traditional and customary structures influences the society’s coping capabilities. In examining these controls, the past and current institutional structures are reviewed. It is important to highlight the influence of various internal and external factors in order to identify and develop adaptation actions that are appropriate for the communities to adopt.

This research explored the notion that effective adaptation begins with understanding institutional capacity, of which enables the environment that supports mechanisms needed to build resilience. After assessing the institutional controls thus identifying the needs and constraints of the enabling environment; the next step analyzed the adaptation tools; highlighting adaptation approaches that work, without ‘reinventing the wheel’. The rationale is that appropriate lead agencies should then be able to develop and adopt appropriate tools to assess adaptation to climate change and its associated cost, given that the effects constitute the basis for sustainable environment development.

In the Marshall Islands, an adaptation tool or mechanism that proves effective is the one that the society receives the most benefits from in the absence of climate change, for instance, in the event of droughts, typhoons, sea level rise, storm surges and epidemic outbreaks of diseases. These measures and strategies put in place are considered ‘no regrets’ adaptation. These ‘no regrets’ options include increasing rainwater catchments and developing sustainable management regulations to enhance adaptive capacity. Too often adaptation occurs because the need is largely driven by the current environment, economic, social and health issues, not a proactive driven approach but more on the reactive mode. Overall, the study aims to facilitate understanding of the barriers that hinder effective adaptation in the Marshall Islands.
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<tr>
<td>ADB</td>
<td>Asian Development Bank</td>
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<tr>
<td>AOSIS</td>
<td>Alliance of Small Island States</td>
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<td>APF</td>
<td>Adaptation Policy Framework</td>
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<td>ARFF</td>
<td>Airport Rescue Fire Station</td>
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<td>AusAID</td>
<td>Australian Agency for International Development</td>
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<td>CBA</td>
<td>Community Based Adaptation</td>
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<td>CBA</td>
<td>Cost Benefit Analysis</td>
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<td>CBDAMPIC</td>
<td>Capacity Building for the Development of Adaptation Measures in the Pacific Island Countries</td>
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<td>CC-Train</td>
<td>Climate Change Training Program</td>
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<td>CDM</td>
<td>Clean Development Mechanism</td>
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<tr>
<td>CEA</td>
<td>Country Environment Analysis</td>
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<tr>
<td>CHARM</td>
<td>Comprehensive Hazard Assessment and Risk Management</td>
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<tr>
<td>CRiSTAL</td>
<td>Climate Risk Screening Tool – Adaptation &amp; Livelihoods</td>
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<tr>
<td>COFA</td>
<td>Compact of Free Association</td>
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<tr>
<td>CROP</td>
<td>Council of Regional Organizations in the Pacific</td>
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<td>CV&amp;A</td>
<td>Community Vulnerability and Adaptation Assessment</td>
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<td>DUD</td>
<td>Delap Uliga Darrit</td>
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<tr>
<td>EBA</td>
<td>Ecosystem Based Adaptation</td>
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<tr>
<td>EIA</td>
<td>Environment Impact Assessment</td>
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<tr>
<td>EPPSO</td>
<td>Economic Planning, Policy and Statistics Office</td>
</tr>
<tr>
<td>EVI</td>
<td>Environmental Vulnerability Index</td>
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<tr>
<td>FSM</td>
<td>Federated States of Micronesia</td>
</tr>
<tr>
<td>GCMs</td>
<td>Global Climate Models</td>
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<td>GEF</td>
<td>Global Environment Facility</td>
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<td>GIS</td>
<td>Geographic Information System</td>
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<tr>
<td>INC</td>
<td>Initial National Communication</td>
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<td>IPCC</td>
<td>Intergovernmental Panel on Climate Change</td>
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<td>IPCC - CM</td>
<td>Intergovernmental Panel on Climate Change – Common Methodology</td>
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<tr>
<td>IWRM</td>
<td>Integrated Water Resources Management</td>
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<td>Abbreviation</td>
<td>Full Form</td>
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<tr>
<td>ITCZ</td>
<td>Inter-Tropical Convergence Zone</td>
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<td>JICA</td>
<td>Japan International Cooperation Agency</td>
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<tr>
<td>JNAP</td>
<td>Joint National Action Plan</td>
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<tr>
<td>MALGOV</td>
<td>Majuro Atoll Local Government</td>
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<td>MDG</td>
<td>Millennium Development Goal</td>
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<td>MEAs</td>
<td>Multilateral Environment Agreements</td>
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<td>MOFA</td>
<td>Ministry of Foreign Affairs</td>
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<td>MWSC</td>
<td>Majuro Waste Sewer Company</td>
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<td>NCSA</td>
<td>National Capacity Self Assessment</td>
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<td>NEMS</td>
<td>National Environment Management Strategy</td>
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<td>NEPA</td>
<td>National Environment Protection Act</td>
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<tr>
<td>NGO</td>
<td>Non-Government Organization</td>
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<tr>
<td>NOAA</td>
<td>National Oceanographic and Atmospheric Administration</td>
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<tr>
<td>NSA</td>
<td>National Scoping Assessments</td>
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<td>NWP</td>
<td>Nairobi Work Programme</td>
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<td>ODS</td>
<td>Ozone Depletion Substance</td>
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<tr>
<td>OEPPPC</td>
<td>Office of Environmental Planning and Policy Coordination</td>
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<tr>
<td>PACC</td>
<td>Pacific Adaptation to Climate Change</td>
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<tr>
<td>PACE-SD</td>
<td>Pacific Centre for Environment and Sustainable Development</td>
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<td>PDRMF</td>
<td>Pacific Disaster Risk Management Framework</td>
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<td>PIC</td>
<td>Pacific Island Country</td>
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<td>PICCAP</td>
<td>Pacific Islands Climate Change Adaptation Program</td>
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<td>PIFACC</td>
<td>Pacific Islands Framework for Action on Climate Change</td>
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<td>PIFS</td>
<td>Pacific Islands Forum Secretariat</td>
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<td>P-SIDS</td>
<td>Pacific Small Islands Developing States</td>
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<td>RAA</td>
<td>Risk Assessment Approach</td>
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<td>RBA</td>
<td>Risk Based Approach</td>
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<td>RMI</td>
<td>Republic of the Marshall Islands</td>
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<td>RMICMF</td>
<td>RMI National Coastal Management Framework</td>
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<td>RMIEPA</td>
<td>Republic of the Marshall Islands Environment Protection Authority</td>
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<tr>
<td>RMISDF</td>
<td>RMI National Sustainable Development Framework</td>
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<tr>
<td>RMI-USP</td>
<td>University of the South Pacific Republic of the Marshall Islands</td>
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<tr>
<td>SDA</td>
<td>Scenario Driven Approach</td>
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<tr>
<td>Acronym</td>
<td>Meaning</td>
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<tr>
<td>SDP</td>
<td>Sustainable Development Plan</td>
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<tr>
<td>SIDS</td>
<td>Small Island Developing States</td>
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<tr>
<td>SimClim</td>
<td>CoastClim of Simulator of Climate Change Risks and Adaptation Initiatives</td>
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<tr>
<td>SNC</td>
<td>Second National Communication</td>
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<tr>
<td>SOPAC</td>
<td>Secretariat of the 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>SPREP</td>
<td>Secretariat of the Pacific Regional Environment Programme</td>
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<tr>
<td>UNCBD</td>
<td>United Nations Convention on Biological Diversity</td>
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<td>UN</td>
<td>United Nations</td>
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<tr>
<td>UNCCD</td>
<td>United Nations Convention to Combat Desertification</td>
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<tr>
<td>UNDP</td>
<td>United Nations Development Programme</td>
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<tr>
<td>UNEP</td>
<td>United Nations Environment Program</td>
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<tr>
<td>UNFCCC</td>
<td>United Nations Framework Convention on Climate Change</td>
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<td>USAID</td>
<td>United States Agency for International Development</td>
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<tr>
<td>USEPA</td>
<td>United States Environment Protection Agency</td>
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<tr>
<td>USNEPA</td>
<td>United States Environment Protection Act</td>
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<tr>
<td>USP</td>
<td>University of the South Pacific</td>
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<tr>
<td>V&amp;A</td>
<td>Vulnerability and Adaptation</td>
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<tr>
<td>VCA</td>
<td>Vulnerability and Capacity Assessment</td>
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<tr>
<td>WB</td>
<td>World Bank</td>
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1 Chapter 1: Introduction and Literature Review

1.1 Introduction

Since the 1970s, evidence has emerged from the scientific community indicating that the climate is changing. The Intergovernmental Panel on Climate Change (IPCC) (2007a) found that precipitation trends have increased in some places, while other places have experienced longer droughts and intensification of extreme weather events such as typhoons, tropical storm and cyclones. These observed climatic changes bring devastating effects to the socio-economic development of Small Island Developing States (SIDS). For instance, the Republic of the Marshall Islands (RMI), like many of its Pacific island neighbors, has been rendered amongst the most vulnerable to the adverse effects of climate change. ‘Vulnerability’ is characterized by the IPCC (2007a, p.27) 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 to, its sensitivity and its adaptation capacity”.

It is within the last 20 years, that the people of RMI have shown strong political will in exemplifying their vulnerability to climate change at the national, regional and international level.

“It is truly frightening to think that our oceans will turn against us…we have been sustained by the ocean for two millennia. It has been bountiful and continues to yield to us its bounty. We have learned that this harmony may be interrupted by the actions of nations very distant from our shores. I hope that the appeal of the peoples of the Pacific can help convince the industrialized nations to discontinue their profligate contamination of the atmosphere.” ~ H.E. Amata Kabua (Welcome address at the Intergovernmental Meeting on Climatic Change and Sea Level Rise in the SPREP Region – 17 July 1989, Majuro)

What is referred to as ‘dangerous’ climate change, according to Pittock (2009), is avoidable and will vary according to national circumstances. The local society’s vulnerability is increased if its ability to adapt has not reached its potential.
Adaptation is crucial when it comes to coping with climate change and its associated effects (Pittock, 2009). ‘Adaptation’ as defined in IPCC (2007a, p.27) is “adjustments in human and natural systems in response to actual or expected climate stimuli or their effects that moderate harm or exploit beneficial opportunities”.

For at least 2,000 years, the Marshallese people have been adapting to the constraints of limited land resources and being dominated by the sea (Terry and Thomas, 2008). The resilience of the Marshallese people builds on traditional skills in navigation tools, fishing and subsistence agricultural farming. This lifestyle has been vital to their livelihood and resulted in sustainable land use management and food production systems (Crawford, 1993). They have adapted by maximizing potential use of their environment and developing a complex social system with little emphasis on permanent (social) structures (Spennemann, 2009). Adger et al. (2003) argues that “all societies are fundamentally adaptive and there are many situations in the past where societies have adapted to changes in climate and to similar risks”. However, projected effects of climate change will undoubtedly push the society’s coping capacity to its limits (Adger et al., 2003). Traditional skills are virtually nonexistent in today’s society, but evidence of a challenging environment has not ceased to persist.

The livelihood of the people and the stability of the economy of RMI are heavily reliant on the sustainability of its environment. Reducing the impact of extreme climatic change is a great challenge to the social well-being and livelihood of the people (Hay and Mimura, 2010). The Marshallese people recognize the need to strengthen efforts to assess the effects of climate change and identify applicable and realistic adaptive measures to deal with these anticipated changes.

Too often, adaptation projects are duplicative of each other or “reinventing the wheel”. For example, the Asian Development Bank (ADB) (ADB, 2011) and the United Nations Framework Convention on Climate Change (UNFCCC) are both implementing adaptation assessments, which have similar outputs. The difference is the time frame of the project. In assessing adaptation, it is important that a historical review take place to scope what activities have emerged since inception of the projects, so that the society does not keep repeating an activity that has already been undertaken.
The need to assess adaptation arose from the emerging effects associated with climate change in the late 1980s and its effect on socio-economic development. In RMI, assessing adaptation formally began in the early 1990s and was driven by a series of one-off independent initiatives resulting from various bilateral and multilateral environmental agreements (MEAs).

The overall aim of this thesis is to provide an understanding of the past and current approaches to adaptation to climate change that have been utilized in RMI since 1990, in order to better inform the national planning and development decision-making process. The thesis highlights the influence of the various foreign regimes that have helped shape the enabling environment that facilitates adaptation today. It also highlights the influence of different vulnerability and adaptation (V&A) frameworks, as well as the influence of the UNFCCC and its associated processes. This thesis reviews the types of adaptation assessments, i.e. those driven by bilateral and multilateral agreements, international treaties such as the UNFCCC, as well as regional and national adaptation policy mechanisms. Methods and tools should be developed to inform policy makers of ways to adapt to climate change in a more sustainable manner that acknowledge the unique environmental characteristics of the Pacific Islands (Nunn, 2009).

The Marshall Islands’ approach to assessing adaptation to climate change shares perspective with the neighboring Micronesian Islands, where adaptation is predominantly donor-driven. With all these adaptation assessments taking place in RMI, eventually they will be able to develop and apply an integrated adaptation management tool, given that the effects associated with climate change constitute an integral part of sustainable development.
1.2 Adaptation actions

This research focuses on three types of adaptive actions, the mechanisms put in place to support building resilience of the human and its associated environment to deal with climate change and variability (Scheraga and Grambsch, 1998).

Through original interpretation of the famous classic children story, The Three Little Pigs, three theories emerge and are explored. The story helps to better focus and conceptualizes this research, which establishes the pillars needed to support effective adaptation in RMI. To illustrate this, the story is revisited (Grisewood and Dempsey, 1997).

“Once upon a time there were three little pigs. One day they set out from the farm where they had been born. They were going out into the world to start new lives and enjoy any adventures that might come their way. The first little pig met a man carrying some straws and asked if he could have some to build his house. ‘Of course, little pig,’ said the man. With a bundle of straw, the little pig builds himself a lovely house of straws. A big bad wolf came along, saw the new house and feeling hungry and thinking he would like to eat the little pig, called to be let it in. When the little pig refused, the wolf huffed, puffed, and blew his house down. The second little pig was walking along the road when he met a man with a load of wood and asked if he can build a house. ‘Of course,’ said the man and gave him a pile of wood. In no time at all, the second little pig built himself a lovely wooden house. Along came the wolf and saw that another little pig, this time is living in a wooden house. The wolf called the pig to invite him in and the second little pig refused. The wolf huffed, puffed, and blew the wooden house down. The third little pig met a man with a cartload of bricks. He asked the man if he could have some bricks to build himself a house. The man agreed and gave him some bricks. The third little pig, patiently layer by layer built himself a beautiful brick house. Along came the same wolf and asked if could be let in, the third little pig refused. The wolf huffed, puffed and blew and huffed, puffed and blew but still the house, which had been so well built with bricks, did not come down….?”
1.3 Assessing Adaptive Capacity

Adaptation mechanisms require assessment of institutional capacity. Wickham et al., (2009) differentiates ‘enabling capacity’ from ‘adaptive capacity’. ‘Enabling capacity’ refers to the ability of institutions to open dialogues to implement and strengthen adaptation. ‘Institutions’ are defined as “specific or special clusters of norms and relationships that channel behavior so as to meet some human, physical, psychological, or social need such as consumption, governance and protection, primordial bonding and human meaning, human faith, and socialization and learning” (Buttel, 1997). Building of the definitions of ‘vulnerability’ and ‘adaptation’ in Chapter 1.1, ‘adaptive capacity’ is, therefore, the effectiveness of integrating and coordinating stakeholder involvement and scaled up approaches to vulnerability reduction and adaptation. Adaptive capacity, as a concept, was initially driven from sociology and management studies as part of the pillars to good governance and organizational structures (Engle, 2011). A community’s adaptive capacity can enhance resilience through strengthening the “ability of a social or ecological system to absorb disturbances while retaining the same basic structure and ways of functioning, the capacity for self-organisation, and the capacity to adapt to stress and change” (IPCC, 2007a).

There is the assumption that the more economically developed you are, the greater the ability you have to adapt. Studies of traditional societies have established that adaptive capacity is also affected by other factors such as experience, knowledge and climate sensitive resources (Adger and Vincent, 2005). Adaptive capacity can be enhanced by fostering the knowledge base and disseminating effective information that is integrated and understood by relevant agencies and increasing financial and human resources where appropriate (Lemos et al., 2007).

Kiparsky et al., (2006) argues that one of the fundamentals to adapting to climate change is the ability to understand the scientific information. On the other hand, Adger et al., (2009) proposes that to build adaptive capacity, the social structure that prevents adaptation needs to be examined. Drawing on the strengths of both arguments, this thesis examines the ethics, knowledge, risk and culture to understand the following questions:

- How does the society value climate change?
- What are the society’s perceptions on climate change?
• How is the society evolving in response to climate change?

An analysis of governance, national development plans, strategies and project documents in climate sensitive sectors, as a core part of this thesis, could provide answers to these questions. There are many resources, in the form of adaptation tools and frameworks, which could enable a society to successfully adapt to climate change; however, those resources, which will be examined in this study, are mostly underutilized. By understanding where the entry points to adaptation are within the enabling environment, resources can then be mobilized to increase adaptive capacity and thereby strengthening institutional capacity. In making necessary adjustments, “insights into institutional form and…research on collective action will establish collective management” (Adger, 2001). If there is coordinated action built on networking and partnership within the enabling environment, then efficiency within society improves.

“Structure matters. While people—their desires, beliefs, fears and hopes—are important, ultimately, when all is said and done, it is the social structures within which all people are embedded which influence how people live and act that are more important. The good news is that all social structures are human inventions, so if we don’t like the way they influence us to live and act, we can change them.” (Dator, 2004)

The challenges faced in negotiating feasible mitigation targets have prompted countries to shift focus towards adaptation (Lövbrand, 2004). Adaptation assessments or desktop studies surfaced around the time the UNFCCC came into force in 1994. At the early stage, focus was on evaluating the human adaptive capacity and vulnerability to interact with his/her environment when affected by various types of stressors (Smit and Wandel, 2006). These initial studies generally targeted the effects of climate change by developing criteria and measuring vulnerability against a set of indicators. Little research was carried out at that time to actually assess adaptive capacity (Gupta et al., 2010).

Vulnerability and adaptation assessments evolved with a stronger social science emphasis to link the political, economic and social conditions to climate change.
change and thus emphasizing the need to assess the enabling environment (institutions) and strengthen adaptive capacity to increase resilience to climate change (Gupta et al., 2010, Lövbrand, 2004). Engle (2011) found that research on adaptive capacity linking science and global change to vulnerability and governance has been lacking. There was a need to focus on assessing the governance, management and institutions’ coping capacity. Diaz et al., (2005) pointed out that the adaptive capacity of institutions should not be mistaken as a risk reduction measure but that enhancing human capacity within the enabling environment facilitated adaptation. Climate Change not only affects a nation's governing system but its physical and enabling environment of which impacts the people. It has become an urgent societal issue for many island nations (Nakalevu, 2006). Studies show that a nation’s resilience to the negative impacts of climate change can be built by assessing the enabling environment, governance structure, availability of resources (human and external) and institutional capacity (Diaz et al., 2005, Tol and Yohe, 2007). In assessing the enabling environment, studies show that developing adaptive capacity to understand the impacts of climate change can build effective adaptation responses.

Developing adaptive capacity within the enabling environment requires assessment of determining factors such as the economy, infrastructure, institutions, population distribution, information and knowledge skills, and technological advancements (Tol and Yohe, 2007). Studies on adaptive capacity indicate that leadership is important to building resilience and that strong political will can encourage the society to change (Gupta et al., 2010). The availability of and accessibility to resources is needed to ensure the effectiveness of institutions (Yohe and Tol, 2002, Gupta et al., 2010). Alberini (2006) suggests that countries with smaller economies tend to have lower coping capacities than those with bigger economies. Developing countries that lack the means to establish coping mechanisms are more vulnerable and often limits them to the reactive approach to adaptation (Berrang-Ford et al., 2011, IPCC, 2007a, OECD, 2006, World Bank, 2010). In preparing for adaptation to climate change, countries with limited resources are least able to establish coping mechanisms to build resilience (Haddad, 2005). Therefore, critical assessments are needed to ensure adaptive capacity within
is built to adapt to the changing conditions and not towards ‘maladaptation’ (Adger et al., 2003).

1.4 Evaluating Adaptation Measures

This section evaluates adaptation measures, in the form of general frameworks, policies, strategies and action plans, which have been introduced by the government of RMI to address the social driving forces of environmental problems which have attributed to its vulnerability to climate change. The focus is to examine gaps and constraints to enable identification of proper tools for adaptation. According to Pittock (2009), optimal adaptation strategies (or measures) will only be adopted if there is a degree of caution to what will likely happen and how it will affect the people. The Marshall Islands has, over the last two decades, introduced and adopted frameworks and policies to ensure the protection of its environment. Evaluating the use and effectiveness of these frameworks, policies, strategies and action plans will hopefully assist practitioners and decision makers to better understand and implement the legal instrument. This constitutes a vital role in adopting the proper tools needed for adaptation.

Adaptation ensures that the current policies incorporate the effects of climate change and variability, thereby reducing the vulnerability associated with these changes ensuring environment sustainability for future generations (Pielke, 1998). Manful and Wangwacharakul (2007) point out in their study that one of the entry points of integrating climate change adaptation into development would be through a systematic application of climate risk assessments to development projects. Many countries have mainstreamed environmental impact assessments (EIA) into their infrastructure sectors. In the context of climate change, mainstreaming implies the integration of climate change into the national development process (NCSP, 2013) Studies point out that local factors and, in particular, institutional arrangements influence the quality and pace of a country’s political instruments and adaptation frameworks (Stadelmann-Steffen, 2011). According to McCright and Dunlap (2003), the implementation of climate change adaptation policies is progressing rather slowly. In order to improve this, it is crucial to know more about the conditions under which national environment policies are adopted (Adger et al., 2003).
Possible entry points to mainstreaming climate change adaptation in RMI could be through the National Coastal Management Framework (2008). According to Wickham et al., (2009) integrating climate change into existing national laws and regulations may assist in building the communities’ coping mechanisms and thus reducing climate risk. The Environmental Impact Assessment (EIA) Regulations (1994) and the Coastal Management Framework contain provisions of possible entry points that could easily be accepted, understood and adopted by the community. However, studies on EIAs have shown that limited adaptive capacity and financial resources, enforcement, compliance and monitoring become great challenges. For instance, modern governance controls such as the enforcement of earth moving regulations impedes traditional system of land use. With the lack of awareness of the benefits associated with modern concepts such as land zoning or land use plans, landowners are less than accepting of regulations on solid waste disposal, sewage disposal, earthmoving or land use that might infringe on their rights over their own land (Crawford et al., 1992). Another valid point that merits consideration is that many islanders are not motivated to manage the resources which they rely on if they have no voice in the process which ultimately controls the allocation of the resource (Carew-Reid, 1989).

### 1.5 Analyzing Adaptation Tools

This section focuses on analyzing adaptation tools such as assessments, approaches, strategies and methods that are targeted at assessing specific sectors where climate change effects have been identified. The increased awareness of the impacts associated with climate change has prompted donor organizations to focus funding on mainstreaming adaptation into sustainable development planning (Gigli and Agrawala, 2007). Donor and implementing organizations for climate change projects in the Pacific are presented in Table 1.1 and Table 1.2 on the next page.
Table 1.1: Sources of funding for climate change projects in the Pacific from 1991 to 2009 (Hay, 2009a).

<table>
<thead>
<tr>
<th>Donor Organizations</th>
<th>Donor-funded Projects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Australia</td>
<td>96</td>
</tr>
<tr>
<td>United Nations Development Program</td>
<td>56</td>
</tr>
<tr>
<td>European Union</td>
<td>49</td>
</tr>
<tr>
<td>New Zealand</td>
<td>44</td>
</tr>
<tr>
<td>Global Environment Facility</td>
<td>40</td>
</tr>
<tr>
<td>Asian Development Bank</td>
<td>35</td>
</tr>
<tr>
<td>Food and Agricultural Organization</td>
<td>26</td>
</tr>
<tr>
<td>Japan</td>
<td>24</td>
</tr>
<tr>
<td>Other United Nations Agencies</td>
<td>23</td>
</tr>
<tr>
<td>World Bank</td>
<td>13</td>
</tr>
</tbody>
</table>

Table 1.1 shows the number of climate change related projects in the Pacific region that were funded by donor organizations during the period from 1991 to 2009. Australia has evidently played a leading role in the provision of financial assistance to support the implementation of many projects.
Table 1.2: Implementing agencies for climate change projects in the Pacific from 1991 to 2009 (Hay, 2009a).

<table>
<thead>
<tr>
<th>Primary Implementing Agencies</th>
<th>Implemented projects</th>
</tr>
</thead>
<tbody>
<tr>
<td>United Nations Development Program</td>
<td>79</td>
</tr>
<tr>
<td>Secretariat of the Pacific Applied Geoscience Commission</td>
<td>77</td>
</tr>
<tr>
<td>Australian Aid</td>
<td>43</td>
</tr>
<tr>
<td>Pacific Island Governments</td>
<td>38</td>
</tr>
<tr>
<td>Asian Development Bank</td>
<td>32</td>
</tr>
<tr>
<td>World Bank</td>
<td>26</td>
</tr>
<tr>
<td>European Union</td>
<td>24</td>
</tr>
<tr>
<td>New Zealand Aid</td>
<td>22</td>
</tr>
<tr>
<td>Food and Agricultural Organization</td>
<td>22</td>
</tr>
<tr>
<td>Secretariat of the Pacific Community</td>
<td>16</td>
</tr>
<tr>
<td>Secretariat of the Pacific Regional Environment Programme</td>
<td>14</td>
</tr>
<tr>
<td>Japan International Cooperation Agency</td>
<td>13</td>
</tr>
<tr>
<td>University of the South Pacific</td>
<td>12</td>
</tr>
<tr>
<td>Red Cross</td>
<td>11</td>
</tr>
</tbody>
</table>

In the Pacific, regional organizations play key roles in assisting countries implement climate change projects on the ground. Table 1.2 shows that the United National Development Programme (UNDP) and the Secretariat of the Pacific Applied Geoscience Commission (SOPAC) are leaders amongst the implementing agencies. Despite the number of climate change projects carried out in the Pacific, the ability to independently access and report on these projects seem to be lacking (Hay, 2009a).

“Policy commitments to manage these risks through integration have stimulated a burgeoning variety of tools and learning resources that aim to improve awareness and decision-making associated with development cooperation in the context of climate variability and change” (Hammil and Tanner, 2011). Analyzing these adaptation tools or assessments forms an important part within the decision making process (Burton et al., 2002).
1.5.1 Evolution of adaption assessments in the Marshall Islands

Early adaptation assessments were largely multilateral and multi-sectoral approaches, which RMI undertook with other Pacific Island Countries. Detailed analysis of the methodologies, approaches, tools and frameworks specific to RMI will be discussed in the subsequent sections.

1.5.1.1 Vulnerability Assessments

In the earlier stages of development, stocktaking exercises largely focused on describing the methodological tools rather than considering lessons learnt at the end of a project’s implementation (Hammil and Tanner, 2011). During the early 1990s, assessments focused on vulnerabilities resulting from scoping studies done at the national level. Subsequently, when the UNFCCC process came along, adaptation was still a framework of policies and proceedings undertaken with scoping of future effects of climate change such long term sea level rise (Manful and Wangwacharakul, 2007). In contrast, studies on mitigating climate change in terms of emission reductions were already well underway. However, the inability to negotiate feasible mitigation targets shifted focus towards adaptation and scoping studies then began to emerge (Lövbrand, 2004).

Early approaches to adaptation focused on the top-down mindset, moving from global models to scoping studies then to assessments (van Aalst et al., 2008). The common methodology developed by IPCC (IPCC CZMS, 1992) focused on vulnerability and therefore was not widely used throughout the Pacific. This was due to the different national circumstances; it was difficult to apply a common methodology focused on vulnerability in one island and project that will be the same in the others. Earlier studies focused on the vulnerability of the current impacts rather than preparing for future impacts. Furthermore, many Pacific island countries lack the technical capacity to understand the methodology and attempts in defining the term “vulnerability” in the native languages was too difficult.

The first study for RMI – the National Environment Management Strategy (NEMS), was undertaken in 1991 and the subsequent report under the same name was published in 1992 (Crawford et al., 1992). The study, which was funded by the
National Oceanographic and Atmospheric Administration (NOAA) in partnership with the Secretariat of the Pacific Regional Environment Program (SPREP), applied the IPCC – Common Methodology (IPCC-CM) to assess the vulnerability of the atolls to sea level rise. In assessing the projected ecological and socio-economic impacts of sea level rise under different emission scenarios, the study concluded that RMI would be severely at risk if sea level were to increase by even the lowest projection set by IPCC Working Group I. The study recognized that coastal degradation would continue to be exacerbated by sea level rise and recommended that attempts to adapt and mitigate the effects of sea level rise be mainstreamed into an integrated coastal management program.

The NEMS, as a vulnerability study, was the first of its kind to be conducted in RMI and in Micronesia. While the results indicated many benefits to the community, the implementation measures recommended were just too costly. Consequently, the initiative ended with a desktop report (Crawford et al., 1992). The economic cost of implementation together with current priorities at the decision making level plays a major role in to adapting to climate change.

1.5.1.2 Index based Assessments

The Environmental Vulnerability Index (EVI) (Kaly et al., 1999) was a complex set of indicators that measured the vulnerability of the economy and the society against multiple factors such as sea level rise, climate and environmental change. The approach targeted Small Island Developing States (SIDS). The EVI indicated that limited availability and poor accuracy of data produced uncertain conclusions. For this reason, EVI findings were not endorsed by many Pacific countries as a tool to assess environmental vulnerability (SOPAC, 2005).

1.5.1.3 Assessments of hazards and managing of risks

The Guidelines for Comprehensive Hazard Assessment and Risk Management (CHARM) was developed to help PICs in establishing response measures at the national level to proactively manage impacts resulting from natural and human causes. The initial steps began in the early 1980s; however, it was not until 2001 that the CHARM was officially launched by the Secretariat of the Pacific
Applied Geoscience Commission (SOPAC). The CHARM focused on integrating disaster risk reduction measures at the national level by developing strategies for preparedness and response at the decision making level (SOPAC, 2001). Countries that have attempted to integrate and apply these guidelines into their national disaster plans include Palau, Kiribati, Fiji and Tonga (UNFCCC, 2009a). While CHARM was also introduced to the Marshall Islands, the lack of support and receptiveness to a preemptive risk management approach was the main factor that limited its widespread application. Despite the failure of CHARM in the Marshall Islands, many other PICs have benefitted from its introduction and have become familiar with risk reduction and adaptation management strategies (Bettencourt et al., 2006).

1.5.1.4 Locally Focused Assessments and Adaptation

The Capacity Building for the Development of Adaptation Measures in the Pacific Island Countries (CBDAMPIC) is thought of as the first adaptation project that involves the community and focuses on a ‘learning-by-doing’ adaptation approach (Nakalevu, 2006a). The methodology, developed and implemented by SPREP, is user-friendly and focuses on the participation of communities. It employs a combination of a top-down and bottom-up process, enabling the community to see a better picture of what vulnerabilities they are exposed to, thus being able to identify ways to build adaptive capacity and implement adaptation measures. Building on the lessons learnt from CBDAMPIC, SPREP in 2006 launched a more in-depth adaptation tool called the Community Vulnerability and Adaptation Assessment and Action (CV&A) approach to assess adaptation in several pilot PICs.

The focus of this approach was to be concise and develop capacity within the local communities to identify their own vulnerabilities, develop suitable adaptation options and improve resilience to climate change. Subsequently, the University of the South Pacific’s Pacific Centre for Environment and Sustainable Development (PACE-SD) put together a similar community-based assessment tool called the USP’s ‘Integrated Approach’ to Vulnerability and Adaptation. This ‘integrated approach’ factors in the current climate variability and long-term climate changes by assessing the socio-economic and environmental impacts of a community (Koshy and Limalevu, 2009). The PACE-SD methodology merges the views of the
community with the expert in a more concise manner, integrating combinations of the SPREP CV&A and the CBDAMPIC methodologies.

1.5.1.5 Integrated Assessments

Under article 4.1 (b) of the UNFCCC, all parties are to “formulate, implement, publish and regularly update national and where appropriate, regional programmes containing measures to...facilitate adequate adaptation to climate change” (UNFCCC, 2006). The Marshall Islands is in the process of developing its Second National Communication (SNC) – a country report assessing the nation’s progress towards achieving the objectives of the UNFCCC. Results from a study conducted by the UNFCCC on the impacts, vulnerabilities and adaptation in developing countries concluded that a useful approach is to integrate feasible adaptation alternatives into national sustainable development plans, thus alleviating the strains put on the environment, reducing risk and improving the social livelihood of the people (UNFCCC, 2008). RMI has chosen to use the SimCLIM methodology to develop its SNC (OEPPC, 2012). The SimCLIM tool is an integrated computer modeling system that has incorporated Geographic Information System (GIS) with the capacity for multi-spatial analysis. The software is constantly updated with the latest data, allowing it to generate likely scenarios (Warrick, 2006). The scenarios produced by SimCLIM indicate existing and likely future conditions, given certain input climate conditions. Given the right information, such as socio-economic conditions and rainfall, SimCLIM is able to create overlays of different input variables for different timeframes in the future. This enables the users to measure the possible effects of climate change and establish suitable adaptation measures (Warrick, 2006). The SimCLIM is a top down approach. This tool does not require participation from the community rather it relies heavily on statistically collected data and computer modeling.

1.5.1.6 Risk-based Approaches

In seeking to develop a risk-based approach to adaptation, the United Nations Development Programme (UNDP) came up with the Adaptation Policy Framework (APF). The framework looks at incorporating the identification of risks and
developing applicable adaptation strategies. The APF is a five-step process that begins with the scoping and design of an adaptation project; on to assessing the present vulnerabilities; then to assess plausible future risks, thus formulating adaptation measures to respond to the present and future conditions and looks at the sustainability of the project. (Lim and Spanger-Siegfried, 2004).

Subsequently, ADB developed a risk-based approach that made it possible to put an economic value on current and anticipated risks associated with climate change and calculating the costs (ADB, 2006). This climate proofing approach identified the advantages and disadvantages of a community adopting a “no regrets” adaptation, thereby showing that anticipated adaptation approach is cost effective in the long term rather than reactive adaptation.

Furthermore, it also determines the incremental costs of adaptation, which is needed to access international funding. In the Federated States of Micronesia (FSM), through the PACC project, one of its state governments: Kosrae, in early 2011, successfully mainstreamed adaptation measures into their legal framework (SPREP, 2011). In using a risk-based approach, the project was able to identify the risks and develop adaptation measures into their EIA process. This required the participation of the community and environmental stakeholders. This approach was successful mainstreamed into FSM's environmental legal framework. This new law falls under the Transportation and Infrastructure sector, making it mandatory for all related development projects to consider climate change during design and implementation phase. This new law effectively delayed a road improvement project which, if carried out without considering the effects of climate change, would have incurred huge cost for maintenance in the long term (Pacific Newsbeat, 2011).

### 1.5.1.7 UNFCCC assessments and associated processes

Since its inception in 1994, the UNFCCC has been the biggest player in assessing vulnerability and adaptation in the Pacific. Non-Annex I Parties, such as RMI and other PICs, are encouraged to use methodologies appropriate to their national circumstances, provided these methodologies are consistent, transparent and well document (UNFCCC, 2003). Through the Pacific Islands Climate Change Adaptation Program (PICCAP), assistance was provided to PICs to implement their
obligations under the Convention on Climate Change. PICCAP is an outcome of the Climate Change Training Program (CC-Train) under the UNFCCC. This program was designed to assist the PICs develop their national communications. The RMI’s Initial National Communication (INC) was funded through PICCAP and was developed using the IPCC-CM (RMIEPA, 2000). In developing its SNC, as required under the UNFCCC, RMI has opted to use the SimCLIM methodology developed by Warrick (2006). Both tools used to develop RMI’s first and second national communications are top down driven approaches and community participation is not required.

Countries have the opportunity to access grant funds to carry out assessments under the UNFCCC and this prompted countries to begin to assess their vulnerabilities and adaptive responses to climate change (UNFCCC, 2008). Because of these adaptation assessments, UNDP launched the National Capacity Self-Assessment (NCSA) project (UNDP, 2005b). This project entailed assessing the implementation aspects of the three Rio Conventions on climate change, biodiversity and desertification at the national level. The UNDP self-assessment looked at the gaps and constraints faced by countries in coping with environment issues as well as the constraints in meeting country obligations to the environmental conventions to which they are a party. RMI is currently working on their NCSA and has not yet set a date for completion of this report. An assessment of countries that have completed their NCSA indicated several factors that hindered the capacity of governments to fulfill their reporting requirements and carry out the mandates of the three Rio conventions (Bellamy and Hill, 2010). The following factors were highlighted in the report:

- Lack of access and complete information as a barrier to fulfilling obligations under these conventions;
- Lack of organizational roles and a coordinated environmental management process;
- Too often in the governance regime of many Pacific Island countries, there is policy on paper, but enforcement and implementation is missing;
- Lack of community participation in the assessments;
- In the end, there is a clear lack of monitoring and evaluation prohibits the governments from knowing where capacity is really needed.
Then there is the Nairobi Work Programme (NWP) a process developed under UNFCCC to build capacity for the most vulnerable countries in understanding and assessing climate change impacts and vulnerabilities. To facilitate adequate adaptation and share lessons learnt from assessing adaptation, the programme covers the use of methods and tools, data and observation, scenario modeling, risk related events, socio-economic information, adaptation planning and so on (UNFCCC, 2010). The NWP was launched in 2005 and ran for five years. This process is not a participatory approach and is focused primarily from the top down.

1.5.1.8 Assessments of International, Regional and other Policy Frameworks

The UNFCCC is an international treaty, which encompasses a set of principles, of which Article 3.1 states “Parties should protect the climate system for the benefit of present and future generations of human kind, on the basis of equity and in accordance with their common but differentiated responsibilities and respective capabilities. Accordingly, the developed country Parties should take the lead in combating climate change and the adverse effects thereof.” (UNFCCC, 2003, UNFCCC, 2006, UNFCCC, 2008). Its progeny, the Kyoto Protocol, is a legally binding agreement, which entails that developed countries are expected to provide technical and financial resources to developing countries to assist them in meeting their obligations. The preamble to the Convention and its Article 4.8 recognizes the vulnerabilities of small island nations and encourages actions to meet their special needs.

The Pacific Islands Framework for Action on Climate Change (PIFACC) 2006-2015, generated by the Pacific Islands Forum Secretariat (PIFS) and coordinated by SPREP, provides a regional framework to assist countries in the Pacific build resilience to combat the adverse impacts of climate change. The PIFACC is a top down approach that is evaluated by its Pacific country members and does not involve the community. Its goals is summed up as follows, “to ensure the Pacific island people build their capacity to be resilient to the risks and impacts of climate change with the key objective to deliver on the expected outcomes under the following Principles”: to implement adaptation measures, governance and decision making, improving understanding of climate and so on (Hay, 2009a).
Along with PIFACC came the Pacific Regional Disaster Risk Management Framework (PDRMF), spearheaded by SOPAC, which looks at disaster risk management, recognizing that climate change effects share a common goal to reduce the society’s vulnerability to hazards by ensuring anticipation, resistance and recovery from their effects (Hay, 2009b). Disaster risk management focuses on risk reduction and management, beginning with prevention, mitigation, adaptation, preparedness, relief and ending with recovery. There is an increase in the intensity and frequency of climate related hazards such as longer droughts and heavy rainfall events. This increase is in line with the projected climate change scenarios and have important implication on disaster related risks (Hay and Mimura, 2010). An integrated approach to climate change adaptation and disaster risk management was suggested as the inter-relatedness of these two themes became increasingly evident (Hay, 2009b).
1.5.1.9 Traditional knowledge and Climate Change

Pacific island communities have been adapting to the environment and its changing conditions long before Europeans colonized the region. In the past, it was much easier for humans to respond to climate change and adapt to the changing conditions (Nunn, 2009). People moved with ease from one place to another, undisturbed by the bureaucracy of land ownership issues that we often see and read about today. In the absence of formal land use system of ownership the migration was simpler.

In addition, communities adapted by using their traditional knowledge of growing climate resilient crops such as breadfruit and digging up groundwater wells to supply their water needs. PACE-SD (2011b) factsheet on traditional knowledge encourages the need to utilize the combination of tradition and science in adapting to climate change. The integration of traditional knowledge and climate change science could potentially enhance the level of resilience in the local communities. For instance, in Palauan folklore, if a spider suddenly comes out of the corner ceilings of the house and creates a web, it is a sign that a typhoon is approaching (Temengil, 1995). A similar legend is also well known in the Marshall Islands. Traditional knowledge in early warning systems, water usage, land use and agriculture are integrated forms of adaptation tools still practiced today.

1.5.1.10 Cost and Benefits of Adapting to Climate Change

Over US$200 million have been spent on climate change projects in the Pacific (Carbon Market Solutions, 2010) which focus on mitigation, vulnerability and adaptation assessments and capacity assessments (Hay, 2009a). Over the last decade, there has been a need to assess the cost of adaptation to provide governments with a clear picture of the impact of climate change on the economies and social well-being of Pacific communities.

The World Bank carried out an assessment in Samoa that utilized a methodology focusing on a two-track approach to estimating the cost of adaptation linking country level costs to regional and global cost of adaptation (World Bank, 2010). Lal et al. (2009) and Lal (2010) assessed the vulnerabilities and quantified the economic cost of severe flooding in 2009 on sugarcane farmers in Fiji using an
integrated ‘with or without’ cost benefit analysis (CBA) in combination with a disaster assessment approach. These studies included policy options on how to minimize risk in flood prone areas within the sugarcane belt. The methodology is a top down approach used by Lal and was originally developed by the United Nations for the Latin American and Caribbean countries.

Chadbourn et al. (2010) developed and applied a methodology for undertaking a CBA utilizing the “backward looking” approach on a community-based project related to climate and disaster risk management. This methodology was demonstrated in Fiji and Samoa, with both studies focusing on flooding. The Samoa CBA assessed the economic value of implementing either structural (flood walls and diversion routes) or non-structural (building codes and flood forecasting systems) options for disaster risk reduction in a water catchment. The non-structural options were found to be more feasible and were preferred over the structural measures (Chadbourn et al., 2010). The Fiji CBA was conducted for the Navua River flood warning system. The study revealed that the benefits could yield high economic returns to the community of Navua, the Fiji government and all other stakeholders. In Kosrae, FSM, a road construction project had to be delayed in order to conduct a CBA. The results showed that, despite incurring extra cost, climate-proofing the road was necessary to reduce the future long term cost due to the risk of climate-related damages (Nakalevu, 2011). The examples above show that CBA can be a useful tool to benefit countries from the national level down to the community level.
Table 1.3: Summary of national, multi-country and regional project between 1991 and 2009 (adapted from Hay, 2009a).

<table>
<thead>
<tr>
<th>Country</th>
<th>Number of Projects</th>
<th>Total Value of Projects (million USD)</th>
<th>Number of Projects not Valued</th>
<th>Average Value of Projects (million USD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cook Islands</td>
<td>11</td>
<td>35.9</td>
<td>2</td>
<td>4.0</td>
</tr>
<tr>
<td>Fiji</td>
<td>46</td>
<td>122.2</td>
<td>7</td>
<td>3.1</td>
</tr>
<tr>
<td>FSM</td>
<td>8</td>
<td>8.5</td>
<td>5</td>
<td>2.8</td>
</tr>
<tr>
<td>Kiribati</td>
<td>22</td>
<td>31.8</td>
<td>5</td>
<td>1.9</td>
</tr>
<tr>
<td>Nauru</td>
<td>10</td>
<td>3.6</td>
<td>4</td>
<td>0.6</td>
</tr>
<tr>
<td>Niue</td>
<td>2</td>
<td>0.0</td>
<td>2</td>
<td>N/A</td>
</tr>
<tr>
<td>Palau</td>
<td>12</td>
<td>11.2</td>
<td>5</td>
<td>1.6</td>
</tr>
<tr>
<td>PNG</td>
<td>19</td>
<td>874.5</td>
<td>11</td>
<td>109.3</td>
</tr>
<tr>
<td><strong>RMI</strong></td>
<td><strong>16</strong></td>
<td><strong>11.1</strong></td>
<td><strong>3</strong></td>
<td><strong>0.9</strong></td>
</tr>
<tr>
<td>Samoa</td>
<td>39</td>
<td>109.0</td>
<td>10</td>
<td>3.8</td>
</tr>
<tr>
<td>Solomon Islands</td>
<td>23</td>
<td>87.7</td>
<td>8</td>
<td>5.8</td>
</tr>
<tr>
<td>Tokelau</td>
<td>2</td>
<td>0.3</td>
<td>1</td>
<td>0.3</td>
</tr>
<tr>
<td>Tonga</td>
<td>16</td>
<td>21.2</td>
<td>7</td>
<td>2.4</td>
</tr>
<tr>
<td>Tuvalu</td>
<td>11</td>
<td>6.4</td>
<td>4</td>
<td>0.9</td>
</tr>
<tr>
<td>Vanuatu</td>
<td>26</td>
<td>40.2</td>
<td>3</td>
<td>1.7</td>
</tr>
<tr>
<td>Mult-country</td>
<td>66</td>
<td>171.9</td>
<td>23</td>
<td>4.0</td>
</tr>
<tr>
<td>Regional</td>
<td>170</td>
<td>324.5</td>
<td>61</td>
<td>3.0</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>499</strong></td>
<td><strong>1,860</strong></td>
<td><strong>161</strong></td>
<td><strong>5.5</strong></td>
</tr>
</tbody>
</table>

Table 1.3, above, shows that a total of 499 projects, valued at US$ 1.86 billion, were implemented throughout the Pacific between 1991 and 2009 (Hay, 2009a). Papua New Guinea received a significantly large amount of funds for projects towards climate change, followed by Fiji and Samoa. RMI received US$11.1 million, Palau, US$11.2 million and FSM, US$8.5 million. These three Micronesian islands received a combined US$30.8 million for climate change projects focusing on mitigation and adaptation. For most of the adaptation projects, the funds were earmarked for reporting and capacity building activities rather than on implementation of on-the-ground projects.

A study by Bettencourt et al. found that in 2004 alone, roughly US$5.7 million had been spent on adaptation and risk reduction response measures in the Pacific (Bettencourt et al., 2006). This study on financing adaptation examined the cost of risks associated with hazards and indicated a shift in donor financing towards disaster risk reduction and recovery.
1.6 Justification of Research

According to (Caldwell et al., 2009), the Pacific lacks the relevant applied natural (physical) science and social science research to better develop ocean and coastal policy and management. While the development of tools over the last two decades indicate a growing awareness and interest in adapting to climate change, it leaves practitioners confused as to which tool is applicable and where development efforts are duplicated (Hammil and Tanner, 2011). It is important to assess current responses to the risks associated with climate change; therefore, countries can know what approaches or measures are appropriate according to their national circumstances (Nunn, 2009). A robust foundation towards establishing effective adaptation to climate change requires assessing the institutional capacity to become resilient to its anticipated effects. This then leads to identifying proper tools to adapt to these anticipated effects. It is important to analyze adaptation tools to highlight existing approaches that work to build mechanisms to prepare for climate change, without duplication.

1.7 Why the Marshall Islands?

RMI is chosen as an ideal case study site because of its vulnerability to the effects of climate change and of its national circumstances (e.g. geography, economy and history, etc., details of which will be presented next in Chapter 2). As a small island state, which is a Party to UNFCCC, as well as a Freely Associated State with the United States, RMI’s bilateral and multilateral relationships make it not only a distinctive example but also an interesting climate change adaptation case study in the Pacific region.

1.8 Research objective, aims and questions

This thesis, a collaboration between USP and the RMI Environment Protection Agency (RMIEPA), presents the results of the case study on assessing adaptation to climate change in RMI.

The overall aim of this thesis is to provide an understanding of the past and current approaches to adaptation to climate change that have been utilized in RMI since 1990, in order to better inform the national planning and development
decision-making process. Institutions form social norms (Gupta et al., 2010). Innovative characteristics or habits built within institutions empower practitioners to take necessary actions to be better prepared to respond to short and long-term effects of climate change. In making necessary adjustments, ‘insights into institutional form and…research on collective action’ will establish ‘collective management’ (Adger, 2001).

This study is developed around the following research objectives:

1) To understand the adaptive capacity of the enabling environment of the Marshall Islands to cope with the effects of climate change;

2) To evaluate the legal frameworks, policies and action plans of which support adaptation;

3) To review the various vulnerability and adaptation assessments/methods that have been used by the Republic of the Marshall Islands over the past 20 years;

4) To identify and determine approaches best suited to the Marshall Islands related to climate change adaptation;

5) To develop principles that may be applicable to understanding the vulnerabilities of the Marshall Islands to the impacts of climate change.

This research will become a living document and made available at the RMIEPA and RMI USP Campus to help inform policy decisions in national planning and development. Within this context, the main research questions of this research are summarized in Table 1.4 on the next page.
Table 1.4: Research questions and sub-questions

<table>
<thead>
<tr>
<th>Questions</th>
<th>Sub questions</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Main Question:</strong> How to assess adaptation to climate change in the Marshall Islands?</td>
<td></td>
</tr>
</tbody>
</table>
| By assessing adaptive capacity, what are the limits to effective adaptation in the Marshall Islands? | What is the governance structure?  
What is the enabling capacity?  
What is the adaptive capacity? |
| What legal mechanisms are available to inform the Marshall Islands climate change strategy? | What frameworks have been introduced which indirectly or directly relate to climate change?  
How is the enforcement and compliance of these legal instruments?  
What types of coordinating mechanisms for planning, implementation and monitoring of instruments addressing climate change is there? |
| What are the most appropriate assessment and adaptation tools and methods to guide adaptation?  
_i.e. What are the “Best Practices”?_ | What adaptation tools have been introduced?  
What are the strengths and limitation to utilizing these tools?  
What are the approaches that could be best adopted? |

1.9 Structure of the Thesis

This thesis is presented in six main chapters. Chapter 1 introduces the research and outlines the components essential for effective adaptation. It lays out the theoretical approach and explores the global and regional ideologies that influence adaptive capacity to implement measures of which enables the appropriate tools to deal with climate change. In Chapter 2, the methodology for this research is explained. Chapter 3 discusses the geography, economy and population, as well as the climatic and environmental conditions of RMI. Chapter 4 presents the key findings while Chapter 5 analyzes and discusses the relevance of those findings. The structure of Chapters 4 and 5 is guided by the three sub-questions identified in Table 1.4, above. Finally, Chapter 6 brings together the conclusions to this research and presents recommendations for the best possible approaches to effectively adapt to climate change in RMI.
2 Chapter 2: Description of Case Study Area

2.1 Geography

![Map of the Republic of the Marshall Islands](image)

Figure 2.1: Map of the Republic of the Marshall Islands (Lonely Planet, 2013).

The Republic of the Marshall Islands, located in the west-central Pacific, is a small nation encompassing 29 coral atolls and 5 solitary low limestone islands. The island group spans over a total area of 1.94 million km$^2$ of the Pacific Ocean, of which land comprises a mere 181 km$^2$ (70 square miles). The atolls and islands form two parallel formations known as the Ratak (Sunrise) Chain, on the east, and Ralik (Sunset) Chain, on the west (Figure 2.1). The sum of all the atolls and islets covering the entire nation is approximately 1,225, with most of its islands and islets extending no more than 1,000 m at their widest point (Terry and Thomas, 2008). The sizes of RMI’s atolls range from the small Nadikdik (Knox) Atoll at about 3.5 km$^2$ to the large Kwajalein Atoll, which has a land area of 16 km$^2$ and a lagoon area of 2,173 km$^2$. Kwajalein Atoll has the largest lagoon in the world (Spennemann and Marschner, 1994).
The capital – Majuro Atoll (Figure 2.2), is part of the Ratak Chain and has a total land area of 9.71 km$^2$ (3.75 mi$^2$). It is considered one of the most densely populated urban centers in the Pacific (Terry and Thomas, 2008). Majuro Atoll is a typical atoll, ring shaped, enclosing a saltwater lagoon and elongated with average land elevation of 2.4 m. Causeways, making Majuro approximately 49.9 km in length, now connects the main islets. It is exposed to the sea, and swells are generated from nearly all directions.

The geological formation of atolls in RMI can be explained by Charles Darwin’s theory of subsidence where sinking ancient volcanoes were slowly surrounded by fringing coral reefs. The earliest atolls began forming towards the end of the Mesozoic Era (about 70 to 80 million years ago) when volcanic activity came to an end. As the volcanoes sank, fringing reefs grew upward and closer to the sea surface to form today’s coral atolls (Terry and Thomas, 2008, Terry and Thaman, 2008). The internal make-up of the atolls of RMI are mainly biogenic organisms and coral sand attached onto the original foundation of cemented coral rubble or limestone that is slightly emerged above sea level. The coring of Enewetak and Bikini atolls yielded evidence of volcanic rock at 4,000 feet (1,219 m), and thus supporting the theory of subsidence (Guilcher, 1988).

Being an atoll nation, RMI’s soil, flora and fauna are amongst the poorest in the world (Terry and Thaman, 2008). The atolls are low and flat with a maximum height of not more than several meters above sea level. Working Group II of the
2007 IPCC report, identifies atoll islands as vulnerable to extreme climate events such as typhoons and environmental changes such as sea level rise (IPCC, 2007a). These factors have all contributed to rendering this atoll nation vulnerable to the effects of both climate and human-induced changes.

2.2 Economy and Population

RMI is a young independent nation and formerly a UN Trust Territory administered by the United States until the two nations signed a Compact of Free Association (COFA) in 1986 (Dunford and Ridgell, 2006). The funding provisions under the original compact terminated in 2005. The United States and the RMI entered a new compact treaty through to 2020 which provides economic stability for RMI together with foreign aid and revenues derived from international land leases (COFA, 2003). Main economic activities in RMI include subsistence farming and fishing (although more prevalent in the outer islands than the urban areas), commercial offshore fishing, wholesale, retail and government services. Tuna fishery generates RMI’s largest export and it has been noted that El Nino events generally bring considerably higher volumes (RMIEPA, 2000).

The 2011 population census revealed a total of 53,158 people in RMI. This indicated an annual growth rate of 0.4% over the 12-year period since the previous census in 1999, when a total of 50,840 people were counted. A significant decline in population growth rate can be seen in comparison to the 30-year period when the population tripled from 13,928 in 1958 to 43,380 in 1988 (EPPSO, 2012). The annual growth rate of 3.8%, at that time, rated RMI as the fastest growing population in the Pacific region. The low growth rate in recent decades is attributed to high migration to mainland United States.

The two most densely populated areas in RMI are on the atolls of Majuro and Kwajalein (particularly on Ebeye Atoll). 74% of RMI’s entire population can be found living in either of these two urban centers. According to the 2011 census, Majuro’s population of 27,797, alone, makes up 52% of the national total (EPPSO, 2012). This translates to a population density of 2,868 people/km² (or 7,413 people/mi²). A population of 9,614 lives on Ebeye, where the land area is much smaller than Majuro. Ebeye has to support a population density of 31,013 people/km² (or 80,117 people/mi²), which is almost 11 times that of Majuro and
among one of the highest in the world. For comparison, Suva, the capital of Fiji has a population density of 43 people/km² (FIBS, 2008) and the world’s most densely populated city, Manila, Philippines has 43,079 people/km² (Census Bureau of the Philippines, 2007). This overcrowding situation due to urbanization has resulted in significant constraints in environmental resource management (Crawford, 1993). The remainder of RMI’s population is scattered throughout the other smaller atolls. Kwajalein Atoll, which is adjacent to Ebeye Atoll and considered the same atoll, is a large US military installation with restricted access and also has a significant population of US Army personnel. They are not counted as part of RMI’s residential population.

2.3 Health and Education

In the RMI, well-known outbreak of diseases are hepatitis B, conjunctivitis and the recent dengue fever (Chutaro, 2011). Moreover, the effects of unsanitary conditions are exacerbated after extreme climatic events, which put pressure on water resources. These conditions are compounded by overcrowding and high humidity creating ideal conditions for epidemics such as diarrhea and dengue fever. The decreased consumption of fresh food and increased preference for imported processed food contributes to the ongoing rise in the incidence of non-communicable diseases such as diabetes.

In 2002, ADB in partnership with the national government conducted the Participatory Assessment on Hardship (2003). The results revealed that the people noticed improvements in the increasing number of children going off-island to seek higher education (i.e. after high school). However, these were mostly the ‘elite’ children (rich), which led to ADB’s conclusion that “…improvements, had probably not reached the more disadvantaged members of the society” (2003). Moreover, it was found in 2004 that many school teachers failed a number of literacy tests (Murray, 2007).

2.4 Land ownership

Land in the RMI is divided into wetos (strips of land running across an atoll from the lagoon to the ocean) which are privately owned by family groups called
*bwij* (Thomas, 2008). *Bwij* trace their land rights matrilineally through the *Alap* or person in immediate charge of the *wetos*. Even though *bwij* owns the land, the *Irojlaplap* (Chief) is recognized as the owner of all land under his authority even if he is not part of the *bwij* living on the land. The RMI constitution preserves traditional land rights (MIRC, 2005).

### 2.5 Environment

#### 2.5.1 Coastal Erosion

Erosion is a real problem in Majuro, causing loss of both ocean and lagoon coastlines. McKenzie et al. (2006) estimated the rate of coastal erosion to be about 0.15 – 0.46 m per year and that more than 99 km of coastline has already been badly affected. While coastal erosion can be attributed to both natural and human-induced causes, in Majuro, aggregate mining exacerbates the problem. Although, this activity generates income for the people, there is a need to consider the negative environmental impacts and long-term sustainability.

#### 2.5.2 Reefs

For the most part, the reefs of RMI are in good condition, having escaped the extensive damage seen in other parts of the Pacific. The fact that RMI is isolated has helped to minimize many potential impacts. The reefs surrounding RMI are home to over 800 species of fish, 250 types of coral, 250 species of algae and over 1,600 species of mollusks (Terry and Thomas, 2008, RMINBT, 2000). Unlike most of RMI, the reefs of Majuro are stressed by industry, pollution and human use; which have caused much damaged. The lagoon reef is a shallow platform consisting of low limestone biogenic elements ranging from fine sand to small boulders, which shows signs of environmental stress (for instance, diseased and dead corals).

#### 2.5.3 Marine Water Quality

The RMIEPA instituted the Marine Water Quality Regulation (1992) to maintain and protect lagoon and ocean waters. The regulation states that no waters of RMI shall be lowered in overall quality unless it has been demonstrated to the
Authority that a change is a necessary result of economic or social development, is in the best interest of the people, and will not permanently damage any marine resource (RMIEPA, 1992). With the development of the urban areas and increasing volume of waste, combined with the general lack of understanding of the effects of pollution, the lagoon and ocean continue to be misused as a dumping ground.

2.5.4 Water resources

Several sources of freshwater are utilized in RMI. These include rainwater, groundwater, desalination and imported bottled water. Rainwater is the primary source and is mainly harvested through a domestic rooftop catchment and tank system. RMI’s largest artificial rainwater catchment, located underneath and adjacent to the Majuro International Airport runway, supplies water to Majuro through a public distribution network (GWP Consultants and SOPAC, 2007). The risk of saltwater contamination to the stored water is high during typhoons and tropical storm.

The Laura groundwater lens on Majuro Atoll is the other major source of freshwater. Majuro Water Sewer Corporation monitors the freshwater lens, which is often threatened by development projects occurring on the land above it. Some threats to the quality of the freshwater lens include Majuro’s sewage disposal system, pesticide runoff from farms, livestock waste, seepage of persistent organic pollutants from the cemeteries and oil spills (Gerber, 2010). Irregular maintenance of domestic rooftop catchments can also introduce contamination to water stored in the tanks. Proper water safety plans and public awareness on water conservation are two methods which can contribute to reducing the vulnerability of RMI to water shortage during dry periods (GWP Consultants and SOPAC, 2007).

2.5.5 Biota

Majority of RMI’s flora and fauna are found out in the sea. Less than 10% of all animals are found on land. The relative good health of RMI’s reefs, discussed in Chapter 2.3.2, supports a rich diversity of fish species. Almost all of the 800 fishes found are native to RMI (RMINBT, 2000). Other marine organisms include shellfish, eels, sea urchins, sharks, turtles and dolphins. There are more than 700
species of plants; majority of which are marine (e.g. algae, seaweeds and sea grasses) and only about 80 are terrestrial. The Marshall Islands are also home to over 250 types of coral (Terry and Thomas, 2008).

2.5.6 Solid Waste

Public solid waste disposal landfills can be found only on the two main urban centers of Majuro and Ebeye. Despite the existence of these facilities and the Littering Act (1982), littering remains a major issue in these areas (Harding, 1996). Various types of municipal waste are often simply left on roadsides or dumped straight into the ocean and lagoon. Packaging waste such as aluminum cans, plastic cups, bottles and plates from imported food and supplies are a common sight. According to ADB (2005a), the ocean surrounding the Majuro and Ebeye are increasingly becoming so polluted that they are starting to affect the health of the marine ecosystem and the quality of seafood from these areas.

Poor waste management practices in the already fragile environment of atolls also present great challenges to sustainable development. Under current population densities and rates of urbanization in RMI, it is clear that the existing waste disposal systems are severely inadequate and a more suitable long-term solution needs to be developed in the near future.

Figure 2.3: Uncontrolled waste management practices on Majuro Atoll (courtesy of Dr. Dean Jacobson).
2.6 Climate

RMI has a tropical climate regime and is hot and humid all year round (RMI National Weather Service Office et al., 2011). The average monthly temperature is around 27°C and rarely fluctuates much (RMI National Weather Office, 2011). Rainfall is an important source of water for most tropical islands in the region, particularly for atolls such as Majuro. Majuro is located in the trade wind belt of the North Pacific Ocean, so the northeast trade winds prevail throughout the year (Terry and Thomas, 2008). There is a dry windy season (December to May) and a wet calm season (June to November). During the summers, Majuro regularly experiences the effects of the Inter-Tropical Convergence Zone (ITCZ) over the islands. Northern atolls are generally drier and experience more pronounced seasonality than the south (Terry and Thomas, 2008). Between March and November, minor storms from the east are common (Shea et al., 2001). Tropical storms and typhoons are rare but when they do occur, they bring heavy rainfall, strong winds and storm surges.

The IPCC (2007b) reported that since the 1970s the climate is changing at much faster pace with increases in precipitation observed in some areas while other areas are experiencing longer, droughts and more intense typhoons.

2.7 Disaster History

The national circumstance of RMI gives indications as to why the country should be concerned with the effects brought on by climate change. The highest land elevation in the whole of RMI is 6 m and can be found on Likiep Atoll. Fragile and vulnerable coral reefs surrounding the atolls make them vulnerable to natural disasters. The history of extreme events that have occurred in RMI has affected the people and the economy. The following subsections discuss the occurrences and effects of drought, tsunami, high surf and typhoon on RMI.

2.7.1 Drought

Majuro has suffered from drought events ranging from minor ones that occurred in the 1970s and 1980s to severe ones in the 1990s and in the last decade. The northern part of RMI is relatively arid, averaging not more than 20 inches (50.8
mm) of rain per month. In contrast, the atolls and islands in the south can receive as much as 160 inches (406.4 mm) of rain per month (RMI National Weather Service Office et al., 2011). This rainfall gradient causes the effect of droughts to be much more severe in the north compared to the south.

### 2.7.2 Typhoon

The greatest threats from natural disasters are from tropical storms and typhoons. RMI sits on the edge of the typhoon belt and experiences, on average, one major tropical storm every five years and one typhoon roughly every 70 years (Spennemann and Marschner, 1994). Historical data on typhoons remains largely incomplete but studies such as Spennemann and Marschner’s (1994) indicate that the ones which occurred in 1890, 1905, 1918, 1951, 1957, 1988 (Typhoons Roy and Pamela), 1992 (Typhoons Axel and Gay) and 1997 (Typhoon Paka) affected at least parts of RMI. Hazards brought on by typhoons that are more recent or tropical storms were mostly flooding due to heavy rainfall, extreme winds, salt spray and surges from waves.

### 2.7.3 High Surf

In 1994, high surf reportedly occurred damaging the Majuro International Airport sea wall and causing saltwater intrusion into the water catchment located adjacent to the runway. The high surf was said to have been created due to a storm that was developing in the southern hemisphere at the time (RMI National Weather Office, 2011).

### 2.7.4 Tsunami

When an 8.3 magnitude earthquake hit the Aleutian Islands in the US in March 1957, it caused 12 feet (3.7 m) tsunami waves in Maui and 14 feet (4.3 m) in Hilo, both in Hawaii. RMI was also affected, with waves at Kwajalein atoll estimated at about 9 feet (2.7 m). The 9.0 magnitude earthquake that struck Japan in March 2011 and resulting tsunami that affected many other parts of the Pacific generated waves of about 2 feet (0.6 m) in RMI, which fortunately did not cause any significant damages (The Marshall Islands Journal, 2011).
Chapter 3: Methodology

3.1 An Interdisciplinary Approach

This thesis uses an interdisciplinary research approach to examine adaptation to climate change in the Marshall Islands using a combination of qualitative, historical and analytical approaches to solve problems that are beyond the scope of any single discipline (Klein, 1990).

The pillars to establishing adaptation require assessing the RMI environment’s adaptive capacity to cope with climate change. This thesis looks at theoretical approaches from the global context and narrows the focus towards the national level. It begins by reviewing literature to build a framework that leads to addressing the barriers to effective adaptation on the ground and assess the gaps and constraints in building capacity to adopt successful lessons. This literature will provide a review going back over the last twenty years, using 1990 as a baseline. The review looks at lessons learnt and those that have yet to be learned, touching on gaps and constraints identified along the way. It goes on to look at the various regional projects, which RMI is a part of, such as the Pacific Adaptation to Climate Change (PACC) Project, and bilateral agreements such as the Australia International Climate Change Adaptation Initiative. The research then explores the use of the Cost Benefit Analysis (CBA) on particularly vulnerable sectors in the Pacific. The study will then identify the proper tools needed for adaptation by evaluating the adaptation measures currently in place to identify existing approaches that work.

Adaptive capacity assessments reveal that coping mechanisms are largely affected by the bureaucracy of legal frameworks and developmental policies (ADB, 2005b). Resilience to climate change is affected not only by climate change but also by various factors e.g. the socio-economic conditions of the enabling environment. Various studies point out that mainstreaming climate change considerations into legal frameworks and policies are needed for countries to strive for effective adaptation (ADB, 2009, Huq et al., 2003, Smit and Wandel, 2006). In addition to evaluating legal mechanisms, analyzing adaptation tools are equally important, in that adaptation tools driven by science can assist practitioners develop adaptation measures to better prepare for the anticipated effects of climate change.
Three key research sub-questions, which emerged from the overarching question of how to assess climate change adaptation in RMI, were earlier presented in Table 1.4. These sub-questions were developed and used to further elaborate the overall intention, which is: how effective adaptation can be achieved, adopted and sustained. Several sources of data were first identified to answer the main questions. These include academic literature (Chapter 3.3), legal documents (Chapters 3.4 – 3.6) and through several participant observation opportunities (Table 3.4) during an internship with RMIEPA. Information was also gathered from national climate change meetings and a workshop that occurred during the research period. In addition, data was also gathered in consultation with relevant Pacific regional adaptation experts who have facilitated or implemented climate change projects in RMI (refer to list in section 3.2).

This research began with consultations with various adaptation experts to guide the remaining research. Participant observation and fieldwork were carried out on Majuro Atoll, RMI from 2010 to 2012. Data gathered from the various sources identified were qualitatively assessed, evaluated and analyzed.

To address the overarching topic in this thesis, it is necessary to explore the history of the evolution of adaptation to climate change in RMI and evaluate how this affects the communities’ perception and ability to adapt today. The author assumes that a review of its history, evaluation of the legal mechanisms and an analysis of adaptation tools would reveal that effective adaptation can take place, if a thorough assessment of the enabling environment has been done. This research aims to identify the barriers that prevent successful adaptation. It is envisaged that by identifying these barriers, conclusions can be drawn on various appropriate approaches that could be developed, mainstreamed and adopted. This can build resilience by minimizing risk thus contributing to ensuring environment is developed sustainably.
3.2 Data Collection

The first question of Table 1.4 investigates academic literature on how adaptive capacity should be assessed as a prerequisite to discussions on adaptation. Subsequently, the second question denotes that legal concepts and policy documents be evaluated. This is to understand the relationship between adaptive capacity and the enabling environment. As a final point, after exploring various researches, theories and mechanisms that enable adaptation, an analysis of the adaptation tools is factored into this study. Notwithstanding, the human ability to adapt to the conditions of its living environment, these tools enhance and contribute to building community resilience. The focus in this case study is to explore the theory that effective adaptation requires assessing, evaluating and analyzing adaptation. Given the limited human and technical resources in small island developing countries, finding the intersection where the theories cross paths becomes crucial. These recurring ideas become basis for identifying, gathering and compiling of data and information. Each central idea drawn from the main topic reveals the sources of where to gather relevant information and data. The formulated questions set the tone for each section. The questions presented in Table 3.1 are indicative of what the main sections of this thesis will look like.
Table 3.1: Presentation of how each research question was answered using various types of methods. The color shades indicate the method used to complete each question.

<table>
<thead>
<tr>
<th>Research Questions</th>
<th>Component 1</th>
<th>Component 2</th>
<th>Component 3</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Assessment and investigation of historical and academic literature. Participatory observation at climate change workshops and meetings</td>
<td>Evaluation of legal proceedings, policy literature and legal documents. Participatory observation at the RMIEPA</td>
<td>Practical Analysis of methodological adaptation tools, framework and assessments. Document analysis.</td>
</tr>
<tr>
<td>1. By assessing adaptive capacity; what can be concluded as the limits to effective adaptation in the Marshall Islands?</td>
<td>✔️</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. In evaluating the current legal mechanisms in place, what can the Marshall Islands tell us about the best suited climate change strategy is according to their national circumstances?</td>
<td></td>
<td>✔️</td>
<td></td>
</tr>
<tr>
<td>3. What can adaptation assessments, methods and tools introduced in the Marshall Islands tell us about the most appropriate approach to adaptation?</td>
<td></td>
<td></td>
<td>✔️</td>
</tr>
</tbody>
</table>

As stated in Table 3.1, research questions 1 and 2 both cover components 1 and 2, and used a combination of desktop study, participatory observations and informal discussion with various environment practitioners. Research question 3 is an empirical research into the various adaptation methods and tools utilized in RMI in response to climate change adaptation. This section on analyzing adaptation assessments, methods and tools introduced in RMI provides an analysis into the use and applicability of these tools.
In addition, data was also gathered through consultation with Pacific regional adaptation experts. These include:

- Dr. Frank Thomas, University of the South Pacific
- Dr. Tony Weir
- Professor John Hay, University of Waikato
- Professor John Campbell, University of Waikato
- Lisa Schipper, Stockholm Environment Institute
- Dr. Arthur Webb, SOPAC
- Mr. David Sheppard, Director General, SPREP
- Mr. Taito Nakalevu, Climate Change Adaptation Officer, SPREP
- Dr. Graham Sem, Consultant
- Mr. Bruce Kijiner, Director, OEPPC, RMI
- Mr. Warrick Harris, Deputy Director, OEPPC, RMI
- Ms. Jennifer deBrum, Climate Change Coordinator, OEPPC, RMI
- Ms. Deborah B. Manase, Former General Manager, RMIEPA
- Mr. Lowell Alik, General Manager, RMIEPA
- Mr. Reginald White, RMI Meteorologist

3.2.1 Data Availability

Available data and documents were acquired through national, regional and international stakeholders. The lead agencies involved in this study are the RMI USP Campus and RMIEPA.

3.3 Literature Review

Literature on assessing adaptation to climate change in RMI emerged alongside the evolution of adaptation in the early 1990s. The evolution of adaptation, as introduced in Chapter 1, is not new. Prior to adaptation becoming an essential component to combating the effects of climate change, adaptation has evolved as part of the human need to survive. This initial review investigates the theories of how and when adaptation evolved into sustainable development venturing into the global political context and trickling down to the regional, national and community level. The literature analysed for this thesis examines adaptation capacity based on:
1) Academic and historical literature
2) Adaptive capacity, governance, institutional capacity
3) Informal consultations with adaptation and disaster risk experts: Professor John Campbell from the University of Waikato.

The findings of this review, which is integrated throughout the thesis, particularly in Chapters 1 and 4, includes the aspects of climate change science, vulnerability, history, tradition, modernism, adaptive, enabling and institutional capacity, governance, policy, climate and hazard risks, coping mechanisms as building blocks to achieve effective adaptation. It is important to build an understanding of what adaptation is in the context of climate change science, politics and practice at the national level and what it is meant at the community level. This literature review is guided by climate change science and adaptation and consultations with environmental practitioners and disaster risk experts from around the Pacific region. These informal consultations occurred through emails, workshops and meetings throughout the entire research process.

Table 3.2: Methodology for literature review.

<table>
<thead>
<tr>
<th>Literature Review</th>
<th>An investigation into academic literature and theories on assessing adaptive capacity, evaluating legal mechanisms and analyzing adaptation tools.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Questions</td>
<td>Refer to Table 3.1</td>
</tr>
<tr>
<td>Objectives</td>
<td>Understanding the theory behind adaptation</td>
</tr>
<tr>
<td>Methodology</td>
<td>Review of academic literature and theory; guided by informal consultation with experts.</td>
</tr>
</tbody>
</table>

3.4 Assessing Institutional Adaptive Capacity

The methodology used to assess adaptation in RMI is adopted from Willems and Baumert (2003) and Wickham et al., (2009), who suggest that a realistic step-by-step process is needed to identify actions appropriate to adapt to climate change. At each step, countries assess their existing institutional adaptive capacities, identifying actions that are within their capabilities and resources to achieve results within a reasonable timeframe. Diaz et al., (2005) point out that adaptive capacity of institutions should be understood as the capacity to perform functions that facilitate the adaptive capacity of their constituencies rather than as the ability to reduce their own exposure to climate risks. The findings of this institutional adaptive capacity
assessment are based on the three components in Table 3.1. The relevant documents reviewed were based on primary literature and documents collected from local and regional environmental agencies and organizations including climate change workshop reports and consultations with various environmental stakeholders and practitioners (refer to Section 3.2 for the experts consulted and Table 3.4 for meetings and workshops).

Institutional capacity is of two forms: enabling and adaptive. Under each form, there is a systematic step-by-step approach, which is needed to assess the enabling environment. This relationship, depicted in Figure 3.1 below, is used as a guide in this research.
RMIEPA was identified as the source agency to acquire the data and documents required for the relevant data and outcomes. An internship at RMIEPA provided access to key documents and data that were otherwise unavailable to the general public and provided the opportunity to gain an in-depth understanding of the limits to effective adaptation. This internship and subsequent opportunities to attend relevant meetings and workshops, made this study possible.
Table 3.3: Research Component 1: Methodology to assess adaptive capacity.

<table>
<thead>
<tr>
<th>Research Component 1&lt;sup&gt;1&lt;/sup&gt;</th>
<th>Review of historical and academic literature, and participatory observation at climate change workshops and meetings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Questions</td>
<td>By assessing adaptive capacity, what can be concluded as the limits to effective adaptation in the Marshall Islands?</td>
</tr>
</tbody>
</table>
| Objectives, Variables, or Questions assessed | Historical Government Structure:  
  - The influence of foreign power on governance  
Modern Government and Traditional Structures:  
  - Overview of structure and type of government  
  - Organizational links between government agencies  
  - Linkage between government and community  
  - Traditional system  
  - Challenges in the 21st century  
Political “will” on climate change adaptation:  
  - Commitment to climate change adaptation  
  - Is there political “will” in national policies and strategies?  
  - Is climate change reflected in Government programs and budget?  
Public Awareness and Education:  
  - What is the communication strategy for climate change and adaptation?  
  - How is communication on climate change disseminated?  
  - What are the indicators for effective dissemination of information and awareness programs?  
  - What is the extent of public education and understanding of the effects on coastal and marine ecosystems by government, practitioners and community?  
Institutional capacity:  
  - Which agency has the lead mandate for climate change adaptation?  
  - Is there a strategic plan? If so, have indicators been established to measure progress?  
  - Are resources available to the lead agency to effectively adapt to climate change?  
  - What is the extent of coordination of programs and initiatives on addressing the adverse effects of climate change?  
  - What is the communication strategy and how are the resources mobilized?  
  - What is the quality of leadership and agency heads?  
International Commitment to fight Climate Change:  
  - What is the extent of participation in global and regional conferences, workshops and meetings?  
  - What is the extent of briefings and communication to national counterparts prior to and after the conferences, workshops and meetings?  

---

<sup>1</sup> Refer to Table 3.1 for overarching methodology
What is the extent of communication on important decision documents and funding opportunities to the national and community stakeholders?

Methodology

1) an examination or review of literature: historical, technical and policy relevant documents;
2) participant observation during four months internship at the RMIEPA, the authority central to environmental management and protection in the Marshall Islands;
3) Consultations with environmental practitioners involved in climate change and environmental policy process.

Output

To understand the institutional capacity of the Marshall Islands to adapt to climate change.

Table 3.4: Meeting and workshops attended during this fieldwork.

<table>
<thead>
<tr>
<th>Internship</th>
<th>Date and Duration</th>
<th>Place</th>
</tr>
</thead>
<tbody>
<tr>
<td>RMI EPA</td>
<td>15th March to 15th August, 2011</td>
<td>Majuro Atoll, RMI</td>
</tr>
<tr>
<td>RMI USP Campus</td>
<td>15th March, 2011 to 16th June 2012</td>
<td>Majuro Atoll, RMI</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Conferences/Meetings and Workshops</th>
<th>Date of meetings/workshops</th>
<th>Place</th>
</tr>
</thead>
<tbody>
<tr>
<td>IPCC Regional Experts and young prospective scientist meeting</td>
<td>27th April to 29th April, 2011</td>
<td>Belmopan, Belize</td>
</tr>
<tr>
<td>RMI USP Campus Adaptation Workshop</td>
<td>4th July to 22nd July, 2011</td>
<td>Majuro Atoll, RMI</td>
</tr>
<tr>
<td>Youth to Youth Conference: Adapting to Climate Change</td>
<td>10th August, 2011</td>
<td>Majuro Atoll, RMI</td>
</tr>
<tr>
<td>Affordable energy - capacity building workshop</td>
<td>7th to 9th September, 2011</td>
<td>Majuro Atoll, RMI</td>
</tr>
<tr>
<td>Pacific Islands Regional Climate Assessment</td>
<td>5th September, 2011</td>
<td>Majuro Atoll, RMI</td>
</tr>
<tr>
<td>Disaster Risk Reduction and Climate Change Adaptation Workshop</td>
<td>10th to 14th October, 2011</td>
<td>Suva, Fiji</td>
</tr>
<tr>
<td>RMI USP Campus Environment Camp Arno and Ine</td>
<td>9th to 14th April, 2012</td>
<td>Arno Atoll, RMI</td>
</tr>
</tbody>
</table>

Table 3.4 shows a list of the internships, conferences, meetings and workshops, which the author attended and participated in throughout the duration of this research. The various meetings, conference and workshops were attended for observation, capacity building and data gathering purposes throughout the duration of this research. These opportunities provided the researcher with firsthand understanding of the barriers that limit adaptation in RMI.
3.5 Evaluating Adaptation Measures

This section evaluates adaptation measures introduced in the form of general frameworks, policies, strategies and action plans by the government of RMI to address the social driving forces of environmental problems which exacerbates vulnerability to climate change. The evaluation focuses on identification of appropriate tools for adaptation as well as constraints and gaps to focus on the development of optimal adaptation strategies (Pittock, 2009). The analysis of the use and effectiveness of RMI’s frameworks, policies, strategies and action plans implemented over the last two decades will assist practitioners and decision makers become better informed to adopt proper tools for adaptation and ensure protection of its environment.

The Magenta Book, developed by Philip Davies, provides a set of guidance tools that can be used by policy evaluators as well as decision makers to examine government frameworks, policies, strategies or action plans to ensure its effectiveness (Davies, 2011). Process evaluation was chosen from among the various methods to examine the effectiveness of the implementation of environment policies that focus directly or indirectly on climate change by identifying its strengths and limitations and whether the policies are producing the expected outputs (Davies, 2011). The process evaluation outcomes identify entry points where adaptation measures can be mainstreamed or integrated into policies, defining what and where to improve. Figure 3.2, below, summarises the process.
It is envisioned that these mechanisms put in place increases the ability of the community to become resilient to the effects of climate change.
Table 3.5: Research Component 2: Methodology for evaluating adaptation mechanisms.

<table>
<thead>
<tr>
<th>Research Component 2</th>
<th>Evaluation of legal proceedings, policy literature and legal documents. Participatory observation at RMIEPA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Questions</td>
<td>In evaluating the legal mechanisms currently in place, what can they tell us the most suited climate change strategy is, according to national circumstances?</td>
</tr>
</tbody>
</table>
| Objectives or Variables assessed | Legal frameworks:  
  - What frameworks have been introduced which indirectly or directly relate to climate change;  
  - What is the extent of implementation, communication and awareness of the laws and regulations; and  
  - How is the enforcement and compliance?  
  Policies and strategies:  
  - What are the types of policies and strategies addressing climate change? both indirectly and directly;  
  - What is the extent of awareness of government officials, stakeholders and communities of policies and strategies;  
  - What is the extent to which policies are used to guide plan an actions to address impacts of climate change on coastal and marine ecosystems;  
  - What is the extent of coordinating and implement policies and strategies; and  
  - What is the extent of coordination of related policies and strategies?  
  Coordinating Mechanism:  
  - What types of coordination mechanisms for planning, implementation and monitoring of V&A addressing climate change impacts on the coastal and marine environments;  
    - What is the extent of coordination beyond government departments and beyond projects;  
    - What are the roles of the coordinating teams including indicators;  
    - What type and extent of resources used for coordination purposes;  
  - What type and extent of communications used to maintain and strengthen coordination;  
  - What is the extent of linkages between related coordination mechanisms?  
  Programming:  
  - Type and quality of resources available to develop national V&A programmes;  
  - Type and extent of mandate and scope of Climate Change Adaptation Programme;  
  - Extent of links between programmes and national policies and strategies;  
  - Extent to which programme outcomes and outputs can be measured;  
  - Extent of participation by provincial and community level stakeholders in the programme; and;  

2 Refer to Table 3.1 for overarching methodology
| Methodology | 1) An examination or review of literature: historical, technical and policy relevant documents; 
2) Participant observation during four months internship at the RMIEPA, the authority central to environmental management and protection in the Marshall Islands; 
3) Consultations with environmental practitioners involved in climate change and environmental policy process. |
| Output | To evaluate the legal frameworks of which enable adaptation to climate change in the Marshall Islands. |

- Extent of donor support and involvement in national climate change adaptation programmes.
- Mainstreaming:
  - Level of awareness and understanding by government and stakeholders on mainstreaming, and
  - Extent to which climate change is included in programmes and budgets of governments, NGOs, private sector organizations.
3.6 Analyzing Adaptation Tools

The methodology for this component, as summarized in Figure 3.3 above, begins with literature and data that is already in hand. Information collected for this section was done through internship at RMIEPA from the period of March 2011 to August 2011 and attachment to the RMI USP Campus from March 2011 to June 2012. Data was collected manually by searching through RMIEPA and USP’s library databases, attending meetings and workshops (Table 3.4) and analyzing documents (desktop review). The anticipated outputs of this task are provided in Table 3.6, below.

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Refer to Table 3.1 for overarching methodology
Table 3.6: Summary of Research Component 3: Methodology to assess best practices

<table>
<thead>
<tr>
<th>Research Component 3&lt;sup&gt;1&lt;/sup&gt;</th>
<th>Practical Analysis of methodological adaptation tools, framework and assessments. Document analysis.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Questions</td>
<td>What can the various assessments and adaptation tools and methods that have been introduced over the past twenty years tell us about the best appropriate approach to adaptation?</td>
</tr>
<tr>
<td>Objectives or Variables assessed</td>
<td>A twenty year review of the various adaptation assessment/methods that have been used or are currently being used by the RMI; A review of the range of adaptation assessments being utilized and developed through bilateral and multilateral partnership. Identification and determination of approaches the will be best applied to assessing adaptation to climate change in the Marshall Islands; Principles or recommendations that may be best applied to understanding the tools used to assess adaptation to Climate Change; appropriate to national circumstances. Lessons learned and those that have yet to be learned; Create a clearinghouse mechanism to help make informed decisions by providing the foundation to adaptation in the Marshall Islands.</td>
</tr>
<tr>
<td>Methodology</td>
<td>1) An examination or review of literature: historical, technical and policy relevant documents; 2) participant observation during four months internship at the RMIEPA, the authority central to environmental management and protection in the Marshall Islands; 3) Informal consultations with adaptation experts from the University of Waikato and SPREP involved in climate change, disaster risk and environmental policy process.</td>
</tr>
<tr>
<td>Output</td>
<td>To understand the barriers to utilizing adaptation tools</td>
</tr>
</tbody>
</table>

<sup>1</sup> Refer to Table 3.1 for overarching methodology
4 Chapter 4: Findings

This section provides a qualitative analysis of adaptation assessments, methods and tools, focused mainly on those that have been introduced specifically to RMI through the Council of Regional Organizations in the Pacific (CROP) agencies. This section synthesizes the findings of each component and compares the underlying objectives, implementation, effectiveness, strengths and limitations of the numerous available tools available for adaptation.

Figure 4.1: Example of a typical step-by-step adaptation assessment tool (USAID, 2009b).

As described extensively in Chapter 1, the last decade has seen the emergence of a range of tools and methods that can assist countries understand and tackle the effect of climate change. These are guidelines that practitioners can refer to that best suit their national circumstances.

Figure 4.2: Example of the general steps to carrying out a Cost Benefit Analysis (Chadburn et al., 2010).
4.1 Assessing institutional adaptive capacity: Governance Factors

Individual communities, like countries, each have their own set of characteristics. As a result, the vulnerabilities that they face and the community’s ability to deal with them differ on a case by case basis (Lambrou and Laub, 2005). To be able to assist communities adapt to climate change, institutional capacity assessment must focus on governance controls alongside adaptive capacity to address the gaps and constraints that block the society’s ability to adapt to climate change. Governance, the process by which government institutions, organizations, communities, or any group of individuals with a mandate or a common purpose make ultimate decisions that direct their collective efforts should be assessed to improve the effectiveness of the adaptation process (Diaz et al., 2005). In this research, institutions are taken to be the means by which adaptive capacity is monitored and evaluated (Diaz and Rojas, 2006).

Four aspects of governance are explored to assess the capacity of RMI to successfully cope with the impacts of climate change:

1) The establishment of a core of well-informed and supportive group composed of community stakeholders including private sector or government agency representatives is critical to success;

2) Successful climate change adaptation requires institutions that are responsible for and/or affected by these adaptation measures to understand and support these efforts’

3) Stakeholder identification is critical and;

4) It is important that stakeholders affected by implementing these actions understand and support the targets, goals and strategies.

Community and stakeholder engagement in the development and implementation of adaptation measures is critical for effective climate change adaptation.

4.1.1 Historical Government Structure

Prior to first known sightings by Spanish explorers around the year 1526, the Marshallese were in relative isolation and their governance systems were in accordance to their own beliefs (Thomas, 2008). From 1788 to 1979, RMI was invaded and ruled by four foreign powers. The arrival of Protestant missionaries in
the late 1840s introduced religion and changed the Marshallese way of life (Andrew and Capelle, 2000). The Germans, Americans, and Australians soon followed with the introduction of copra trading. The Germans initiated formal economic development in RMI by using money in exchange for coconut plantations. In 1886, the Marshall Islands officially came under German protection. By 1914, Japan took control, changing the administration to a military system form of discipline and protocol (Thomas, 2008). This change also introduced the fisheries industry and the school system. In 1945, the United States won the war against Japan and took over control of the country until 1979.

During the early years of its authority, the United States carried out a series of highly controversial nuclear tests in Bikini Atoll, consequences of which persist to this day. In 1947, the RMI then officially became administered by the United States under the United Nations Strategic Trust Territory together with Palau and the Federated States of Micronesia (FSM). From 1950 to 1959, the affected population pursued justifiable compensation for the damage done by the nuclear tests on their land and subsequent effects of radiation. The US entered a 99-year lease agreement for the use of 750 acres of the land in Kwajalein Atoll between 1960 and 1979 at the cost of US$750,000.

The first Marshallese woman was elected into the Congress of Micronesia in 1973. RMI achieved self-governing status in 1979 when they ratified their new constitution. RMI gained full sovereignty in 1986 and officially entered into a Compact of Free Association (COFA) with the United States. Under the principles of Compact I, as it is commonly known, the United States gives economic aid in return for full military rights and defense responsibility (COFA, 2003, Powles and Pulea, 1988). Since gaining sovereignty, RMI has continued to use the governance system of the United States (Dunford and Ridgell, 2006). For 191 years, the Marshall Islands have continuously adopted many of their colonizers’ ideals, customs and ways of life but simultaneously struggled to remain true to their traditions and values.
“When the Missionaries arrived, the Africans had the Land and the Missionaries had the Bible. They taught us how to pray with our eyes closed. When we opened them, they had the land and we had the Bible.”
– Jomo Kenyatta

Traditional values and beliefs in governance methods largely fell out of practice with the introduction of the American system of governance (Crawford, 1993). It is this history and relationship between RMI and the United States that has heavily influenced its approach to developing adaptive capacity.

The Marshall Islands is one of the most vulnerable atoll nations in the world because of their nuclear past (Aguon, 2008). The advent of sovereignty from the late 1980s gave RMI additional power to challenge the United States’ bureaucracy that grew out of the early nuclear test period (Johnson, 2009). The impacts of the 1946–1979 nuclear program has driven the nation to build adaptive capacity on its own merit, whether it be adapting to human-induced or natural change.

5 Jomo Kenyatta (October 20, 1893 – August 22, 1978) was an African politician, the first Prime Minister (1963–1964) and President (1964–1978) of an independent Kenya. He is considered the founding father of the Kenyan Nation. Nairobi’s Jomo Kenyatta International Airport is named after him.
In the traditional and customary setting of governance, the social class system benefitted not only the individual person but trickled down from the head of the clan (chief), to the warrior and then to the worker (Thomas, 2008). Prior to foreign contact, the only form of governance was the traditional and customary clan system. In this social class system, the chief, the warrior and the worker all worked hand-in-hand to manage the environment and its resources to sustain the livelihood of the community. For at least 2,000 years the Marshallese people have adapted to the constraints of living on their islands through sustainable land use management and food production system (Terry and Thomas 2008). Recent studies have also shown that RMI’s colonization history has moved the society away from a traditional environment-dependent one towards a more economic dollar-based form (Hart, 1998).

Individuals and communities have been adapting to climate variability and change historically (Nunn, 2007), acquiring valuable knowledge in sustainably using their resources and regulating man-made environmental impacts (Kempton, 2001). There are values and benefits in mainstreaming traditional governance methods into contemporary modern governance when addressing the issue of adaptation to climate change. Effective resource management, for instance, was illustrated through strong mutual social obligations among community members to care for one another in the past (Hart, 1998). As a result, in the traditional and customary law system, a unified setting is established within the community, whereas “decision-making by majority vote causes division and unrest” (Shuster et al., 1998).
4.1.2.1 Governance today in the Marshall Islands

Over the past decades, traditional decision making processes have undergone constant transformation following the adoption of foreign parliament and democratic principles. Today, RMI has an intricately complex government system which is best described as multi-dimensional; combinations of Westminster, American and traditional styles, in a move towards harmonizing democracy, parliamentary and traditional ways of governing (Stege, 2009). Table 4.1 below presents an overview of the existing traditional and customary government structures in RMI.

Table 4.1: The institutional characteristics of the national and traditional government of the Marshall Islands (Powles and Pulca, 1988, MIRC, 2005).

<table>
<thead>
<tr>
<th>Institutional Arrangements</th>
<th>Marshall Islands</th>
</tr>
</thead>
<tbody>
<tr>
<td>National Government</td>
<td>RMI is a Republic with the President as its Head of State. The President is elected through a vote of the majority of the Nitijela (legislature).</td>
</tr>
<tr>
<td>Nitijela (members of Parliament)</td>
<td>33 members elected through electoral districts.</td>
</tr>
<tr>
<td>Municipal or Atoll Governments</td>
<td>24 atoll governments or electoral districts headed by a Mayor.</td>
</tr>
<tr>
<td>Community Councils</td>
<td>All communities have their traditional leadership structures based on kinship groups.</td>
</tr>
<tr>
<td>Traditional Leadership</td>
<td>Council of Iroij or House of Chiefs. 12 are chosen through customary law representing the two chains of atolls: 5 from Ralik and 7 from Ratak.</td>
</tr>
</tbody>
</table>

RMI’s government is led by a President who is the Head of State, as well as the Head of Government. The President serves a four-year term, similar to that of the United States, but is elected by majority of the Nitijela (legislature or lower house) requiring 17 out of 30 votes thus constituting a parliamentary system. In 2009, the parliamentary exercise resulted in a ‘voting without confidence’, thus changing the leadership of RMI twice in one year, consistent with the British political process.

The national government, including the cabinet and all ministries and legislative offices, is located in central Majuro, known as D.U.D referring to the hamlet names of Delap, Uliga and Rita (Djarrit). The Council of Iroij (traditional chiefs) serves as the consultative council and gives advice on matters related to

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6 See map of the Marshall Islands (Figure 2.1)
tradition, customary law and land issues. The local governments (of the atolls) are responsible for promoting community and rural development, while the national government oversees the environment sector, sets policies and enforces regulation. Mayors serve as executive officers in the atoll governments and are elected every four years on the same day the national general elections takes place in November.

RMI has an array of policies, laws and frameworks for environmental management and sustainable development. Despite improvements, the reality on the ground reveals ineffectiveness in implementation and enforcement of these policies (ADB, 2005b). One of the major environmental challenges exists in the traditional land tenure system (Terry and Thomas, 2008, Crawford, 1993). Public land ownership in RMI is rare, and according to traditional and customary laws, native landowners have rights of control over their own land.

Modern governance controls such as the enforcement of earth-moving regulations impedes traditional system of land use. The RMIEPA National Coastal Management Framework (2008) stipulates that land relocations or land filling require earth-moving permits. The activity itself is viewed as a traditional right, even though customary reclamation does not exist in the islands. The government and the public often see regulations on infrastructure development as an impediment to economic growth. The lack of partnership between the national government, the developer and the landowners was brought to light during a recent major coastal development project. In 2011, a US$15.7 million airport safety project funded by the US Federal Aviation Administration was interrupted because of the monetary disputes with the landowners (Johnson, 2011a). Landowners were claiming customary rights over the proposed dredging site and demanded payment for fill extraction. Necessary EIA permits had already been approved by project developer according to other news articles, but the landowners used customary law to demand more money. The project is currently still on hold (Johnson, 2011b). Without proper environmental education and awareness, there will always be that disconnect between the national government and the community.

An ADB, Country Environment Analysis (CEA) on mainstreaming environment considerations into economic and development planning in RMI concluded that although the government may undertake development projects that will have benefits to the society, lack of awareness and stakeholder support effectively deters such projects (ADB, 2005b). The ADB CEA in 2005 examined the
state of the environment, its role and the development impacts on the resources. Furthermore, the CEA analyzed the barriers and potential benefits of existing environmental frameworks, policies, associated budgetary processes and how management of the environment is affected. The study identified constraints in an attempt to seek funding through its ADB donors to assist developing countries remove barriers and build adaptive capacity to ensure sustainable use of their natural resources. Consultations with stakeholders from government agencies such as RMIEPA and OEPPC; nongovernmental agencies such as the RMI Conservation Society and private sector agencies like the Bank of the Marshall Islands revealed continued degradation of the quality of the environment and poor performance was a priority concern.

Other concerns identified by stakeholders included the need to develop a sustainable development plan, and in-depth biodiversity and vulnerability assessments. This study presents a roadmap to mainstream sound environment management practices into development, policies, plans and projects.

4.1.2.2 Challenges in the 21st century

Foreign political influence and uncontrolled global economic recession combine with extreme climatic events, damages to reefs, storm surges, sea level rise, human development and human political corruption, to severely degrade the nation’s resources. Murray describes politics in RMI since the 1980s as unstable governance, ‘dirty’ politics, corruption and environmental degradation (2007).

Greenhouse gas emissions driven by increases in industrialization, human population growth and expanded development in the last 100 years have caused major changes to the climate of the planet. The warming of the planet has also caused thermal expansion of the oceans and melting of the cryosphere (Pittock, 2005). Pacific sea level monitoring data suggests that between 1993 and 2010, RMI has experienced an average annual rise in sea level of 3.8 mm (Australian Bureau of Meteorology, 2010). At the current rate of sea level rise, low-lying atoll nations like RMI will experience major erosion along the shorelines, loss of land, degradation of the coral reef, serious flooding of lands and homes, and outbreaks of disease.

Shoreline development is essential to provide jobs, income opportunities, higher standard of living, and education and health opportunities to the people of
RMI. According to RMIEPA for the period 2008-2012 Majuro Atoll, in particular, was fast developing, with improvements to schools, hospitals, airports and private sector developments. The economic growth of RMI has created serious consequences on the environment through illegal mining of beach sand for infrastructure construction (e.g. houses, sea walls, schools, offices, land reclamation) (Terry and Thomas, 2008). Destructive methods used to extract aggregates include dynamite blasting of the reef, dredging of shorelines, use of machines to remove vegetation and hand shoveling to mine beaches. Removing beach sand increases erosion and reducing the natural land protection from sea level rise (Terry and Thomas, 2008). The reef flat in front of the land acts like a natural sea wall absorbing wave energy (Ford, 2012). If the reef is continuously mined and degraded, there will soon be no natural protection from coastal wave action. The trees and vegetation along the shoreline bind the sand to create a stable ground foundation. Once the trees are removed, the roots die and the sand and land are washed away.

The local governments are empowered under the Constitution to control development within 8 km (5 miles) from the baselines of each atoll. Rather than creating their own sources of income, some local governments rely largely on grants from the national government and foreign aid. Poor planning and management continuously characterize local atoll governments like Majuro. For instance, the 2005 RMI Social Economic report ‘Juumeimej’ characterized a hamlet in Majuro as an indication of the future (ADB, 2005a).

Jenrok, a village only 0.065 km² with 5% free space, encompassing five pieces of land owned and overseen by an Irooj (Chief). A councilman represents 215 households, is elected every four years and sits on the Majuro atoll governing body. The majority of its 1847 occupants live in poverty. Houses are congested with extended family members, relying on limited water access and handouts. Babies are adopted regularly, unemployment is high and cemeteries are faltering because of erosion (ADB, 2005a).

The next section explores adaptive capacity and government commitment, which requires political will, leadership and coordination at appropriate high level
decision and long term commitment of sufficient financial resources to implement projects successfully.

4.1.3 Political ‘will’ in a changing climate

To assess the effectiveness of political interventions, this study used the indicators listed in Table 4.2, below.

Table 4.2: Indicators of ‘adaptive capacity’ to mainstream climate change

<table>
<thead>
<tr>
<th>Political “will”, leadership and coordination at the highest level of government</th>
<th>Analytical questions</th>
<th>Analysis: Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Has the appropriate level of government formally instituted a coordinating mechanism to address climate change issues? Have there been endorsements and approvals of climate change policies or plans?</td>
<td>The government established the Office of Environmental Planning and Policy Coordination to establish coordinate and identify appropriate policies on Climate Change. OEPPC is designated as the focal point for multilateral and environment agreements to include the United Nations Convention on Climate Change. A Climate Change Policy has now been developed and awaiting adoption by the legislature. There is a National Climate Change Steering Committee where OEPPC serves as the secretariat.</td>
</tr>
<tr>
<td>Climate Change issues that have been identified and prioritized?</td>
<td>Are climate change impacts and associated risks routinely assessed?</td>
<td>Crawford (1992) conducted a vulnerability study on sea level rise. RMI submitted its First National Communication to the UNFCCC in 1999. Second National Communication is currently being developed. Strategic issues identified in the 2006 Climate Change Strategic Plan include: develop capacity in climate change adaptation. OEPPC is tasked to assess the major environmental vulnerabilities of the RMI.</td>
</tr>
<tr>
<td>The national and community goals for climate change adaptation.</td>
<td>Are there national or community goals for climate change adaptation?</td>
<td>In 2001, the government launched the Vision 2018 with a clear goal to meet RMI’s internal and external challenges to mitigate the threats to sustainable development such as climate change. In the National Conservation Plan, “Reimaanlok”, there are quantitative conservation targets and well-defined biodiversity goals that have been set through a community participatory process at national level. The Plan was initiated by OEPPC – the environment agency mandated to develop and implement environmental policies. Indicators of success include improved knowledge base, improved methods of examining vulnerability to</td>
</tr>
<tr>
<td><strong>Institutional Arrangements and capacity</strong></td>
<td>Have adaptation strategies and activities been developed? Is there a community outreach program to address climate change?</td>
<td>National Climate Change Steering Committee has been established. The Environment Protection Agency has an environmental outreach strategic plan that aims at educating the public and raising awareness on the effects of climate change. In 2006, a climate change strategic plan was released.</td>
</tr>
<tr>
<td><strong>Stakeholders involvement and participation</strong></td>
<td>Are the public and decision makers well-informed and engaged in adaptation to climate change?</td>
<td>Guided by Vision 2018, OEPPC has the mandate to promote public education and awareness programs on Climate Change.</td>
</tr>
</tbody>
</table>
Table 4.3: Mapping climate change in RMI with the MDGs (CANA, 2006).

<table>
<thead>
<tr>
<th>Changes in mean climate, variability, extreme events and sea level rise</th>
<th>Poverty Impacts</th>
<th>Relevant Millennium Development Goals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increased temperature and changes in precipitation reduces agricultural and natural resources</td>
<td>Lowered industrial output and labor productivity, high inequality, impacts on trade, and fiscal and macroeconomic burdens lead to reduced economic growth, and its poverty-reducing effects</td>
<td>Goal 6: Combat HIV/AIDS, malaria and other diseases</td>
</tr>
<tr>
<td>Change in precipitation, run-off and variability leads to greater water stress</td>
<td>Reduced productivity and security of poor people's livelihood assets, and reduced access for the poor to their livelihood assets</td>
<td>Increased prevalence of mosquito-borne diseases</td>
</tr>
<tr>
<td>Increased incidence or intensity of climate related disasters leads to damage to infrastructure</td>
<td>Less effective coping strategies among the poor, and increased vulnerability of poor people</td>
<td>Goal 7: Ensure environmental sustainability</td>
</tr>
<tr>
<td>Temperature, water and vegetation changes contribute to increased prevalence of disease</td>
<td></td>
<td>Climate change indication of unsustainable practices. Move towards more energy-efficient models of consumption</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Goal 8: Promote global partnerships</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Wider forum must acknowledge the role of climate change in impacting MDGs</td>
</tr>
</tbody>
</table>

While it appears that political will is indeed present at the national level, there are some constraints that limit effective political movement to address climate change actions on the ground in RMI. These limitations include but are not limited to:

1) Political action – there is limited understanding at the political level of what the degrees of climate change impacts are on the livelihoods of the community (ADB, 2005b). Political "will" to engage grassroots level to ensure that they are part of the process is lacking. Political action is still a top down process.

2) Financial resources are limited and reliance on foreign aid is creating a welfare dependency mentality (ADB, 2005a).
3) Effective administrative inputs and implementation – national expertise to use science and economics to enable effective decision-making is severely lacking. Science is one of the weakest subjects in the education system (Johnson, 2011b).

4) Limited capacity of the National Climate Change Steering Committee to provide political leaders with feasible adaptation measures put in place to prepare for the anticipated effects of Climate Change.

4.1.4 Public Awareness and Education

The RMIEPA is the national authority charged with public education on all environment-related matters, including climate change. They are mandated to coordinate, implement and disseminate information to provide guidance to support commitments under the three Rio Conventions, which RMI is a signatory member. The authority has an ongoing public education and awareness program via radio broadcast conducted weekly to increase understanding on protecting the environment and of the adverse effects of climate change. However, the basic science is not well understood by the community and without this foundation, the ability to implement effective adaptation actions are limited. Based on this understanding, the RMI national policy on climate change underscores that a vital component to building institutional capacity is public education and awareness.

To accomplish the priorities set forth in the national climate change policy, the Jaññõr Windward Forest Project was developed to integrate results from global and national climate change studies into the RMI education system. The Ministry of Education has indicated that mainstreaming sustainable development principles into the school curriculum will alleviate the problem of scientific illiteracy and will build better understanding of science and environmental management (JWFP, 2011, Crawford, 1993).

In Peter Rudiak-Gould’s thesis, titled “Facing climate change in the Marshall Islands: a study in the cultural cognition of risk” (2011), he investigates how climate change is communicated and perceived by the Marshallese people. According to Christian beliefs, climate change will not occur because the Bible states God’s promise in this verse – “I will establish my covenant with you; neither shall there be
any more flood to destroy the earth” (The Holy Bible, Genesis 9:11). This very point has sparked the denial and ignorance mentality. People look to the heavens when it rains, for assurance of this (Selverston, 2006). The people of the Marshall Islands have strong religious ties and the church plays a major role in their livelihood (Loeak et al., 2004). Public awareness programs need to highlight that sea level rise is caused by humans, not God (Gould, 2011). Understanding how a community lives, interacts and perceives their environment helps build adaptive capacity.

Unfortunately, RMI has limited resources and capacity when it comes to addressing the public’s perception on the causes and impacts of climate change. Some indicators that limit public education and awareness on adaptation to climate change include:

- Lack of a national communication strategy enabling an effective public education and awareness programme;
- Lack of translation of climate change terminologies into the Marshallese language;
- Lack of climate change science curriculum in the education system;
- Lack of public participation and outreach programs on adaptation initiatives;
- Limited knowledge and human capacity to develop climate change communication tools appropriate for the community;
- Limited funding to create tools needed for effective implementation of communication strategies.
- Lack of communication and dissemination of useful and relevant information to the public, policy makers, and other decision makers.

### 4.1.4.1 Addressing the need to educate climate change champions

As a Party to UNFCCC, RMI is obligated, under Article 4(i) to “promote and cooperate in education, training and public awareness related to climate change and encourage the widest participation in this process, including that of non-governmental organizations” (UNFCCC, 1992). This section describes the results of a workshop which was conducted to illustrate the need to educate climate change champions.
The actions that RMI must take in order to fulfill its international obligations are consistent with the ‘no-regrets’ policies, plans and actions. Many climate change response strategies are similar to those, which contribute to sustainable development. These are appropriate responses to climatic variability, natural hazards and other stresses on social, cultural, economic and environmental systems. Such ‘no-regrets’ strategies are beneficial even in the absence of climate change. Given that the UNFCCC also calls for RMI to promote sustainable management, there is a strong overlap and synergy between initiatives taken under the Framework and those that represent best practice in environmentally sound and sustainable development.

As part of its promotion of climate change education, the RMI USP Campus developed an awareness training camp to enhance youths’ understanding of climate change adaptation. The workshop, known as “I’m ADAPTING to Climate Change” was conducted in Majuro from July 4 to 21, 2011. The theme of the training was “Climate Change Summer Science Camp – Addressing the Need to Cultivate Climate Change Leaders for the Future of the RMI”. The workshop was designed to achieve two principal outcomes:

1) To provide participants with an introduction to the knowledge and skills required to understand climate change adaptation and of possible adaptation options, in accordance with the best practice and other methodologies relevant to Small Island developing states;

2) To expose talented high school students to various local environmental issues and environmental science related careers.

4.1.4.1.1 Workshop Programme and Approach

The principal beneficiaries of the workshop were intended to be:

1) The high school students and teachers, through enhanced knowledge of the vulnerability of SIDS, such as the Marshalls, to climate change, and the feasibility of reducing the adverse impacts by way of practical implementation of adaptation measures;

2) RMI, through enhanced international standing as a responsible Party to the UNFCCC and as a result of gaining information relevant to national development planning; and promotion of climate change education;
3) Workshop participants, through the learning-by-doing process resulting from acquisition of knowledge and skills of ongoing relevance to Marshall Islands.

Participants in the workshop acquired the required knowledge and skills through targeted learning-by-doing activities in three small working groups; these activities were guided by information provided in semi-formal presentations. The main components of the workshop are summarized in Figure 4.3, below.

![Figure 4.3: Components of “I’m ADAPTING to Climate Change” Workshop.](image)

The methodologies and procedures followed in the workshop were consistent with the PICCAP Guidelines for the Preparation of National Vulnerability and Adaptation Statements (Campbell et al., 1999) and Figure 4.4, below, summarizes the case study process.
Figure 4.4: Steps of “I’m ADAPTING to Climate Change” Workshop.

Three working groups were formed for the workshop. In the initial scoping process, each working group would alternate sectors and exposure unit (or sub-sector) to focus. The scope of the workshop is presented in Table 4.5, below.

Table 4.4: Climate-sensitive sectors investigated during workshop

<table>
<thead>
<tr>
<th>Sector</th>
<th>Exposure Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Climate</td>
<td>Weather observation and early warning systems;</td>
</tr>
<tr>
<td>Agriculture</td>
<td>Agro forestry;</td>
</tr>
<tr>
<td>Forestry</td>
<td>Mangroves;</td>
</tr>
<tr>
<td>Water Resources</td>
<td>MWSC water reservoir, airport catchment, Laura water lens and water consumption;</td>
</tr>
<tr>
<td>Human Health</td>
<td>Human exposed to vector borne diseases; water contaminations;</td>
</tr>
<tr>
<td>Infrastructure</td>
<td>Rip rap sea walls, water catchments, stilt houses, floating houses;</td>
</tr>
<tr>
<td>Fisheries</td>
<td>Climate change on migratory species;</td>
</tr>
<tr>
<td>Coastal</td>
<td>Erosion and sea level rise</td>
</tr>
<tr>
<td>Energy</td>
<td>Efficiency through best practices and alternative forms of energy.</td>
</tr>
</tbody>
</table>
Participants were allocated to working groups in such a way as to maximize the diversity of technical expertise devoted to present to each group. The principal outputs from the workshop were:

- Group presentations, projects (oral and displayed projects and reports—these are incorporated in the brief findings presented in this section);
- Workshop documents, that is, the formal workshop report, including the workshop evaluations;
- Draft material on RMI’s adaptation assessed, for RMI USP Campus’ reference;
- The proposal that was submitted to the Australian government for financing this adaptation project for RMI USP Campus.

**Main Workshop Findings**

![Figure 4.5: Workshop attendees and their teachers at the Laura Beach, Majuro atoll learning about the water lens and how to protect it.](image)

About fifty high school students from local public and private high schools participated in the 2-week summer science workshop. The workshop, funded by the AusAID Small Grants Scheme, consisted of classroom lectures and application of concepts through field trips and activities and culminated with a science fair to showcase and further disseminate the information that participants have gained.

The camp attempted to address the lack of hands-on, problem-based experiences offered to high school science students, which result in a shortage of students pursuing post-secondary degrees in science-related fields, in particular
climate change. The lack of skill and training of talent in this area presents particular problems when an increase in knowledge is necessary to combat the threat of climate change and the promotion of environmentally sustainable development in any developing country.

Each day of the program centered on specific environmental science topics in relation to the science of climate change: the physics, the biology, the geology, and the economics of climate change leading on to what is climate change and adaptation in the context of RMI. Climate change crosscuts into all relevant sectors of a government system: water, health, economy (fisheries), agriculture, transportation and industry.

The first week of the program brought students to the classroom to learn about the foundation to understanding what the science behind climate change is. The second week brought students on various field trips to the RMI Weather Station, Water Treatment Plant, Taiwan Technical Farm, and Laura beach - water lens and to the Airport Rescue Fire Fighting Station. The field trips were designed for students to learn more about what RMI is currently doing to adapt to climate change from the public water systems and water quality to early warning systems culminating in looking at cost effective ways to utilize sea walls and state of the art water catchments.

At the weather station, students learned about climate variability and change, and got a behind the scenes glimpse of weather forecasting and how temperature and rainfall data are collected to enhance early warning systems.

A day at the Taiwan Technical Mission farm in Laura gave the opportunity for students to learn about diversifying crops for agriculture purposes and appropriate crops to grow on atolls. Students also toured Laura beach to participate in an experiment to investigate how the speed of ocean currents will affect the movement of waste and pollution that may have seeped into the ocean from land-based activities. At Laura beach, students also got a chance to try out the new GIS software courtesy of the IWRM project and got to understand how coastal assessments are conducted.
Figure 4.6: Ms. Tamara Heine showing the students how to use GIS technology to measure sea level rise and coastal change in the RMI.

The students learned about the importance of water conservation and water quality in afternoon a tour around the Water Treatment Plant. They saw the reservoirs and how vulnerable water can be on an atoll such as Majuro should an extreme event such as drought occur.

During a trip to the Airport Rescue Fire Station (ARFF), students learned that the biggest catchment on Majuro Atoll is located adjacent to the runway and is a good example of an adaptation solution. At the ARFF station, the students saw the rip-rap sea wall stretching to the terminal facility together with the mangrove trees to protect the coast from erosion and also providing a habitat for marine species to spawn and thrive.

Throughout most of the two weeks, the students were provided with food from the wellness center, emphasize a healthy life style and to promote eating plant-based products to reduce the use of carbon dioxide burning. To emphasize the principle of the three Rs - reduce, reuse and recycle, the students were given a reusable PET (Polyethylene Terephthalate) water bottle to avoid generating waste from disposable Styrofoam cups.

On the final day, students worked together in groups on solution-oriented projects to address how RMI can adapt to climate change. The result was a July 15 science fair demonstrating models of solar powered homes, floating houses, stilt houses on pipes and wood, a fully structured model of a mangrove/rip rap sea wall around the ARFF station, a 3D cross sectioned Laura water lens, a greenhouse effect model, rain water harvesting contamination and decontamination station, heat
convection in air/water demonstration and an egg-in-vinegar experiment to demonstrate the effects of ocean acidification.

Figure 4.7: Students teaching the community during the science fair

Figure 4.8: Model of Laura Lens

Figure 4.9: Students display models of energy efficient homes to stilt house.
The Deputy Vice Chancellor of USP, Professor Susan Kelly and the Australian Ambassador to RMI, Mr Martin Quinn, along with other guests and parents were invited to attend the presentation of certificates to participants to mark the closing of the workshop (Figure 4.11).

On July 20th and 21st, teachers from local high schools attended a teacher-training workshop with science camp lead instructor Olai Uludong. On the first day, teachers learned the science of climate change in the classroom (just as the students had done two weeks before). On the second day, the teachers were also taken on field trips to visit the ARFF, the weather station and the water treatment plant C. The goal was to help teachers fully understand issues of climate change and how to present climate change facts in their classrooms.
The workshop intended to provide insights into RMI’s adaptive capacity to cope with climate variability and change, based on the best information available on the ground. In addition, the workshop aimed to address the following major questions:

A) Is the country vulnerable to climate and sea-level change, and in what areas or sectors are the vulnerabilities the most critical?

B) What difficulties, especially in the critical areas or sectors, is the country likely to have in adapting to changes in climate and sea level?

C) What is required to achieve adaptation?

D) What priorities should be set?

As an island nation, it is essential to understand how climate change and sea level rise will affect and impact RMI’s coastal ecosystems, marine resources, subsistence and commercial agricultural developments, domestic and industrial developments, human health and well-being, water resources, population, and the national economy at large given its land resources in its entirety purely coastal in nature. In order to develop and implement appropriate response strategies, it is also important to establish a baseline of what adaptation measures currently exist and the adaptive capacity level. The current situation in RMI and an understanding of the effects of climate change, the degree of vulnerability and the national capacity to adapt.

4.1.5 Institutional capacity

Another category of governance factors and their impacts on adaptive capacity is the determination of a common vision and unambiguous goals identified of which can be measured.

4.1.5.1 International and national responsibilities for climate change

The Office of Environmental Planning and Policy Coordination (OEPPC) was created in 2003 under the Office of the President (OEPPC, 2008) with a mandate to facilitate a coordinated approach to RMI's response measures to environmental degradation, protection, and if possible, rehabilitation of natural habitats at the national level. Its main duties and responsibilities are to advise the
President and his cabinet ministers on all environmental matters. In addition, the OEPPC is the Operational Focal Point (OFP) for various environment and sustainable development related international organizations and conventions. As the OFP, the OEPPC is to ensure that RMI’s Party obligations to the conventions are effectively accomplished within the timeframe set forth by each of the conventions. As the environment agency charged with RMI’s Party obligations to the multilateral agreements, the OEPPC undertakes national reporting requirements that overarches many international bodies. This office serves as the operational focal point for the three Rio Conventions for climate change, biodiversity and desertification. The OEPPC also works with each of the Convention Secretariats, and Small Island State partners to promote and negotiate issues that are priorities for RMI. The OEPPC is also the Secretariat for various bodies that focus on natural resources management thematic areas. The office is tasked to ensure that response measures are in place to combat adverse effects of climate change and its associated environmental vulnerability and adaptation issues (UNDP, 2005b). Guided by the “Vision 2018”, OEPPC ensures that the RMI works towards achieving sustainable development by developing action plans and strategies on adaptation and mitigation to climate change and the environment.

OEPPC is funded by the national government and spearheaded by a Director (OEPPC, 2008). Full staff is comprised of two professionals and one administrative. Its national stakeholders include the President and his Cabinet, all national government offices, the local governments, community leaders, United Nations Development Programme and other regional organizations to name a few. Its operational budget annually is roughly US$85,000 and their climate change strategic focuses are as follows (OEPPC, 2006):

1) Build capacity and strengthen national institutions;
2) With regards to climate change, focus on mitigation efforts;
3) Fulfill obligations to the UNFCCC, UNCBD and UNCCD;
4) Serve as a clearinghouse mechanism for climate change;
5) Ensure climate change awareness;
6) Mainstream climate change into national policy;
7) Develop adaptation plan of action.
4.1.5.2 National responsibilities on environmental protection and education

The RMIEPA is the government agency charged with ensuring that development is conducted in a manner that minimizes degradation of the environment (RMIEPA, 2008). It was created as the implementing and regulatory authority, while OEPPC serves a coordination function at the international level. In 1984, RMIEPA was created with a common vision to protect, preserve and regulate the natural resources of the Marshall Islands. This includes regularly updating the RMIEPA website, broadcasting programs, publishing articles in the newspaper, producing brochures, quarterly school and community visits (ADB, 2005b). The authority is funded by the national government and works in partnership with the Ministry of Health to regulate national environmental sanitation. RMIEPA is the national focal point for SOPAC and work in coordination with other international and regional organizations such as the United States Environmental Protection Agency, the United State Department of Interior, UNDP and SPREP. A five-member board, appointed by the President oversees the authority and is managed by a General Manager who oversees day-to-day operations. With an operational budget of about US$ 300,000, the RMIEPA supports around 20 staff members and a volunteer from the Japan International Cooperation Agency (JICA).

Environmental protection has its challenges and successes. In 2009, the US funded a project to extend the airport runway. The project budgeted at US$16 million has been an off-and-on project due to the controversy of mining for fill material and the impact of dredging on the environment. In 2011, lawsuits against foreign fishing companies for oil spills resulted in settlement outside of court for environmental damages. Significant milestones since the inception of RMIEPA include establishment of a water quality and monitoring program, environment education and awareness programs and so on. The RMIEPA still faces many challenges such as environmental education and awareness, institutional capacity on environmental management, high staff turnover rate, ineffective or outdated laws and regulations and land tenure issues.
4.1.6 **International commitment to fight climate change**

In the global environmental arena, the RMI in its pursuit towards ensuring environment sustainability has signed on to a number of multilateral environmental agreements. By acceding to these treaties, the nation agrees to reform its policies on environmental protection and conservation to include institutional and structural changes (UNDP, 2005b). In 2009, RMI together with members of the Alliance of Small Islands States (AOSIS) declared concerns that climate change poses a significant threat to the survival and coping capacity of small island nations and that climate change weakens the ability to achieve sustainable development goals and threatens livelihoods (AOSIS, 2009). In 2011, noting the lack of human resource and capacity skill at country level to address the current and projected impacts of the rising sea on RMI, former President Zedkaia strongly urged the United Nations to examine this issue at the international level (Zedkaia, 2011).

According to Wickham et al., (2009), measuring institutional capacity and engaging and accessing benefits in the name of climate change through various global and regional avenues remain a challenge. The adoption of many MEAs places a burden on the limited human and financial resources of the lead agencies to ensure continued active participation in regional and international climate change activities and meetings. There often seems to be disintegration between community, national and international level actions on climate change. It is important that dissemination of climate change meeting outcomes reach all decision makers and stakeholders. Misconception and poor understanding by the local community leads to lack of awareness regarding regional and international decisions and their potential impacts on RMI.

The primary challenge is coordination at the national resource management level and linkage to the international level in ensuring adaptive capacity is in place to meet sustainable development goals (Adger et al., 2003). To put this into context, RMI, as a member to the United Nations, participates in the international and regional foras. Table 4.5, below, lists a summary the relevant foras. Table 4.6 and Table 4.7 present a detailed assessment of the listed international and regional frameworks, respectively.
Table 4.5: Summary of international and regional fora of which RMI actively engages with in the environment setting.

<table>
<thead>
<tr>
<th>International</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>United Nations Millennium Development Goals (MDG)</td>
<td></td>
</tr>
<tr>
<td>United Nations Framework Convention on Climate Change (UNFCCC)</td>
<td></td>
</tr>
<tr>
<td>United National Convention on Biodiversity (UNCBD)</td>
<td></td>
</tr>
<tr>
<td>United Nations Convention to Combat Desertification (UNCCD)</td>
<td></td>
</tr>
<tr>
<td>Regional</td>
<td></td>
</tr>
<tr>
<td>SPREP Pacific Islands Framework for Action on Climate Change (PIFACC)</td>
<td></td>
</tr>
<tr>
<td>SOPAC Pacific Disaster Risk Management Framework (PDRMF)</td>
<td></td>
</tr>
</tbody>
</table>

Table 4.6: International frameworks

| United Nations Millennium Development Goals (MDG) Adopted by 189 countries; entered: 2000 |
|-----------------------------------|-----------------------------------------------------------------------------------|
| Developed by                      | United Nations General Assembly                                                   |
| Purpose                           | “...uphold the principles of human dignity, equality and equity at the global level” (United Nations, 2000). |
| Description of steps              | Goal 1 Eradicate Extreme Poverty and Hunger  
                                        Goal 2 Achieve Universal Primary Education  
                                        Goal 3 Promote Gender Equality and Empower Women  
                                        Goal 4 Reduce Child Mortality  
                                        Goal 5 Improve Maternal Health  
                                        Goal 6 Combat HIV/AIDS, Malaria and other Diseases  
                                        Goal 7 Ensure Environmental Sustainability |
| Year/ Used                        | 2004, MDG monitoring and reporting was formed by the EPPSO and UNDP. |
| Ease of Use                       | Progress to meet these goals has been a great challenge in the RMI (ADB, 2005b) |

<table>
<thead>
<tr>
<th>United Nations Framework Convention on Climate Change (UNFCCC) Ratified: 1992</th>
</tr>
</thead>
<tbody>
<tr>
<td>Developed by</td>
</tr>
</tbody>
</table>
| Purpose                           | To stabilize greenhouse gas emissions levels in the atmosphere and not allow anthropogenic interference that could alter the entire climate system. This will give ecosystems the ability to adapt to climate change naturally and not infringe on food security and economic development.  
                                        The framework is dedicated to ensuring that parties develop and implement national strategies to adapt to climate change. Where appropriate the framework allow for provisions of financial and technical assistance. |
| Description of steps              | Parties should protect the climate system for the future of humanity, recognizing the special needs of developing countries and their circumstances and encourage developed countries to take the lead in combating the adverse effects of climate change |
Year/ Used | 1997, Pacific Islands Climate Change Assistance Programme assisted to develop Marshall Islands’ First National Communications (RMIEPA, 2000)
---|---
Ease of Use | The Framework recognizes adaptation as a vital component to address climate change. The limitation for PICs such as the Marshall Islands is the lack of human capacity to access funds for adaptation.


| Developed by | United Nations Country Parties |
| Purpose | In 1992 parties agreed to aim to protect and conserve different species of flora and fauna and their living environment. |
| Description of steps | Parties are encouraged to develop and implement biodiversity and conservation plans. |
| Year/ Used | NBSAP, “Reimaanlok” – national conservation plan |
| Ease of Use | Methodologies are community driven, have been translated to the Marshallese language and are therefore easier to apply. “Reimaanlok” – the national conservation plan is a by-product of the NBSAP, which is a product of the UNCBD. |


| Developed by | United Nations Country Parties |
| Purpose | To establish linkages between the environment and development through sustainable land management. “…to reverse and prevent desertification/land degradation and mitigate the effects of drought in affected areas”...to reduce poverty and promote environment sustainability. |
| Description of steps | Parties are encouraged to address land degradation issues and develop sustainable management practices. |
| Year/ Used | Sustainable Land Management Project (SLM) |
| Ease of Use | With a limited land resources base and land ownership issues, the RMI faces land management issues. |
### Pacific Islands Framework for Action on Climate Change (PIFACC) 2006-2015

<table>
<thead>
<tr>
<th>Developed by</th>
<th>Pacific Island Forum, coordinated by SPREP</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Purpose</strong></td>
<td>A regional framework that is developed to assist Pacific Island countries build their adaptive capacity to become more resilient to the effects posed by climate change.</td>
</tr>
<tr>
<td><strong>Description of steps</strong></td>
<td>By linking adaptation strategies to weather systems, coastal/marine and ocean management and ensuring improved understanding of the climate.</td>
</tr>
<tr>
<td><strong>Year/ Used</strong></td>
<td>Pacific Climate Change Roundtable, Marshall Islands (Hay, 2009a)</td>
</tr>
<tr>
<td><strong>Ease of Use</strong></td>
<td>Requires establishing a direct linkage and understand of applicable national, sub-regional, regional and international climate change policies.</td>
</tr>
</tbody>
</table>

### Pacific Regional Disaster Risk Management Framework (PDRMF) 2005-2015

<table>
<thead>
<tr>
<th>Developed by</th>
<th>Pacific Island Forum, spearheaded by SOPAC</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Purpose</strong></td>
<td>A regional framework with a focus on risk reduction management strategies and reducing the communities’ vulnerability to hazards by advocating a proactive approach to risk management (Hay, 2009b). To provide technical and policy advice and support in reducing the vulnerabilities of the PICs to disasters.</td>
</tr>
<tr>
<td><strong>Description of steps</strong></td>
<td>Developing disaster risk reduction, disaster management, mitigation, preparedness, response, relief and recovery systems; Integrating risk reduction and disaster management into national planning and development processes at the national and community levels. Ensure partnership is strengthened amongst all stakeholders in disaster risk reduction and management.</td>
</tr>
<tr>
<td><strong>Year/ Used</strong></td>
<td>Joint National Action Plan for Climate Change and Disaster Risk Management (OEPPC, 2011a).</td>
</tr>
<tr>
<td><strong>Ease of Use</strong></td>
<td>Requires understanding of Disaster Risk Reduction and Climate Change Adaptation measures and recognizing the similarities to reduce vulnerability. The framework still has not emphasized disaster risk reduction as a vital component to adapting to climate change at the national level.</td>
</tr>
</tbody>
</table>
4.2 Evaluating Adaptation Measures

4.2.1 Overview of the legal framework

For years, RMI has continuously adapted to each foreign colonizer’s legal frameworks. The greatest influence on its environmental legal framework began under the COFA with the United States in 1986, which was subsequently amended in 2004. Under this agreement, the two countries agree to promote efforts to prevent harm to the environment and its marine ecosystems and to foster understanding of the natural resources in RMI. Under the agreement, the United States continues to apply elements of the U.S. National Environmental Protection Act (NEPA) of 1969 in RMI. “The United States [continues] to apply environmental controls which were in effect [prior] to Compact I”. This means applying environmental standards similar to those of the US environmental studies (water quality and environment impacts assessments) but not limited to technical support from US federal agencies such as the US Environmental Protection Agency (USEPA). RMI, similarly, is obliged to develop and enforce comparable environmental standards and procedures (ADB, 2005b). The act calls for a national policy to be established to ensure a balance between man and environment thus preventing harm to the environment (NEPA, 1969). In 1984, with NEPA 1969 as its foundation, the RMIEPA was established with a mandate to protect the natural resources and environment of RMI. Under the powers given by the RMI NEPA 1984, the RMIEPA developed regulations and acts to safeguard the environment. These legal frameworks are summarized below in Table 4.8 and Figure 4.12. The most important ones are considered to be the Environment Impact Regulations and the 1988 Coastal Conservation Act.
Table 4.8: The chronology of the RMI environment legal instruments.

<table>
<thead>
<tr>
<th>National legal instrument:</th>
<th>Year</th>
<th>Purpose</th>
<th>Responsible Agency</th>
</tr>
</thead>
<tbody>
<tr>
<td>RMI Constitution</td>
<td>1979</td>
<td>To preserves traditional land ownership systems by prohibiting any land development without approval of traditional land owners</td>
<td>National Government</td>
</tr>
<tr>
<td>NEPA</td>
<td>1984</td>
<td>To preserve and improve the quality of the environment</td>
<td>RMIEPA</td>
</tr>
<tr>
<td>Coastal Conservation Act</td>
<td>1988</td>
<td>To protect and preserve all coastal areas from impacts related to development.</td>
<td>RMIEPA</td>
</tr>
<tr>
<td>Office of Environmental Planning and Policy Coordination Act</td>
<td>2003</td>
<td>To establish an advisory body to the government on all matters related to the environment. To establish focal point on all environmental matters and lending institutions</td>
<td>OEPPC</td>
</tr>
</tbody>
</table>

As Figure 4.12 above shows, the US NEPA of 1969 has guided all the formal environmental instruments in RMI. Article VI: section 161 of the 2003 Compact Agreement (as amended) stipulates that the US Government will continue to apply its standards of environmental protection as stated in the NEPA of 1969 (COFA,
In 1979, RMI opted for a constitutional government establishing itself as a self-governing nation. The RMI constitution establishes the principles of land ownership (MIRC, 2005) in recognition of the importance of the land and environment as an asset to the livelihood of its people. In 1984, the Environment Impact Assessment process was formally included in the RMI National Environment Protection Act of 1984. This meant that all major development projects that would significantly alter the natural state of the environment must undergo an EIA (Crawford et al., 1992). In 1988, recognizing that development in coastal area was rapidly increasing; the country adopted the Coastal Conservation Act. Furthermore, recognizing that coordination and capacity development is vital to implementing these legal environmental frameworks, the Office of Environment Planning and Policy Coordination was developed under the OEPPC Act of 2003 (MIRC, 2004). To go a step further, ensuring that the coastal areas and marine ecosystems in RMI are preserved and protected, in 2008, the Coastal Management Framework was adopted. The purpose of this framework is to assess current coastal activities, including dredging, seawall construction, reclamation, landfills, coral reef degradation, shipwrecks and natural disasters, as well as, to recommend proposals for action and policy to achieve sustainable future development and revitalize past development in and around the coastal zone of RMI (RMIEPA, 2008).

Land ownership and control is an integral part of the Marshallese culture and way of life (Terry and Thomas, 2008) and, therefore, must be addressed before successful adaptation measures can be implemented. The land, to a Marshallese, is an important asset linked to a person’s status within the society (Boer, 1996). The atoll or island is basically divided into parcels called wato, which begins at the lagoon and end at the ocean. These wato are handed down along the matrilineal line, normally to the eldest child. The chiefs own most of the land and its marine resources according to customary law. The rights to lands are differentiated amongst the chief and the workers. The constitution recognizes these holders of the land – paramount chiefs (Irooj), lesser chiefs (Alab) also known as the head of the commoners and administratively manage the lands, and workers or commoners (Dridjerbal) who maintain and work on the land (Stege, 2009, Terry and Thomas, 2008, Boer, 1996). The administrators of the land (Alab) and the workers (Dridjerbal) perform services to the Chiefs (Irooj) in exchange for use of land. The workers maintain the lands by cleaning it and cultivating it, while the administrators
manage and coordinate the activities. Land can be exchanged between commoners; however, ownership and rights remain with the Irooj.

In the Marshall Islands, most of the land and its surrounding marine waters are under customary tenure, and challenges to effective environmental management are inevitable. In the past, the ability to relocate in response to the changing environment and variable climate conditions in the Pacific were easier compared to today (Nunn and Mimura, 1998). In traditional society, it was possible to simply move from vulnerable to less vulnerable areas, unaffected by the bureaucracy of land ownership, which had yet to be formally established (Nunn, 2009). The traditional concept relied on decisions made on what benefits the community. Today, the clashing of the western and traditional Marshallese culture has altered the approach of land ownership and development, causing slow progress in development and conflict within the society (Boer, 1996). Many development projects are also delayed or stopped because of land ownership issues and the lack of government regulatory oversight (Johnson, 2011a, Boer, 1996).

### 4.2.2 Policies and strategies

In the previous section, we began with an overview of the legal frameworks recalling the adoption of the RMI NEPA of 1984 then subsequently the Coastal Conservation Act of 1988 and emerging in the last decade, the OEPPC Act of 2003. This section takes it a step further to assess policies, strategies and action plans relevant to climate change (see Table 4.9).
As shown in Table 4.9, there is evidence of real and existing national policies, strategies, action plans indicating the direction for bilateral and multilateral development efforts to be channeled. In not limiting the scope these could include requiring international development partners to consider incorporating climate change into their portfolios. This entails establishing coordinated efforts with multilateral donors such as ADB, WB, GEF, UNEP, UNDP, SPREP, and SPC. This array of relevant climate change policies, which have already been politically endorsed, could guide the implementation of projects on the ground and avoid duplication. In addition, scientific assessments are limited and an increase in effort
to reach out to the international science community to carry out in-depth studies of the vulnerabilities of atolls to climate change is a challenge. Many policies are also written in the English language, which is not the native language of the Marshallese people, and incorporating translations of policies into the local language must be taken into consideration. This should assist practitioners identify implementation plans and financing schemes that are in line with the policies and are easily understood. This builds assurance that the national climate change projects have the needed support to be implemented accordingly, thus enabling knowledge transfer and adaptive capacity.

4.2.3 Coordinating Mechanisms

Coordination is critical to implementing successful adaptation measures. The leading authority in RMI, charged with planning, coordinating and implementing climate change activities at the international, regional and national level is OEPPC under the Office of the President (OEPPC, 2008). Ongoing projects with a focus on climate change include RMI’s SNC and PACC. Both are undertaken in partnership with various stakeholders (see Table 4.10, below). A strong partnership and dissemination of clear roles and responsibilities ensure that projects are implemented according to their project outputs. The following table shows the list of stakeholders and their relevant roles in the areas of climate change adaptation and mitigation.
Table 4.10: Climate change project partners

<table>
<thead>
<tr>
<th>Key Agency Partners</th>
<th>Role</th>
<th>Indicators</th>
</tr>
</thead>
<tbody>
<tr>
<td>Joint utilities: Marshalls Energy Company (MEC), Majuro Water and Sewer Company (MWSC) and Kwajalein Atoll Joint Utility Resource (KAJUR), Inc.</td>
<td>Oversee utilities: electricity, sewage, water and alternative forms of energy such as solar.</td>
<td>Adaptation and Mitigation</td>
</tr>
<tr>
<td>Republic of the Marshall Islands Environment Protection Agency (RMIEPA)</td>
<td>Lead agency on enforcement of environmental protection, particularly the EIA process, Water Supply and Sanitation, Toilet Facility and Sewage Control Systems and Coastal Development Regulations. In addition, coordinates the Integrated Water Resources Management Project.</td>
<td>Adaptation and Mitigation</td>
</tr>
<tr>
<td>Majuro Atoll Local Government (MALGOV)</td>
<td>Represents the community and landowner’s interest.</td>
<td>Adaptation</td>
</tr>
<tr>
<td>Ministry of Public Works</td>
<td>Oversees the public access roads and drainage system</td>
<td>Adaptation</td>
</tr>
<tr>
<td>Ministry of Internal Affairs</td>
<td>In charge of land surveying and zoning</td>
<td>Adaptation</td>
</tr>
<tr>
<td>Ministry of Foreign Affairs</td>
<td>International Policy Affairs</td>
<td>Adaptation and Mitigation</td>
</tr>
</tbody>
</table>
Table 4.11: Linkage between climate change programmes and donor involvement

<table>
<thead>
<tr>
<th>Activity or Programme</th>
<th>Funding Organization</th>
<th>Possible Indicator</th>
</tr>
</thead>
<tbody>
<tr>
<td>Developing the MWSC Comprehensive Recovery Plan</td>
<td>ADB</td>
<td>Adaptation</td>
</tr>
<tr>
<td>Inspection of Standpipe Facility in Majuro</td>
<td>ADB</td>
<td>Adaptation</td>
</tr>
<tr>
<td>Pacific Adaptation to Climate Change (PACC)</td>
<td>SPREP, UNDP and GEF</td>
<td>Adaptation</td>
</tr>
<tr>
<td>Pacific Adaptation to Climate Change (PACC Plus)</td>
<td>AUSAID</td>
<td>Adaptation</td>
</tr>
<tr>
<td>IWRM Demonstration Project</td>
<td>GEF</td>
<td>Adaptation</td>
</tr>
<tr>
<td>IWRM EU Policy/Planning Component</td>
<td>EU</td>
<td>Adaptation</td>
</tr>
<tr>
<td>EU/EDF 9 Projects</td>
<td>EU</td>
<td>Mitigation</td>
</tr>
<tr>
<td>Japan International Research Center for Agricultural Sciences</td>
<td>Japan</td>
<td>Adaptation</td>
</tr>
<tr>
<td>Ministry of Health Solar Project</td>
<td>Japan</td>
<td>Mitigation</td>
</tr>
<tr>
<td>Guide on implementing effective shoreline protection</td>
<td>USAID</td>
<td>Adaptation</td>
</tr>
<tr>
<td>Sustainable Land Management Project</td>
<td>UNDP, GEF</td>
<td>Adaptation</td>
</tr>
<tr>
<td>Coping with Climate Change in the Pacific Island Region (CCCPIR)</td>
<td>SPC, GIZ</td>
<td>Adaptation</td>
</tr>
<tr>
<td>Second National Communication Project</td>
<td>UNFCCC</td>
<td>Adaptation and Mitigation</td>
</tr>
<tr>
<td>US Army Corps of Engineers assessment of Majuro Utilities</td>
<td>US</td>
<td>Adaptation</td>
</tr>
<tr>
<td>Water Catchments for Majuro and Ebeye</td>
<td>US</td>
<td>Adaptation</td>
</tr>
<tr>
<td>National Climate Change Committee Advisor</td>
<td>USAID</td>
<td>Adaptation and Mitigation</td>
</tr>
<tr>
<td>Land Grant Extension agents: water quality awareness program</td>
<td>USAID</td>
<td>Adaptation</td>
</tr>
<tr>
<td>Increasing resilience of land, forest and society</td>
<td>USFS</td>
<td>Adaptation</td>
</tr>
<tr>
<td>Reverse Osmosis and Catchment Project</td>
<td>Utrik Trust Fund</td>
<td>Adaptation</td>
</tr>
<tr>
<td>National climate change technical assistance for building codes and water</td>
<td>WB</td>
<td>Adaptation</td>
</tr>
<tr>
<td>Water Safety Planning Initiative</td>
<td>WHO/SOPAC/EU</td>
<td>Adaptation</td>
</tr>
<tr>
<td>National Health and Climate Change Vulnerability Assessment</td>
<td>WHO</td>
<td>Adaptation</td>
</tr>
<tr>
<td>Micronesia Challenge Initiative</td>
<td>MC and FAS countries, Guam and Saipan</td>
<td>Adaptation and Mitigation</td>
</tr>
<tr>
<td>National Energy Projects</td>
<td>SPC, EU, Japan, Taiwan</td>
<td>Mitigation</td>
</tr>
<tr>
<td>USP Climate Change awareness camps</td>
<td>AUSAID</td>
<td>Adaptation and Mitigation</td>
</tr>
</tbody>
</table>
All projects, which have climate change adaptation as an overarching theme, are funded externally by international development partners (refer to Table 4.11). The biggest development partners include USA, UN and ADB. While Pacific island nations are facing some of the most immediate and devastating effects from climate change, they often have the least resources (both human and financial) to address the looming threat of climate change.

4.3 Analyzing Adaptation Tools

Adaptation tools and methods have only emerged over the last few decades to assist developing countries understand and deal with the effects of climate change. There are many useful tools and guidelines which are appropriately suited to various national circumstances (e.g. geography, demography) that practitioners can refer to and adopt. This section analyzes various adaptation tools and methods of assessment that have been introduced and implemented in RMI over the last two decades by CROP agencies and foreign donors. Overall, the period from 1991 to 2009 saw an increase in the number of donor driven climate change projects in RMI.
4.3.1 Climate Change Adaptation Methods and Tools: Twenty years in review

Figure 4.13: Evolution of methodologies, approaches, frameworks and tools used to assess adaptation in RMI through regional multi-sectoral initiatives. The above model concept is modified after Hay (2011).

Table 4.12: Implementing agencies for climate change projects in RMI from 1991 to 2009 (adapted from Hay, 2009a)

<table>
<thead>
<tr>
<th>Primary Implementing Agencies</th>
<th>Implemented projects</th>
</tr>
</thead>
<tbody>
<tr>
<td>UNDP</td>
<td>2</td>
</tr>
<tr>
<td>SOPAC</td>
<td>1</td>
</tr>
<tr>
<td>AusAID</td>
<td>4</td>
</tr>
<tr>
<td>ADB</td>
<td>2</td>
</tr>
<tr>
<td>World Bank/GEF</td>
<td>3</td>
</tr>
<tr>
<td>European Union</td>
<td>4</td>
</tr>
<tr>
<td>SPC</td>
<td>2</td>
</tr>
<tr>
<td>SPREP</td>
<td>1</td>
</tr>
<tr>
<td>JICA</td>
<td>3</td>
</tr>
<tr>
<td>USAID</td>
<td>3</td>
</tr>
<tr>
<td>Others (WHO, Taiwan, MC, Utrik TF)</td>
<td>4</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>29</strong></td>
</tr>
</tbody>
</table>
### 4.3.1.1 Key Aspects of Vulnerability Assessments

Table 4.13: Analysis of vulnerability-based assessments

<table>
<thead>
<tr>
<th>a) Intergovernmental Panel on Climate Change (IPCC) Common Methodology</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Developed by</td>
<td>Inter-governmental Panel on Climate Change (IPCC)</td>
</tr>
<tr>
<td>Purpose</td>
<td>Launched in 1991, useful for conducting baseline analysis of coastal vulnerability.</td>
</tr>
</tbody>
</table>
| Description of steps | 1. Outlining the study area;  
2. Stocktaking of case study area;  
3. Identifying of socio economic factors;  
4. Assessing of physical changes;  
5. Formulate response measures;  
6. Assessing vulnerability profile;  
7. Identifying future needs. |
| Ease of Use | Requires extensive knowledge in the biophysical environment and socioeconomic sector. Significant training required. |

<table>
<thead>
<tr>
<th>b) USAID Guidance Manual: Vulnerability and Adaptation</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Developed by</td>
<td>United States Agency for International Development (USAID)</td>
</tr>
<tr>
<td>Purpose</td>
<td>A vulnerability and adaptation tool used to assist project managers and planners assess and mainstream climate risk into project design, development and strategy. This tool also identifies vulnerability and explores possible adaptation options to consider integration.</td>
</tr>
</tbody>
</table>
| Description of steps | A six steps approach for climate sensitive programs:  
1. Diagnosis of problem: Screening;  
2. Design of the project: identify adaptations,  
3. Perform analysis;  
4. Identifying actions;  
5. Implementation of adaptation options;  
| Year/ Used | Adaptation to Climate Change: Case Study on Freshwater Resources in the RMI (USAID, 2009a). |
| Ease of Use | Requires knowledge of the USAID guidance manual on adapting to climate variability and change. |
4.3.1.2 Index-based Assessments

Table 4.14: Analysis of index-based assessments

<table>
<thead>
<tr>
<th>Environment Vulnerability Index (EVI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Developed by</td>
</tr>
<tr>
<td>Secretariat of the Pacific Applied Geoscience Commission (SOPAC), United Nations Environment Programme (UNEP) and others (Kaly et al., 1999).</td>
</tr>
<tr>
<td>Purpose</td>
</tr>
<tr>
<td>To measure the vulnerabilities of the environment against a set of stresses, looking at the social and economic factors.</td>
</tr>
<tr>
<td>Description of steps</td>
</tr>
<tr>
<td>1. A subset of variables are identified and then measured against a set of indicators.</td>
</tr>
<tr>
<td>Year/ Used</td>
</tr>
<tr>
<td>Ease of Use</td>
</tr>
<tr>
<td>Requires external consultants to conduct the environment assessment. Significant time and knowledge on environment and social factors needed.</td>
</tr>
</tbody>
</table>

4.3.1.3 Assessments of hazards and managing of risks

Table 4.15: Analysis of hazards-based assessments

<table>
<thead>
<tr>
<th>Guidelines for Comprehensive Hazard Assessment and Risk Management (CHARM)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Developed by</td>
</tr>
<tr>
<td>Secretariat of the Pacific Applied Geoscience Commission (SOPAC)</td>
</tr>
<tr>
<td>Purpose</td>
</tr>
<tr>
<td>A hazard/risk management tool used to integrate disaster risk reduction measures into the national development planning process.</td>
</tr>
<tr>
<td>Description of steps</td>
</tr>
<tr>
<td>1. Identify nation development priorities; initial risk evaluation;</td>
</tr>
<tr>
<td>2. Identify hazards, vulnerable sectors, and impacts;</td>
</tr>
<tr>
<td>3. Risk assessment with stakeholders against a set of indicators;</td>
</tr>
<tr>
<td>4. Evaluation of levels of risk and determination of actions;</td>
</tr>
<tr>
<td>5. Results evaluated, risk reduction measures selected; role distribution.</td>
</tr>
<tr>
<td>Year/ Used</td>
</tr>
<tr>
<td>From mid 1990s, national agencies were trained to use this tool and are familiar with the CHARM (Bettencourt et al., 2006)</td>
</tr>
<tr>
<td>Ease of Use</td>
</tr>
<tr>
<td>Requires knowledge and experience in policy analysis, development planning and intergovernmental planning.</td>
</tr>
</tbody>
</table>
### a) Community Vulnerability and Adaptation Assessment and Action (CV&A)

<table>
<thead>
<tr>
<th>Developed by</th>
<th>SPREP (Nakalevu, 2006a)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Purpose</strong></td>
<td>Tool to assist the Pacific Islands Countries understand their vulnerabilities to climate variability and sea level rise at the community level.</td>
</tr>
<tr>
<td><strong>Description of steps</strong></td>
<td>Systematic process that involves engaging the community to gather data, and then assessing the data against current climate and non-climatic changes.</td>
</tr>
<tr>
<td><strong>Year/ Used</strong></td>
<td>2011 Draft Vulnerability Assessment Report – Marshall Islands</td>
</tr>
<tr>
<td><strong>Ease of Use</strong></td>
<td>Used to conduct community vulnerability assessment, encourages community partnership and ownership. Requires community involvement.</td>
</tr>
</tbody>
</table>

### b) Community Base Adaptation (CBA)

<table>
<thead>
<tr>
<th>Developed by</th>
<th>Ecosystem Based Approach modified for NGO’s (OEPPC, 2009)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Purpose</strong></td>
<td>To support community based non-government organizations support community based projects in the Marshall Islands. To increase the coping capacities of ecosystems to adapt to environment and climate changes.</td>
</tr>
<tr>
<td><strong>Description of steps</strong></td>
<td>The methodology utilizes the rapid ecosystem based assessment and combination of the rapid rural appraisals. Integrating the bottom up approach, through community empowerment and ownership of projects, rather than the top down approach of generating climate models.</td>
</tr>
<tr>
<td><strong>Year/ Used</strong></td>
<td>2009 funded by the Australian Government Aid in partnership with NGOs.</td>
</tr>
<tr>
<td><strong>Ease of Use</strong></td>
<td>Requires community partnership with NGOs</td>
</tr>
</tbody>
</table>

### c) Community-based Risk Screening Tool: Adaptation and Livelihoods (CRiSTAL)

<table>
<thead>
<tr>
<th>Developed by</th>
<th>International Institute of Sustainable Development (IISD)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Purpose</strong></td>
<td>A guide to assist project managers and planners integrate climate change adaptation and risk reduction measures at the projects implemented at the community level.</td>
</tr>
<tr>
<td><strong>Description of steps</strong></td>
<td>Develops adaptation measures based on the community’s local conditions, strengths and needs.</td>
</tr>
<tr>
<td><strong>Year/ Used</strong></td>
<td>Introduced to the RMI in 2009 but has not been used on community projects.</td>
</tr>
<tr>
<td><strong>Ease of Use</strong></td>
<td>Requires project managers and planners to study the user manual.</td>
</tr>
</tbody>
</table>
4.3.1.5 Risk-based approaches

Table 4.17: Analysis of risk-based approaches

<table>
<thead>
<tr>
<th><strong>Climate risk profile methodology: climate change scenario generation</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Developed by</strong></td>
</tr>
<tr>
<td><strong>Purpose</strong></td>
</tr>
</tbody>
</table>
| **Description of steps** | In reference to weather data obtained from Majuro Weather Service Office, the following hazards were considered and projected.  
  - Rainfall extremes;  
  - Drought;  
  - Sea levels;  
  - Extreme wind;  
  - Extreme high temperature. |
| **Year/ Used** | Climate Risk Profile for the Marshall Islands (Hay, 2005) |
| **Ease of Use** | Requires external consultants to conduct climate risk profiles. |
### Table 4.18: Analysis of UNFCCC-associated tools

#### a) Intergovernmental Panel on Climate Change (IPCC) Common Methodology

<table>
<thead>
<tr>
<th>Developed by</th>
<th>Inter-governmental Panel on Climate Change (IPCC)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Purpose</td>
<td>Launched in 1991, useful for conducting baseline analysis of coastal vulnerability.</td>
</tr>
</tbody>
</table>
| Description of steps | 1. Outlining the study area;  
2. Stocktaking of case study area;  
3. Identifying of socio economic factors;  
4. Assessing of physical changes;  
5. Formulate response measures;  
6. Assessing vulnerability profile;  
7. Identifying future needs. |
| Year/ Used    | 2000 Initial Communication under the United Nations Framework Convention on Climate Change (RMIEPA, 2000) |
| Ease of Use   | Requires extensive knowledge in the biophysical environment and socioeconomic sector. Significant training required. |

#### b) CoastClim of Simulator of Climate Change Risks and Adaptation Initiatives (SimClim)

<table>
<thead>
<tr>
<th>Developed by</th>
<th>Climsystems Ltd (Warrick, 2006)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Purpose</td>
<td>To simulate biophysical and socio economic effects of climatic changes. This tool was designed to assist decision-makers climate proof projects that may be affected by climate change.</td>
</tr>
<tr>
<td>Description of steps</td>
<td>An integrated modeling system that generates future scenarios such as the effects of sea level rise given existing conditions. Its main focus area is on coastal areas and looks to integrate the climatic conditions over certain periods of time.</td>
</tr>
<tr>
<td>Year/ Used</td>
<td>2010, development of the draft Vulnerability and Adaptation for RMI Second National Communications.</td>
</tr>
<tr>
<td>Ease of Use</td>
<td>This tool requires training and obtaining of software license.</td>
</tr>
</tbody>
</table>
### Assessments of national policy frameworks

Table 4.19: Analysis of national policy frameworks

<table>
<thead>
<tr>
<th>a) RMI National Sustainable Development Framework (RMISDF) 2006</th>
</tr>
</thead>
<tbody>
<tr>
<td>Developed by</td>
</tr>
<tr>
<td>Purpose</td>
</tr>
</tbody>
</table>
| Description of steps | • To assure the sustainable development and preservation of the nation’s natural resources.  
• The Framework sets the criteria to determine which development activity within the RMI requires a Development Activity Permit. |
| Year/ Used | 2006-2011 (RMIEPA, 2006) |
| Ease of Use | Success of the Framework depends on the partnership between the community and the government. Limitations occur because of land ownership issues, lack of funding and human capacity to understand the framework and to implement the actions. |

<table>
<thead>
<tr>
<th>b) RMI National Coastal Management Framework (RMICMF)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Developed by</td>
</tr>
<tr>
<td>Purpose</td>
</tr>
</tbody>
</table>
| Description of steps | • Recommend proposals for action and policy at the national level to achieve sustainable future development and find solutions to address past developmental issues in and around the coastal zone of the RMI.  
• The Framework urges the need to improve environmental management, such as managing the range of coastal activities, minimizing environmental impacts to include emphasize on using the Environmental Impact Assessments (EIA) as a tool for managing major development projects. In addition encourage raising awareness and build capacity at the community level to understand the impacts of natural disasters. |
| Year/ Used | 2008 till present (RMIEPA, 2008) |
| Ease of Use | Success of the Framework depends on the partnership between the community and the government. Limitations occur because of land ownership issues, lack of funding and human capacity to understand the framework and to implement the actions. |
4.3.1.8 Cost Benefit Analysis

Table 4.20: Analysis of cost benefit analysis methodology

<table>
<thead>
<tr>
<th>Cost Benefit Analysis methodology</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Developed by</td>
<td>SOPAC</td>
</tr>
<tr>
<td>Purpose</td>
<td>To perform a Cost Benefit Analysis on the value of the RMI Integrated Water Resource Management Activities.</td>
</tr>
<tr>
<td>Description of steps</td>
<td>• Determine the losses and gains the project has on the community against a set of values;</td>
</tr>
<tr>
<td></td>
<td>• Sum up the monetary values of the losses and gains and converting them to benefits and costs;</td>
</tr>
<tr>
<td></td>
<td>• Apply the with or without analysis;</td>
</tr>
<tr>
<td></td>
<td>• Determine sustainability of the project.</td>
</tr>
<tr>
<td>Year/ Used</td>
<td>2010 (Gerber, 2010)</td>
</tr>
<tr>
<td>Ease of Use</td>
<td>Requires knowledge in economic assessments</td>
</tr>
</tbody>
</table>

4.3.1.8.1 Application of CBA in Majuro Household Rainwater Harvesting

There is inadequate skill in carrying out economic assessments required at the national level; therefore, the CBA carried out for the water sector in this research (Table 4.21, below) is only a partial project appraisal for the purposes of determining the usefulness and applicability of this type of adaptation tool. This is in light of the international movement towards assessing the cost of adaptation for determination of future infrastructure development. The purpose and usefulness of appraising a project for developing countries is needed to determine whether the project is worthwhile (Brent, 1998).

In their economic assessment of the CBDAMPIC project, Kovenhaven and Cheatham (2006) found that in the absence of a detailed economic CBA, identifying catchments specifications, daily water usage and types of catchment tank, can be used to carry out a preliminary appraisal if the preferred solution is best when faced with climate change effects such as drought.
Table 4.21: CBA for Majuro household rainwater harvesting.

<table>
<thead>
<tr>
<th>Factor</th>
<th>Detail</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location</td>
<td>Majuro Atoll(^7), Marshall Islands</td>
</tr>
<tr>
<td>Community</td>
<td>Laura Community</td>
</tr>
<tr>
<td>Targeted population</td>
<td>2,700</td>
</tr>
<tr>
<td>Targeted households</td>
<td>372</td>
</tr>
<tr>
<td>Average household size</td>
<td>7.3</td>
</tr>
<tr>
<td>Project type</td>
<td>Water harvesting, installation of household catchment tanks</td>
</tr>
<tr>
<td>Status</td>
<td>Complete</td>
</tr>
<tr>
<td>Climate change impacts</td>
<td>Salt water intrusion (sea level rise; changes in sea level), lack of rainfall (drought; changes in temperature and rainfall)</td>
</tr>
</tbody>
</table>

Brief background of Laura

Laura lies on the western end of Majuro Atoll (Figure 4.14, below) and is connected to the main urban center of Delap-Uliga-Dirita (DUD) by a 48.3 km (30-mile) strip of land, no more than 400 m wide in most places. The thin coastal strip surrounds a lagoon with an area of 295 km\(^2\) (113.9 mi\(^2\)).

\(^7\) See Figure 2.2 for map of Majuro Atoll
Traditionally known as ‘Laura Village’, Laura’s population totaled 2,256 in 1999, up from 1,575 in 1988 (EPPSO, 2012). By 2012, it is estimated that its population is now approaching 3,000 (or about 10% of Majuro Atoll’s population) with the number of people living in Laura expected to double over the next two decades. In the 21st century, Laura has rapidly moved on from its traditional setting of a ‘village’.

Laura continues to see rapid residential and small commercial development, including recent growth in small-scale commercial agriculture, with its economic contribution to RMI increasing. As a growing urban center, Laura is considered a government priority for development. There is an increase of funding for expanding and developing infrastructure in Laura, including a number of new public school facilities, relatively recent re-paving of the Laura lagoon road and new paving of the ocean side and feeder roads. However, the urbanization of Laura is having unprecedented adverse impacts on the groundwater lens, lagoon and surrounding marine environment.
Water resources

Seawater covers 97% of the atoll, making land and freshwater resources extremely scarce and especially vulnerable to climate variability and change. In these environmental settings, the primary sources of water come from the rain and underground freshwater lenses. Some households in Laura have water tanks connected to rooftops to harvest and store rainwater.

Laura contains Majuro’s largest groundwater source and supplies freshwater to the entire population of the atoll. The airport catchment water is supplemented by the groundwater pumped from seven wells in Laura to the reservoirs. In frequent periods of drought, the reservoirs often get dry, resulting in a major dependence on emergency backup supply from the Laura freshwater lens. The Laura lens currently produces about 378,541 litres (100,000 gallons) of freshwater every day, which is about 70% the estimated dependable yield of almost 197 million litres (52 million gallons) annually, that is, 539,292 litres per day (Beca International Consultants, 2003).

Laura is not connected to the Majuro Atoll sewage pipes or public water supply systems and the community relies on the freshwater lens to supply water to its residents. The few households that have individual septic tanks have not kept them well maintained. There is currently no proper treatment or safe disposal of sewage and animal waste from the large number of piggeries in the area. The increasing number of graves in the many cemeteries in the area could further exacerbate adverse impacts on the groundwater lens.

The lack of solid waste collection, treatment and disposal facilities in Laura means that all waste is discarded into previous dug pits or into the lagoon. The infiltration of pollutants from the discarded waste, combined with sewage from the poorly functioning septic tank systems cause fecal coliform contamination in the groundwater. Fertilizer applications to the small scale agriculture plantations and increasing runoff from recent commercial, industrial and housing programmes along the main road traversing the lens have led to an increase in the loadings of nitrates and phosphates into the freshwater lens.

Threats to the Laura freshwater lens

- Climatic factors
  - Recurring drought due to climate variability
Salt-water intrusion due to high sea level and high tides.

- **Non-climatic factors:**
  - Rapid population growth and development due to urbanization.
  - Lack of land resources, planning and zoning.
  - Increasing number of graves and burial sites.
  - Lack of awareness of potential persistent organic pollutants from the cemeteries and chemical pollutants from farming and agriculture.
  - Lack of solid waste collection system.
  - Lack of sewage and wastewater treatment system leading to *e-coli* contamination from fecal waste and leaching from piggery farms into the lens.
  - Overflow and leakage from home septic tanks.

**Assess whether the project is feasible**

The IPCC’s Fourth Assessment Report found that weather patterns have become more extreme, with more frequent and intensive rainfall events, more intense heat waves and prolonged droughts; the timing and location of rainfall has been altered (IPCC, 2007a). People living in regions affected by fluctuating temperatures and rainfall, sea level rise, flooding and drought bear the brunt of climate change. These communities have no choice but to continue to use the resources at their disposal to adapt and survive. Yet in order to adapt, people need to appreciate that potentially profound changes are in store and that future impacts are uncertain. Environmental stress induced by climate change affects communities and regions that are least able to adapt to these changes.

Developing countries, including Pacific SIDS, stand to bear much of the negative impacts of climate change. 98% of the most badly affected populations and 99% of all deaths from weather related disasters are found in these countries; in addition, over 90% of the total global economic losses from these extreme events are borne by these same countries (GHF, 2009). The UNFCCC estimated that US$49-171 billion will be needed annually by 2030 for adaptation to climate change (UNFCCC, 2009b). Weather related disasters have already cost as much as US$230 billion over the past five years (GHF, 2009). Developing countries are at an
economic disadvantage and, compared to developed countries, are therefore, not able to mitigate and adapt to these disasters.

The cost to recover and adapt touches on the sobering reality of the challenges and the associated costs brought on by climate change. However, there is little doubt of the many opportunities and lessons to be learned from communities who are either already adapting to the changing environment or have the means and therefore the potential to do so. An adaptive tool becomes more effective if the particular local community possesses the tangible assets, such as financial and natural resources, that will allow them to apply the tool. As such, many studies are available or are in the pipeline, which indicate the resourcefulness and resilience of many vulnerable communities. The cost of implementing domestic rainwater harvesting systems in Majuro households is provided in Table 4.22, below.

Table 4.22: Cost of implementing Majuro household rainwater harvesting

<table>
<thead>
<tr>
<th>Target Population (2,700)</th>
<th>Pilot</th>
<th>Community (Laura Zone 1, 2, 3)</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adaptation Project</td>
<td>$US</td>
<td>$US</td>
<td>$US</td>
</tr>
<tr>
<td><strong>Threats to Laura Lens:</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Worsening water quality and sanitation, urbanization, water scarcity and excessive extraction</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Costs</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Rainwater Harvesting</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water Catchment Facility (target (168-75=93 households) 93 x $874 (50% co-sharing between homeowner and project)</td>
<td>$40,641</td>
<td>$40,641</td>
<td>$81,282</td>
</tr>
<tr>
<td>Labor to repair ($170 x 168)</td>
<td>$14,280</td>
<td>$14,280</td>
<td>$28,560</td>
</tr>
<tr>
<td>Installation (water pipes) (93 x $380)</td>
<td>$35,340</td>
<td>$35,340</td>
<td>$70,680</td>
</tr>
<tr>
<td>House guttering and fitting (12 meters with a 8 x 3)</td>
<td>$ -</td>
<td>$18,600</td>
<td>$18,600</td>
</tr>
<tr>
<td><strong>Total Rainwater Harvesting</strong></td>
<td>$90,261</td>
<td>$108,861</td>
<td>$199,122</td>
</tr>
<tr>
<td><strong>Percentage of cost sharing</strong></td>
<td>45%</td>
<td>55%</td>
<td>100%</td>
</tr>
</tbody>
</table>
It has been said that vulnerability underpins adaptation (Berger and Enson, 2009). It is the perception of vulnerability to some aspect of climate change that motivates and defines the objective to carry out or implement adaptation activities. However, this observation raises two questions. Firstly – how is this perception arrived at? Berger finds that the generation and communication of climate change knowledge plays a significant role in how we understand the conclusions of climate science. Secondly – what is meant by ‘vulnerability’ and vulnerability to what? Understanding climate change is only a starting point, as climate change will bring different hazards and impacts in different places and will require much more in-depth studies.
5 Chapter 5: Discussions

The findings of this research bring to light certain major factors. However, the overarching outcome is that adapting to the adverse effects of climate change in RMI is a step-by-step process. This process entails assessing adaptive capacity as an initial step towards enabling effective adaptation. Next, existing and proposed legal frameworks evaluated can reveal entry points for mainstreaming climate change considerations into national policy and planning levels. It is then necessary to analyze adaptation tools to highlight the best-suited approaches that lead to successful adaptation to climate change. Figure 5.1, below, shows an ‘Adaptation Triangle’, which summarizes the process.

5.1 Assessing institutional adaptive capacity: Governance Factors

Initial assessment into institutional adaptive capacity reveals that good governance is essential to building resilience in support of adaptation. Adaptive capacity is the ability to change in response to climate change; while resilience is the ability to absorb or cope with the unexpected. In assessing the four categories that constitute governance in this study, results reveal that the first approach should be a shared vision that clearly defines adaptation goals and its accompanying principles. Secondly, stakeholders and community are well informed and supportive of climate change adaptation programmes. Thirdly, commitment by the national government through the legislative process has to be in support of adaptation programmes.
Lastly, adequate and sufficient capacity within the enabling environment is needed to implement policies and plans of action on climate change. In Palau, Chilton (2007) found that in adopting the foreign explorers’ ideologies and governance structures, the enabling environment has dramatically transformed itself away from adapting naturally to changes within the environment to a more economic dependent society. A similar reaction may have occurred in the Marshall Islands that have contributed to a more donor dependent mentality approach to climate change adaptation. Adaptation to climate change entails building adaptive capacity by knowing institutional capabilities, allowing room for changes, climate change leadership champions, available financial resources and good governance (Gupta et al., 2010). Understanding governance structures, institutions and management within enabling environments enhances and strengthens adaptive capacity in lieu of the changing climate (Engle, 2011).

5.1.1 Historical Government Structure

Colonization and introduction of foreign governance systems in the Marshall Islands, which began in the early 1500s, has shaped the current institutional enabling environment. In the mid-1800s, the arrival of Christianity transformed the Marshallese way of life towards a greater appreciation and respect for religion. Economic boom toward the late 1800s can be attributed to the Germans, who introduced copra trading in exchange for German money. Once Japan took control of the islands in early 1900s, fishing and trading were well underway. After World War II, strategically and for defense purposes, the islands came under the administration of the United States; this period has had a profound effect on the current governance regime.

History indicates that the system of governance has been altered and modified to conform to colonialism. This suggests that to begin building adaptive capacity, it is futile to find out what builds this ability and what limits the Marshallese from adapting to the climate change effects being experienced today. Historical findings also indicate that the impacts of the nuclear testing program between 1946 and 1979 by the United States has had and still has a profound long term effect on the institutional capacity of the nation to cope with human or natural change. This study does not attempt to explore the relationship between the United
States and the Marshall Islands, however, only to emphasize the free migration status afforded to the citizens within this agreement. This is so to establish the factors affecting building adaptive capacity and factors that limit adaptation.

### 5.1.2 Traditional Structures and Modern Governance Systems

Adaptive capacity can be strengthened through merging traditional and modern knowledge and incorporation of historical experiences of changes both societal and environmental. There is this perception throughout the Pacific that traditional knowledge is the key to environment sustainability. Nurse et al. (2001) in the IPCC Third Assessment Report, highlighted that traditional knowledge and skills, community structures, historical and cultural sites are vulnerable to the effects of climate change. Findings in assessing the traditional and modern government system of RMI reveal certain influencing factors on building institutional adaptive capacity. Findings indicate that the Marshallese government has moved away from the traditional system of governance using the social class system into a hybrid system of governance: combinations of parliament, democratic and traditional. The traditional social class system, where responsibility as stewards of the environment is passed down from the Chiefs of the land to the land managers and down to the workers, is virtually non-existent today.

The barrier is not just in the lack of public education and awareness but also the traditional beliefs and governance structures. In a case study carried out by Lata and Nunn (2011) on the misperceptions of climate change risks as barriers in Rewa Delta in Fiji, they conclude that the key is to provide the law makers and traditional chiefs with appropriate tools that can assist them make effective decisions on the effects of climate change on the environment. Findings suggest that the modern government structure is not inheriting the concept of social class system and integrating it with modern governance system. Today, the nation operates a very complex governance regime, attesting to that of its foreign predecessors.
5.1.2.1 Governance today in the Marshall Islands

When looking at building adaptive capacity to combat the effects of climate change in the long term, consideration and understanding of the nation’s political regime is necessary. After all, good governance is built through partnership and understanding between the national government, traditional leaders and the community. “To buck the tide…education is the key” in Tim Bruce’s ‘A time for heroes: leadership and political change in the Pacific’ cited in (Shuster et al., 1998). When all the stakeholders are aware of what the projected effects of climate change may be and how to utilize traditional knowledge and skills integrating modern tools for adaptation, resilience is built and coping mechanism in place.

5.1.2.2 Challenges in the 21st century

The Marshallese society today is slowly moving away from the traditional community of being responsible stewards to the environment. In the early 1990s, the RMI government began selling citizenship to foreigners for investment in the country, entering the list of countries having failed good governance (Murray, 2007). Marshallese passport holders are afforded the same immigration rights to that of Palau and FSM. Passport holders of these three countries are allowed legal entry into the United States, under the COFA Agreement, to live, work and join the armed forces.

An ADB assessment (2003) focused on determining how communities envisioned their current livelihood. The assessment also revealed that the majority of the Marshallese people are poor and relatively disadvantaged compared to other countries. Today, governance at both national and community level is often regarded as hopeless and corrupted. The primary issue is not the amount of financial resources, but overall governance. Management remains the biggest challenges to achieving economic and social progress thereby attaining self-reliance (ADB, 2005a). This additional stress compounds the already limited adaptive capacity to cope with climate change. The disadvantaged members of the community who depend on the environment for nourishment, for health and for livelihood, depend on the existing laws to protect the environment and ensure a sustainable future, but the laws are ineffective at stopping the continued degradation of the environment (ADB, 2005a).
5.1.3 Political ‘will’ on climate change adaptation

The findings in this section show that a society’s vulnerability and adaptive capacity to the effects of climate change is a reflection of the level of national development and political capacity. If a society is without policies that clearly prioritize and address climate change adaptation, then response would be more reactive, reflecting on what measures are currently in place. Effective response measures need to link all sectors of the government ranging from the environment to resource, tourism, economy and others. Manful and Wangwacharakul (2007) find that strategic response to deal with the effects of climate change need to have linkages to policies. They argue that effective adaptation requires institutions and policies to spearhead assessments and financial and human resource.

This study found a general willingness to adapt to climate change at all levels of the government and the community. The leaders continue to show political “will” and raise international awareness of the nation’s vulnerability to the changing climate in forums such as the Pacific Island Forum Chief Executive annual meetings and the UNFCCC. Decision makers are also starting to give climate change the attention it deserves. This realization stems from acknowledging that the impacts are real and affecting the livelihood of the people (Manful and Wangwacharakul, 2007). Political commitments continue to increase, indicating the Pacific’s willingness to face the challenges posed by climate change. At the sub-regional level, Micronesian countries are making commitments to protect the environment by endorsing adaptation initiatives such as PACC (SPREP, 2011). At the 2011 Pacific Islands Forum Heads of State meeting in New Zealand, climate change was put at the top of the agenda. The meeting was addressed by the UN Secretary General, Ban Ki-moon, who continuously reiterates in his statements to the UN that climate change is a threat with economic costs that could prevent countries from reaching their Millennium Development Goals (MDG) (Ban, 2007). According to Climate Action Network Australia (2006), many Pacific countries, including RMI, will construct rip rap seawall to protect infrastructure from the effects of erosion. The social and economic cost on the infrastructure will be affected and will require financial resources that are beyond accessibility of these small nations.

In Micronesia, lead agencies have been established to coordinate and develop climate change policies and measures. However, not all risks associated with climate change are being incorporated into decision making, even with regard to natural
weather extremes. Decision making often focuses on shorter term scales, neglecting the longer-term perspectives (ADB, 2005b). A review into national development strategies and project documents in climate related sectors revealed that such documents pay little or no attention to climate change, and often very limited focus on existing risk. Even when climate change is mentioned, specific action plans to guide implementation on how to take it into account is generally not present (Agrawala, 2005). This, in part, is due to the lack of local expertise to develop and formulate feasible action plans.

Like many other Pacific countries, the Marshall Islands have no choice but to opt for one-off initiatives in hopes of building capacity and successfully implementing projects. Nearly all climate change projects currently being implemented in RMI, including the SNC, PACC and IWRM, are donor-funded. Details in project documents reveal that countries’ obligation is ‘in kind’, for example, the RMI National Capacity Needs Self-Assessment (NCSA) grant for global environment management in kind contribution was US$20,000 included in grant total request of US$245,000 with a duration of 18 months (UNDP, 2005b).

In 2000, the RMI signed the United Nations Millennium Declaration, in efforts to adhere to MDG 7, which has a goal to ensure environmental sustainability by integrating sustainability principles in policies, strategies and programmes. RMI’s first MDG report indicated that the goal of MDG 7 has not been met (ADB, 2005a). General election in RMI is held every four years, following the US system. Unsurprisingly, politicians strategize and reposition their priorities on every election cycle, therefore getting political commitment to endorse and support much needed strategic plans and projects to address climate change are put on hold until the new administration is sworn into office.
5.1.4 Public Awareness and Education

A national policy framework and a strengthened institution is effective if they have the support of the public. It is essential for the public to actively participate in the decision making process at the community level to ensure that their social and cultural well-being is taken into account. A national policy framework should be driven by the needs of the community; their traditional knowledge, their wisdom and their religious beliefs. Community awareness and education programs need to be developed and implemented, to facilitate grasping of the science of climate change and its associated effects and how it relates to sustainable management of community resources, in the present as well as in the future.

Research findings on the promotion of public awareness and education on climate change adaptation shows that people should be educated about the science of climate change in the Marshallese language. Translation of the basic science of climate change into the Marshallese language will allow people to start understanding the extent of the effects of climate change and be empowered to advocate for actions to adapt. Without the basic understanding of the causes and effects of climate change, the community will likely stay true to their Christian beliefs and continue to have faith that sea level rise will never inundate the country as in their biblical principles. This is demonstrated in the Republic of Kiribati, a neighboring atoll nation to the RMI. A study was carried out in Kiribati on the general understanding and awareness of climate change and its associated impacts, where 20% of the respondents were unconcerned due to their religious beliefs (Kuruppu and Liverman, 2011). Religious leaders may be the most effective advocates in raising public awareness to overcome this problem (Gould, 2011). After all, when an extreme climatic event occurs, the people will turn to God for salvation. Schipper (2010) finds that in a global study, people tend to turn to their religious beliefs as a source of hope in times of great adversity. Therefore, well-informed religious leaders will be able to raise greater understanding of the consequences of climate change and encourage their congregations to prepare for its effects. Religion is a vital part of Marshallese way of life and one only needs to drive down the length of Majuro on a Sunday to realize that there are more churches than there are schools.

From the Climate Change Summer Science Camp, major findings and conclusions arising from the “learning by doing approach” aimed to assess how capacity can be built with regards to climate change adaptation. It highlighted gaps
and constraints in the area of climate change science and science as a general subject in the school education curriculum. The findings provide the basis to attract attention to prioritize climate change education and awareness at the school level.

Statistics produced in 2001 point to a major challenge facing the Marshall Islands: the lowest percentage of college-educated population in the region (World Bank, 2006, UNICEF, 2008, ICDE, 2013). Science education in RMI schools appears to be inadequate in preparing the younger generation with the basic knowledge and skills required to enter careers in any science related field, in particular climate change. It was observed during this research that the primary method used for the teaching of science at the elementary and high school level is through texts, ‘chalk and talk’ and worksheets – very little opportunity is provided for students to engage in problem-based learning or applied science: to apply science in relevant and realistic contexts. Hands-on activity and practical experimentation are rare and many young Marshallese who are interested in studying science in high school or post-secondary levels do not have the necessary foundation to proceed. This poses a great challenge to the country in nurturing future climate change adaptation champions.

Combining the critical human resource and education gaps with the increasing threats of climate change and environmental degradation paints a depressing picture for the future of RMI. In order to adapt to the consequences of climate change, an adaptation action plan should be a priority including training of citizens for capacity building and knowledge to lessen the effects of climate change. While many studies focus on meaningful adaptation to climate change, little has been done in developing countries, especially PICs. This thesis emphasizes on the need to adapt to current and future climatic changes. Adaptation is vital especially to the people of RMI because the impacts resulting from the changes in climate are already being felt. Planning response measures now will effectively minimize the adverse effects of climate change and increase benefits to adaptation through public education and awareness, which will ultimately lead to behavior change.

Moreover, information dissemination to the community is vital for all to understand the effects of climate change on the RMI. This will empower the community to be able to understand what climate change is and how to adapt to the changes brought on by climate change. It is imperative that the people of RMI take ownership of climate change. In order to take ownership, there should be a basic
understanding of what climate change means to the Marshall Islands. To effectively do this, climate change will need to be mainstreamed in the media and coordinated efforts needs to be written and oral outreach promoted. Considering the role of churches in RMI, awareness needs to be raised with religious leaders to assist in this outreach effort. Education and awareness is key. Educating children at an early age is a proactive approach that needs to be harnessed. The community needs to be empowered at all levels with the necessary knowledge to increase their adaptive capacity to cope with climate change.

The "I'm ADAPTING to Climate Change" Workshop provided this opportunity to start building that adaptive capacity and identifying options to become more resilient to the adverse effects of climate change. A key outcome of the workshop was the identification of the most vulnerable sectors and specific exposure units within them. This was presented in Table 4.4 in the previous chapter.

While this workshop provided an opportunity to start documenting the level of adaptive capacity of the RMI to climate change beginning at the public awareness and education level, it is an indication that the vulnerable sectors of major significance such as the government level have not been considered more in detail. Baseline conditions were at best defined using this workshop as a launching point, even in the best of situations. In the end, this workshop could be carried out with other sectors to encourage and enhance adaptive capacity.

### 5.1.5 Institutional capacity

Research findings in this section suggest constraining factors hamper development of institutional capacity to adapt to climate change. Findings seem to indicate that whilst climate change adaptation plans are adequately in place on paper, reality falls short within the national authorities’ responsible to implement the plans. OEPPC was created in 2003 at the highest level of the government, however lack of financial resources has resulted in ineffective implementation of programs (OEPPC, 2006). With very limited number of staff and such a huge mandate, progress has become a challenge.

A number of factors prevent national authorities in effectively coordinating climate change initiatives and programmes:
• Limited capacity to organize and/or develop a comprehensive and coherent national framework of government policy and regulations for integrated environmental management integrating climate change issues (Hay, 2009c);
• Limited capacity to develop and strengthen the group of professional and technical staff engaged in environment and climate change management;
• Lack of strengthening institutional capacity of government and organizations to be more effective and collaborate in addressing climate change issues;
• Disintegration with the public to ensure they are aware of the importance of the climate change related programs that are currently being implemented; for instance, development of policies and procedures to enhance capacity of the local government for land use planning and regulations of building and development (Hay, 2009c).

In a regional synthesis report carried out by SOPAC from the period of 2007 to 2009, an institutional analyses comprised of desktop reviews related to climate change adaptation was undertaken in seven countries: Cook Islands, FSM, Palau, Fiji, Samoa, Tonga and Vanuatu (SOPAC, 2009). The countries were analyzed at the policy, institutional and operational levels. In the case of Tonga, the challenges are similar to that of RMI in institutional challenges. The key point is illustrated in the case of Tonga in this regional study. Effective coordination occurred at the bottom up: driven by the community, the families and the individual who want to improve their livelihood. Institutional reorganization did not occur, but the commitment of practitioners at the national level and on the ability of the responsible lead agencies to work together with the community. National plans were in place, but fell short in putting the paper into practice (UNISDR and UNDP, 2012). Finding in this thesis indicated that effective coordinating mechanisms in place will foster partnerships within the national government, traditional government, private sector and the society. This entails building institutional capacity within the lead agencies to understand the science behind climate change and division of roles and responsibilities.
5.1.6 International commitment to fight climate change

What are the challenges that RMI faces in accessing the full membership benefits by signing on to these international, multilateral and bilateral agreements? Findings in this research reveal that with limited human and knowledge capacity to access funds and technical assistance, the adoption of too many MEAs (see Tables 4.6 and 4.7), overwhelms RMI’s existing capacity to implement these treaties, in addition to the pressure of achieving national priorities on economic development. For instance, by signing on to the UNFCCC, the RMI is obliged to develop national communications to report not only on their greenhouse gas emission levels but also to report on its state of vulnerability and ability to adapt to climate change. The obligations require not only participation at the international level of negotiations but also ensuring mitigation and adaptation is achieved on the ground. Similar obligations are required by the Conventions on Biodiversity and Desertification.

The completion of the RMI’s INC, the National Biodiversity Report and the “Reimaanlok” National Conservation Area Plan are steps towards achievement. However, with more than 30 other MEAs, implementation gives reasons for concern over the human capacity to carry out the enabling activities (UNDP, 2005b).
5.1.6.1 Comparison of the international frameworks – MDG and the three Rio Conventions

A comparison of these frameworks (Table 4.6) is necessary to identify the overlaps and the challenges to fulfilling international obligations. Too often obligations are beyond national level capacity resulting in a lack of implementation and reporting.

5.1.6.1.1 Similarities

- All these international frameworks are developed for United Nations member countries;
- Most Pacific Islands Countries are a party to these international framework;
- The RMI is a party to the above mentioned treaties;
- For SIDS such as RMI, the frameworks are not legally binding. Moreover, achievement of the goals and implementation of the articles are “encouraged”.
- These frameworks share a common goal: for the betterment of humanity;
- These frameworks have to be endorsed and adopted at the highest level of the government;
- These frameworks recognize the vulnerabilities of SIDS;
- Parties are to seek ways to protect the environment from climatic and non-climatic factors;
- Progress in implementation of these frameworks has been a great challenge;
- Lack of human capacity and knowledge for reporting, implementing and monitoring.

5.1.6.1.2 Differences

- MDG uses the word “ensure”. The UNFCCC, on the other hand, uses “protect”. UNCBD includes the use of “protect” but after using the word “assess”. UNCCD encourages parties to “address” the issues of land degradation. While the uses of these words can be interchangeable and can be defined in the broader sense. Each framework defines and applies it differently.
- The lifespan of the goals and principles are very different. The MDG has a goal limit at 2015. While UNFCCC depends on targets, which can range from
a certain percentage of mitigation measures achievable to “stabilize” GHG emission levels that will not alter the climate system. UNCBD principles depend on each countries pledge to protect biodiversity. UNCBD does not explicitly set a lifespan on meeting it principle obligation.

- These frameworks are not legally binding. MDG parties can agree to “ensure environment sustainability”, but to what extent, is up to the individual countries. Whether or not the goal is met, is not addressed. Under UNFCCC, the burden to “stabilize” GHG emissions falls on the developed countries while developing countries, including PICs, are not legally bound to reduce emission to any specified level.

- Interestingly the MDG focuses on the environment as whole, by ensuring that all countries collectively do its share of being responsible stewards to the environment. UNFCCC does highlight the need to reduce emission levels to a level not dangerous for humanities survival, even though developing countries are not bounded to do so.

5.1.6.2 Comparison of regional frameworks – PIFACC and PDRMF

A comparison of the two regional frameworks (Table 4.7) is necessary to identify where they conflict. Conflicting mandates can result in power struggles amongst implementing agencies and misunderstanding among donors, which can in turn result in key policies not being implemented or delay in implementation.

5.1.6.2.1 Similarities

- Both frameworks are policy driven and developed for PICs. There is no acknowledgement of the differences between the countries, including the different development assistance from developed countries, nor of the different development challenges faced by the countries.

- Both ensure regional cooperation and integration into national planning and development processes.

- Neither documents are binding, legally or otherwise, but both will seek highest-level endorsement at PIFS, and therefore becoming legally recognized
documents. There is a need to clarify what ‘legally recognized’ and ‘legally binding’ mean at the regional level.

- Both share the goal to reduce vulnerability and build resilience to climate risks;
- Both support sustainable development;
- Both commit to reduce communities’ vulnerability to hazard-related risks by building resilience and the ability to prepare for future risk and recovery efforts.
- Both have greatest impact on livelihood at the national and community level.

5.1.6.2.2 Differences

- Both have separate regional and national institutional arrangements, strategies, policies and action plans.
- PDRMF makes it clear that its focus is on addressing hazard related risks, while PIFACC focuses on future climate risk;
- PDRMF has used, tested and applied many risk based tools whereas limited adaptation tools have been applicable under the PIFACC;
- PDRMF focus on reducing disaster-related risks while PIFACC responds to the ability of a system to adjust itself to the potential effects of the changing climate.

These differences imply that there is a need to harmonize these approaches since they both have the same objective to reduce society’s vulnerability to extreme climate events.

5.1.6.2.3 Other notes

- The PIFACC, as it stands, contains weak text. One can only imagine how much greater impact the framework would have if the language was stronger, if it used language like “climate change is already threatening the very existence of PICs”, rather than how it currently reads – “climate change may threaten the very existence of (PICs)”
- It is surprising that the only reference to the Kyoto Protocol in the PIFACC is about Clean Development Mechanisms (CDM) opportunities, which may be possible only with developed countries. This is surprising because as a climate
policy, the PIFACC should have drawn much more from the Kyoto Protocol than just CDM opportunities. To date only Fiji has succeeded in submitting projects considered to be eligible for funding under the CDM. The requirements to get a project qualified remain a major challenge for other Pacific island countries.

- A number of countries in the Pacific have already ratified the agreement to phase out the use of Ozone Depleting Substances (ODS). Why list this as an expected outcome under Principle 5 of the PIFACC? There obviously is no benefit from this expected outcome to PICs.

5.1.7 Limits to effective adaptation in RMI

The IPCC defines limits as "the conditions or factors that render adaptation ineffective as a response to climate change..." (IPCC, 2007a). Recalling Chapter 2, the limits to effectively adapting to climate change in the Marshall Islands will be due to the scarcity of resources like many Small Island Developing States (Pittock, 2005, p. 274). This thesis describes an atoll with limitations in so many aspects – geography, geology, finance, and human adaptive capacity, to name a few.

Geographically remote and away from major air and shipping ports, the standard of living becomes higher and comes with a heavy price tag. The cost of transportation and imports such as fuel, food, and construction material, for instance, becomes so high that it becomes impossible not to rely on financial aid. The resulting donor dependency is unsustainable and comes with a price, mostly in the form of United Nation votes. RMI is not an exception in this unfortunate situation and many SIDS can attest to this dependency on foreign aid for climate change adaptation. Putting together the RMI story from birth to independence shows a diminishing traditional system of adaptation to a politically influenced concept of adaptation. Existing literature identifies limitation to adaptation on finance, cultural values and political influence and shows that the causes and limitations to the effectiveness of adaptation efforts are, in part, due to the transformation of ideology.
5.2 Evaluating Adaptation Measures

Evaluations on the legal instruments of RMI pertaining to the environment and climate change support the notion that numerous studies point out: It is the local factors and, in particular, institutional arrangements that influence the quality and pace of a country’s political instruments and adaptation frameworks (Stadelmann-Steffen, 2011). A good example is the United States’ refusal to adopt the Kyoto Protocol. According to McCright and Dunlap (2003), implementation of climate change adaptation policies are progressing at a very slow pace. It is therefore, crucial to know more about the conditions under which national environment policies are adopted (Adger et al., 2003). Government laws and regulations implemented are not separate from individual adaptation but go hand-in-hand with the existing governance processes (Adger and Vincent, 2005). For example, many development projects in RMI are undertaken without conducting an EIA, as is required under the RMI NEPA 1984. The local communities generally view EIAs as a hindrance to the development rather than an opportunity to assess its possible harmful consequences on the environment. Examples are found in two Marshall Islands Journal news articles: (Johnson, 2011b), (Chutaro, 2011). This shows a disconnection between government policies, the social benefits, the capacities and the individual member of the community in understanding what this process means.

Due to the customary rights under the traditional law, the environment practitioners are unable to successfully enforce the environmental laws and regulation in place. As referred to in earlier sections, the ADB (CEA) in the RMI concluded that the government may consider development projects that will have benefits to the society but the land tenure system can deter enforcement of the laws hence stop the projects (ADB, 2005b). Additional challenge is enforcing the policy in a traditional system.

After establishing the linkage between adaptive capacity and its enabling environment, entry points can then be identified within the existing legal frameworks to effectively integrate climate change adaptation measures. The reality is that the public does not fully understand how the EIA process works and its associated benefits. This is due to lack of awareness on what is required of an EIA, how it should be developed and how the determination process takes place (ADB, 2005b).
5.2.1 Policies and strategies

From the top down approach, policies and strategies are pillars, which can support the implementation of successful adaptation measures. This requires reviewing and assessing the usefulness and validity of the various climate change policies and strategies. Through this review and assessment process, harmonization becomes a possibility. It has always been a challenge for developing countries to ensure that adaptation is integrated into national sustainable development plans. Throughout history, adaptation has been part of the human evolution context, it is the concept of mainstreaming adaptation into policy development and implementation that is fairly new (Lim and Spanger-Siegfried, 2004). This concept of harmonizing adaptation contributes to reducing risk thus supporting a proactive approach.

5.2.1.1 Harmonizing adaptation

In RMI, effective implementation of adaptation measures into existing national development plans is an approach that is feasible, considering the limitations within the enabling environment and adaptive capacity. Through mainstreaming of adaptation into existing framework, strategies and action plans, resilience can be gradually built thus reducing the effects of climate change on the limited resources. This approach requires development of relevant policies, education and training on enforcement and implementation of these policies. Translation of the EIA Regulations into the local vernacular would provide a helpful starting point to enhance the community’s understanding on what the EIA process entails.

5.2.1.2 Mainstreaming climate change adaptation

Effective adaptation requires the highest level of support at the national government. This suggest that implementation of effective adaptation measures must be mainstreamed across all levels of economic development and decision making (Burton et al., 2006). Therefore, development agencies are provided with clear indications of the entry points to address climate change adaptation within their agency’s mandate and programmes.
Effective adaptation needs institutions and relevant applicable legal instruments to assist with assessing adaptive capacity. Schipper and Pelling (2006) point out, in Figure 5.2 above, that integrating human-induced climate risks into disaster risk management is an essential component to preparedness and response planning. While there is a National Climate Change Steering Committee comprised of various member agencies, it is RMIEPA that has the mandate to implement and enforce environmental laws and regulations through the Sustainable Development Regulations with guidance under the Coastal Management Framework (CMF) of 2008. The entire population depends largely on coastal resources and the lack of human capacity to implement the CMF hampers the ability to build resilience against the effects of climate change.
5.2.1.3 Challenges

Although significant progress has been made in introducing climate change policies, the existence of gaps and constraints in effectively integrating these policies into current development plans still presents challenges. Some of these challenges include:

- Lack of awareness of the basic science of climate change at the decision making level and the fact that lawmakers perceive this issue as a long term challenge rather than short term development priority.
- Poor understanding of environmental regulations
- Lack of coordination among the national and community level agencies.
- Reliance on one-off projects from multilateral development partners.
- Lack of the community support of the lead agencies in charge of climate change.
- Conflicts between formal regulations and traditional laws.
- Inadequate human and financial resources.
- Short duration of projects. The development projects such as the INC, PACC and most ADB projects are piloted and have duration of five years or less. These initiatives attract donors by grouping together forming multi-sectoral projects rather than reactive projects such as emergency response aid. An example is the 2011 dengue outbreak which not only prompted the community to become proactive but financial resources became available for eradication (Chutaro, 2011).

Some of the challenges identified are due to the lack of resources while some are dependent on political influence under the current political regime. Culturally related challenges are due to a general lack of awareness and understanding of landowners on what are the benefits of environmental protection. Some challenges are technical in nature when they are due to the lack of information and assessments and a lack of understanding (due to language barrier or use of technical terms).

The Marshall Islands and many of its neighboring SIDS face similar challenges – often the priorities are meeting what is needed now rather than preparing for what is going to happen in the long term by adopting the proactive
approach. This in part is donor driven, too often climate change funding assistance are channeled to address present needs emphasizing on the “adaptation now” concept (ADB, 2009).

### 5.2.1.4 Possible approaches or entry points

Entry points refer to avenues where climate change can be mainstreamed into existing development policies. Identifying entry points minimizes the need to keep reinventing the wheel with regard to development of new policies. For example, the EIA process, the NEPA and CMF all have regulations and guidelines for new development projects. This then opens the opportunity to integrate adaptation into the EIA process.

Currently, the EIA process only investigates possible impacts on the environment. The principles could then expand to explore the effects of the climate change on the project. This could be done at the scoping and screening stages as outlined in Figure 5.3 below. In the INC, stakeholder participation in integrating adaptation into the development process was lacking, however, general climate change awareness campaigns were present (RMIEPA, 2000). During the scoping and screening stage, possible incorporation of a CBA could assist not only the developers but also government agency in charge to plan and respond accordingly with appropriate adaptation measures.
Empowering communities with knowledge is vital to effective climate change adaptation. For this to happen, it is necessary that relevant information, such as the fundamentals of climate science, the principles and process of EIAs and the outcomes of CBAs, is first translated into the Marshallese language for it to be understood by community decision makers and policy planners.

5.2.2 Effective Coordinating Mechanisms

Findings in this section reveal that climate change partners in RMI are already established. To mainstream adaptation into the national and community level, appropriate institutional coordinating mechanisms should be promoted. This entails that leading authorities facilitate the assessment of national priorities,
identification and funding sources and human resources focusing on implementation of adaptation measures within the relevant sectors. Institutional coordinating mechanisms are critical; the established leading authorities should work together with all relevant stakeholders. Findings suggest that the Ministry of Foreign Affairs (MOFA), Economic Planning, Policy and Statistics Office (EPPSO) and the Office of Environment Planning and Coordination (OEPPC) need to be vigorous and take the lead in strengthening coordination (UNDP, 2005b). The key partners are established and their roles and responsibilities are set forth within their respective mandates. MOFA, as the national focal point for the MEAs, and OEPPC, as the operational focal point, should work in tandem to improve the coordination between the political focal point and the operational focal point. Effective coordination can improve the quality of work in implementing, reporting and meeting RMI’s obligations to its international partners. In addition, cooperation is needed across all stakeholders and all levels of leadership; creating an enabling environment that develops and strengthens the nation’s human resource and ensures coordinating mechanisms are in place (OEPPC, 2011b).

5.2.3 Most suitable climate change strategy for RMI

A suitable national climate change strategy for the Marshall Islands addresses the adverse effects of climate change to its national circumstance. This requires the enabling institutions and policies to prioritize assessing the impacts and the cost associated with the impacts and then tailoring national efforts to focus on relevant areas. These suggest that an effective climate change strategy has to be mainstreamed across all decision-making levels (Manful and Wangwacharakul, 2007). There is really no one size fits all approach; an effective climate change strategy is one that reflects the unique circumstances of the Marshall Islands.

5.3 Analyzing Adaptation Tools

After evaluating adaptation measures, it is important to analyze the various adaptation tools to identify the existing approaches that work. It is important that these best-suited tools are understood and adopted by the local communities to better prepare them for climate change. Results of this analysis highlight critical findings
mainly in support of the notion that there isn’t a “one size fits all” solution in assessing adaptation. The influx of a wide range of adaptation tools has also enabled national environment planners and project managers to apply these tools informing their decisions for the last two decades. On the other hand, the influx is a clear indication that countries are becoming more aware of the need to adapt to climate change; this leaves practitioners confused as to which tool is appropriate and projects reinvented.

Therefore, it is important to analyze these tools and clarify their use by describing and categorizing those that have been and are currently in use (Hammil and Tanner, 2011). Assessment of the experiences of both the user and developer enables identification of the challenges and gaps, which therefore leads to identify which tool is best suited for countries to adopt.

### 5.3.1 Climate Change Adaptation Methods and Tools: Twenty years in review

Analysis of the evolution of adaptation methods and tools in RMI over the last twenty years reveals that one-off adaptation initiatives have been in use as early as 1991. International and regional organizations have financially supported these initiatives right from the beginning. While donor reliance is regionally accepted and practiced, Tompkins et al. (2005) suggests in their study that adaptation should not be on a one-off basis but rather focus on long-term sustainability.

Since RMI’s very first vulnerability and adaptation study (NEMS) in 1991, countries including Australia, the European Union, Japan and the United States have financed further adaptation assessments, either through bilateral partnerships or multilateral funding mechanisms such as the Global Environment Facility (GEF) and UNDP. These same countries are also the biggest donors for projects related to climate change adaptation in RMI (Table 4.12). International and regional organizations such as the UNFCCC, ADB, SPREP, UNDP, SPC, SOPAC and GEF have also been active in funding multi-regional adaptation projects. The 1991 NEMS study was considered a ‘one-off’ initiative and subsequent adaptation assessments that followed have not ventured far from this approach.

Gigli and Agrawala (2007) in a stocktaking exercise to look at the progress of integrating adaptation into climate development activities, found that initiation of this approach has been supported through partner countries and donors. However, ensuring that this approach is systematically integrated has not occurred. This is due
to the lack of awareness of climate change at the community and national level and
the lack of resources for implementation of this mainstreaming approach. The
development of appropriate response measures is still in its infant stages and more
effort is still needed. While the number of climate change projects the Pacific over
the last twenty years has increased (Hay, 2009a), effective mainstreaming of
adaptation measures remain a challenge.

5.3.1.1 Vulnerability Assessments

This particular study carried out in the Marshall Islands utilized the IPCC
Common Methodology to assess changes given the effects of climate change and its
associated impacts such as sea level rise. This case study (Table 4.13a) was designed
to assess the vulnerability of Majuro Atoll to accelerated sea level rise. Referring to
IPCC projections that the sea level is expected to rise between 30 to 100 centimeters
over the next 100 years, this assessment aimed to make a determination on its
physiological, socio-economic and ecological impacts on Majuro (Crawford, 1993).
This study utilized computer generated models by inputting quantitative data to
project possible impacts. Financial and technical resources were provided by the
NOAA and SPERP in collaboration with the RMI National Government. This study
also developed action strategies for strengthening environmental management in the
RMI of which were provided in a follow up report to this.

With funding support from USAID, a vulnerability and adaptation
assessment (Table 4.13b) was conducted on Majuro’s freshwater resources in 2009.
This assessment utilized the USAID Guidance Manual which employs a step-by-step
approach (Hammil and Tanner, 2011). The tool begins by identifying the risk, by
diagnosing the problem at the initial screening stage. Once the problem and its
associated adaptation strategies are identified, an analysis is performed. After this is
done the adaptation response measures identified are tested and evaluated. The
project’s objective was to develop appropriate adaptation strategies in light of the
effects posed by climate variability and change. The project recommended that the
policy sector amend building codes for the infrastructure sector and make it
mandatory for buildings to have a water catchment system. Through this way, RMI’s
rainwater harvesting capacity can be greatly improved. Public education in water
conservation should also be promoted simultaneously to ensure that valuable freshwater is not being wasted.

5.3.1.2 Index-based Assessments

Developed in 1999 by Kaly et al., the EVI used “smart indicators” to determine the vulnerability of the environment to external and internal stresses (Table 4.14). The EVI was a tool designed to provide an assessment of the environment as a basis to seek funding assistance to improve awareness of environment vulnerability and sustainability issues (SOPAC, 2005). Using a series of variables identified and then measured against a set of indicators, a vulnerability index score could then be calculated. In 2000, a fact finding and data gathering mission was completed in RMI by SOPAC to calculate its vulnerability index. The resulting report card, which classified RMI’s EVI, was published in 2003.

![Figure 5.4: RMI’s score as a result of the EVI (Pratt and Mitchell, 2003).](image)

As Figure 5.4 above shows, RMI scored 348, which ranked the nation at the 55th position out 235 countries and classified as ‘highly vulnerable’ to external and internal shocks or stressors. With data accuracy at 80%, calculations of data fell below 100%, indicating that minimum data requirement was reached (Pratt and Mitchell, 2003). Results from this study indicate uncertainties with its methodology; therefore, findings at the end were not endorsed widely.

5.3.1.3 Assessments of hazards and managing of risks

The CHARM is what Hammil and Tanner (2011) describe as a ‘data and information gathering tool’ which requires the user to collect data and input it into a database program (Table 4.15). It is a five-step process, which involves identifying
national development priorities and evaluating the associated vulnerabilities and hazard risks. Part of the process also includes identification of stakeholder and their respective roles and responsibilities. Developed and administered by SOPAC, CHARM is used to manage hazards and risks with an objective to integrate risk reduction measures into national development projects (UNFCCC, 2009a). Project managers and development planners can use this tool to mainstream disaster risk reduction at the national level. CHARM uses the top-down approach and requires familiarity with policy analysis and inter-agency planning. The outputs produces a matrix summarizing the risk at the national level and identifies risk reduction measures that take into account all activities implemented by all national agencies (SOPAC, 2001). It is readily usable and has been implemented in Palau and introduced in RMI.

5.3.1.4 Locally focused assessments and adaptation tools

Locally focused assessments and adaptation tools are considered to be community-based action tools, which follow a bottom-up approach. These tools require practitioners to work in collaboration with the communities to identify their current climate or environment exposures and identify their capacities to cope with climate change. The CV&A (Table 4.16a) is a combination of a process guidance tool, collecting information tool and a sharing of knowledge tool. With a vision to improve sustainability at the community level, this tool was used in the CBDAMPIC RMI project, which produced a 2011 draft vulnerability assessment report. As a result of this project, vulnerabilities and capacity needs at the community level were able to be identified; and support for this tool gained momentum. Overall, the ease of use of this tool, increased awareness after the pilot project was implemented. With the success of this tool in previous PICs case studies, such as the Cook Islands and Vanuatu, this initiative accomplished practical implementation measures at the community level and should be a preferred model for international adaptation approach (Nakalevu et al., 2005).

In 2009, the Community Based Adaptation (CBA) programme was extended to RMI (Table 4.16b), with funding support from the Australian government. The programme is being implemented through the Non-Government Organizations (NGOs) to support community-based projects. The CBA focuses on community ownership and empowerment towards improving livelihoods. The methodology
utilizes the bottom-up approach, through community empowerment and ownership of projects. One of its main objectives is to assess the environment’s vulnerability to the projected effects of climate change and to increase the coping capacity of ecosystems to adapt these changes (OEPPC, 2009).

The PACC project, implemented by SPREP, was launched in 2009 in 13 PICs, including RMI, to improve and increase adaptation response measures on the ground. The project is multi-sectoral, that is, countries identify their most vulnerable sector and develop suitable adaptation measures accordingly. In RMI, the priority sector identified to be most vulnerable to climate change was the water sector. In using a community-based adaptation methodology, the project is now in full implementation mode to climate proof its water sector. The PACC methodology uses an integrated bottom-up approach to climate change adaptation assessment (Hay, 2009b).

Another demonstration of locally focused tools is the Ecosystem-Based Adaptation (EBA) approach. The application of the EBA tool is spearheaded by local non-governmental organizations (NGOs) in partnership with the community. This approach advocates sustainable use of natural resources by building resilience through biodiversity conservation as an adaptation strategy.

The Community-based Risk Screening Tool: Adaptation and Livelihoods, commonly known as CRiSTAL (Table 4.16c), is another such tool introduced in RMI. This tool allows project managers and coordinators to integrate climate risk into climate change adaptation planning at the community level. CRiSTAL looks at a project’s effect on the community and the community’s capacity to adapt in respond to these effects. While this tool has been introduced in RMI, it has yet to be piloted on any community project. This is due to CRiSTAL being a computer-based tool, which is relatively new to local communities and who also lack the necessary experience in working with computer models.

5.3.1.5 Risk-based approaches

Risk-based approaches are utilized to assess climate risks, where Hammil and Tanner (2011) defines climate risks where “the hazards in question are climatic in origin”. In 2005, Professor John Hay conducted the first climate risk assessment on RMI (Table 4.17), evaluating current conditions and future condition using climate-modeling tools. He used observed climate data and identified potential hazards, and
then developed likely future climate change projection for RMI. This approach utilizes one or more of 24 IPCC-recognized global climate models (GCMs) to produce computer-generated outcomes. Likely future rainfall and temperature were projected using the Hadley Centre – United Kingdom model for RMI’s profile. The climate risk profile for any given country requires assessing the current climate risk, based on observed climate data (Hay, 2005). This type of tool has certain limitations because it requires specialized training in the use of GCMs and there is often a cost associated the access of these computer programs.

Fortunately, there are risk-based assessment tools that do not require computer models and are free. The PACC project used a risk-based tool that was developed by ADB to successfully mainstream adaptation measures into Kosrae, FSM’s legal framework (SPREP, 2011). The project was able to identify the risks and develop adaptation measures into the EIA process. This new law falls under the transportation and infrastructure sector, making it mandatory for all related development projects to consider the climate during design and implementation phase. This new law was able to postpone a road improvement project that if carried out without considering the effects of climate change, would have incurred huge cost for maintenance in the long term (Pacific Newsbeat, 2011).

5.3.1.6 UNFCCC associated process tools

Approaches to assessing adaptation in the Pacific Islands Countries have always been dominated by the UNFCCC process since 1994. It was through the Pacific Islands Climate Change Adaptation Program (PICCAP), that assistance was provided to Pacific Island countries to implement the Convention on Climate Change. The PICCAP is derived from the Climate Change Training Program (CC-Train) under the UNFCCC. This program was designed to assist Pacific Island countries develop their national communications and fulfill their obligations as signatory members to this convention. It was through this program that the first national communication of the RMI was initiated. The RMI’s First National Communication funded through the PICCAP Program used the IPCC common methodology (Table 4.18a) as a supporting tool to develop its initial climate change report (RMIEPA, 2000). This national climate change report requires an assessment of RMI’s vulnerability to the impacts of climate change be carried out. The vulnerability chapter focused on the sea level rise impacting the shorelines of
Majuro and Kwajalein Atolls. This report based its assessment on the initial desktop studies by Crawford et al., (1992). Of which Crawford et al, used seven steps in assessing vulnerability. The ease of use of this methodology requires an extensive knowledge in how the biophysical systems interact and the socio economic impact on the environment. Significant training is required as practitioners need to outline the geographical area, stock take and identify vulnerable sectors, develop response measures and assess the vulnerability of the environment.

In developing the Second National Communications as required under the UNFCCC, the Marshall Islands has opted to use the SimCLIM methodology (Table 4.18b) developed by Warrick (2006). This methodology relies on a computer stimulating software based on modeling programs and mapping tools. It is what Hammil and Tanner (2011) describe as data information provision tools of which depend on climate observation data’s such as temperature and rainfall and response options such as poverty maps to generate model simulations. In drafting the Second National Communication, a consultant from Climsystems Ltd was hired to carry out the assessment. This tool requires obtaining of software license and considerable amount of training.

5.3.1.7 Assessment of national policy frameworks

Earlier on in the literature review and subsequently in the evaluating adaptation measures section, emerged an international treaty and two regional frameworks. The Convention on Climate Change: UNFCCC is a treaty that set out a set of principles encouraging member countries to seek ways to protect the global environment system for the future survival of the human race. From the international arena to the regional setting, enters two players: the PIFACC and the PDRMF. The PIFACC of which focuses on urging Pacific countries to take action on adapting and mitigating the effects brought on by climate change while PDRMF comes in looking at how Pacific countries can reduce risk by managing their vulnerabilities to hazards.

Moreover, from the regional frameworks, the national key players develop their national policy frameworks with a purpose to ensure that national environmental systems are protected for their own future survival. In the RMI, at its national level, appear two environmental frameworks: the National Sustainable Development Framework (RMISDF) (Table 4.19a) and the National Coastal
Management Framework (RMICMF) (Table 4.19b). RMISDF developed and launched in 2006, is a framework that sets out principles and guidelines on various permits needed for any development to occur in the RMI with a view to stabilize the human impact on its environment.

On the other hand in 2008, comes in the RMICMF, which looks at what the present state of the environment is, and monitors the activities that may have major impacts on the ecosystems. RMICMF urges the use and implementation of the Environmental Impact Assessment process, encouraging developers to adopt this tool. In RMI, Professor John Hay in 2005 carried out a country environment analysis on behalf of the Asian Development Bank. ADB in its regional portfolio carried out this study in the Pacific to evaluate the process of implementing their environmental laws and regulations. In this ADB (2005b) analysis, Hay found that national efforts focus on supporting economic development and little emphasis on environmental management and good governance. Too often, effective mainstreaming is stalled when national priorities are misplaced. In this case, at the national level, there is a vast amount of policies, regulations and frameworks to ensure sustainable environmental development. In order to promote and foster sustainable development and the need to protect the environment, there needs to be an improvement in these procedural processes within the national institutions. This is also needed to gain technical and financial support from regional and international organizations to adapt and mitigate the adverse effects of climate change (ADB, 2005b).

5.3.1.8 Cost Benefit Analysis

Adaptation to climate change requires considerable planning and lifestyle changes. There are two ways to go about it, you either prepare for it or you choose the wait and see option. There is no doubt that adaptation will be costly (Pittock, 2009). Therefore, assessing the cost and benefits of adapting to climate change becomes a need. Why is that? It was Chadburn et al., (2010) that defined Cost Benefit Analysis (CBA) as a useful economic tool to evaluate the cost of a particular project. This tool is beneficial in the area of disaster management and risk reduction, whether it be hazard or climate related. Used by governments this tool can assist decision makers to plan and prepare for making decisions that will help the community cope with the adverse effects of climate change. In preparing for disasters resources are often not available or are unattainable because of the cost,
however, when one considers post-disaster costs, the recovery becomes insurmountable. This is a great tool to demonstrate the significance of a proactive approach and protecting investments from risk approach (Chadburn et al., 2010).

To demonstrate the applicability and usefulness of this tool, SOPAC in 2010 performed a preliminary economic assessment of the IWRM project in Laura on Majuro Atoll (Table 4.20). The purpose of this project is to ensure effective management and protection of the groundwater supply on Majuro Atoll. Successful project implementation would mean a safe and reliable supply of freshwater, not only to the Laura community but Majuro Atoll as a whole (Gerber, 2010). Gerber’s objective was to carry out an economic assessment of the output of the IWRM implementation. The results of this study aimed at harnessing education and awareness of the community to appreciate the value of the project and secure additional financial resources for sustainability after the project is completed. Gerber’s methodology entailed determination of losses and gains that the project has on the community against a set of valued indicators. The measurements were then calculated against the present social and economic cost to determine overall “net” value (Gerber, 2010). Upon completion of this assessment, it was recommended that additional financial resources be obtained to ensure the longevity of the IWRM project.

Furthermore, a partial project appraisal through participant observation was carried out on rainwater harvesting in the Laura Community. Given the lack of expertise at the national level, a detailed economic assessment such as Gerber’s (2010) was not achievable. The purpose of this partial appraisal was to determine if the CBA tool should be used on selected projects of high economic value. The appraisal required examination of project documents and relevant surveys, and later participant observation at RMIEPA. At the end of the process, it was identified that rainwater harvesting, through the installation of rooftop catchment systems, was a suitable project to consider. Findings from this partial appraisal revealed challenges; solutions and recommendations that could better assist the community in developing a planned approach to address the adverse effects of climate change. Tables 5.1 and 5.2 below, summarizes these challenges, solutions and recommendations.
Table 5.1: Challenges and solutions identified through partial appraisal

<table>
<thead>
<tr>
<th>Challenges</th>
<th>Solutions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lack of public education and awareness on the importance of water</td>
<td>Increase public awareness on water conservation</td>
</tr>
<tr>
<td>Limited understanding on status of groundwater resource</td>
<td>Assessments of the Laura groundwater lens</td>
</tr>
<tr>
<td>Groundwater contamination due to seepage of pollutants</td>
<td>Development of water safety plans and land use restrictions</td>
</tr>
<tr>
<td>Water management</td>
<td>Household rainwater harvesting projects</td>
</tr>
</tbody>
</table>

Table 5.2: Recommendations identified through partial appraisal

<table>
<thead>
<tr>
<th>Benefits</th>
<th>Improvements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Improved human health</td>
<td>Improved water quality as a result of increased water catchment facility</td>
</tr>
<tr>
<td>Gender Issues</td>
<td>Increased participation from women as water management becomes a family activity</td>
</tr>
<tr>
<td>Empowerment</td>
<td>Problem and solution proprietorship</td>
</tr>
<tr>
<td>Stress</td>
<td>Less stress due to increase availability of daily water</td>
</tr>
<tr>
<td>Networking</td>
<td>Build knowledge and capacity network</td>
</tr>
<tr>
<td>Awareness</td>
<td>Community become better informed</td>
</tr>
</tbody>
</table>

The population of Majuro is already growing at a faster rate that the national average and is projected to increase even faster in the future with rapid urbanization and place more pressure on the water supply system (ADB, 2005b).
6 Chapter 6: Conclusions and Recommendations

The three main components analyzed in this thesis are adaptive capacity, adaptation mechanisms and adaptation tools. This section draws the findings of this thesis to a final conclusion and provides recommendations that could further enhance the efforts of climate change adaptation in RMI.

This study reveals that, in agreement with Dator (2004), structure indeed matters and that good governance is a vital component to ensuring adaptive capacity, and is essential to strengthen effective risk management (IPCC, 2007a). RMI’s history is marked by colonialism and an unclear nuclear past, which has had and continues to have a profound influence on the nation’s ability to adapt to climate change. For more than a hundred years, the society has adapted and embraced foreign driven ideals, customs and ways of doing things, for instance in chapter 4, when the RMI become a self-governing country it inherited the United States NEPA and its governance process of democracy while struggling to build its own governance system, add the British and the Japanese to the mix. Structure mattered, even before foreigners made contact, the Marshallese were adapting to climate change, in their own language. The struggle now is the need to define and understand climate change adaptation in a foreign language. In a traditional context, the Marshallese society has adapted to this sea of change through traditional practices in their ways of life. Integration of the traditional knowledge and modern technological knowledge can further strengthen the structure that has always mattered.

The legal and regulatory frameworks, policies and strategies of RMI today are reflections of their foreign predecessor’s administrative influence. Its legal instruments on environmental protection are well established; however, much improvement is still needed in its implementation, enforcement and effective coordination. Language is a barrier and resistance forms early in the implementation process when these instruments are not well understood and accepted by the community. Many regulations have been enforced without adequate consultation with traditional leaders and customary laws; and this has attracted much criticism from the local communities. Therefore, effective communication is essential in enhancing communities’ resilience.
Donor organizations employ similar approaches across the Pacific but the ‘one size fits all’ concept clearly does not apply in identifying a ‘magic’ tool that everyone can use, because national circumstances differ across the Pacific islands. This case study finds that critically analyzing the approaches that have already been used in the RMI and adopting those successful tools is the appropriate way forward. This method can significantly reduce the chances of duplicating previous similar efforts. For instance, by assessing, analyzing and evaluating all the tools to date can assist in deciphering, which methods or tools are appropriate and which ones are just not implementable by the practitioners. The key is how to avoid ‘reinventing the wheel’ but to use it.

The overall findings of this study support the notion that effective adaptation begins by assessing the enabling environment's adaptive capacity to cope with the effects of climate change; subsequently evaluating the coping mechanisms that are currently in place and analyzing the tools which are aimed at building resilience. The analogy with ‘The Three Little Pigs’ folktale, presented in Chapter 1.2, reflects the notion that effective adaptation needs to be built on strong foundations.

For improvement in RMI’s climate change adaptation, this study also recommends that:

1. The climate risk profile of the Marshall Islands to be updated;
2. More applied natural and social science research and assessments to be carried out;
3. Clear roles and responsibilities of the relevant agencies, organizations and communities are understood at the outset of adaptation project implementation;
4. To increase adaptive capacity assessment of the enabling environment;
5. There is a need to identify when and how best to use different adaptation approaches;
6. The traditional, social, cultural and economic effects of climate change and needs of communities to be documented;
7. Climate change adaptation to be mainstreamed into the EIA process;
8. Government efforts to address adaptation to climate change to be linked to NGOs’ and communities’ approach;
9. Adaptation planning and implementation activities should focus on long-term rather than short-term benefits;
10. Institutions and governance arrangements ensure that disaster risk reduction and adaptation to climate change are one package to avoid duplication of efforts;
11. Adaptation projects are regularly monitored, evaluated and analyzed to ensure good progress.
12. Basic climate change science and sustainable development concepts to be mainstreamed into the education system
13. Latest scientific information to be communicated accurately and in suitable language to different stakeholders
**Appendix 1: A summary of assessments introduced and utilized in RMI from 1991 to 2009**

<table>
<thead>
<tr>
<th>Type</th>
<th>Name</th>
<th>Acronym</th>
<th>Target</th>
<th>Key input</th>
<th>Output</th>
<th>Strengths and Limitations</th>
<th>References</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assessment</td>
<td>Community Vulnerability and Adaptation Assessment and Action</td>
<td>CV&amp;A</td>
<td>Project Managers, local practitioners and the community</td>
<td>Participatory gathering of data from community. Combinations of local knowledge and science.</td>
<td>Assessment reveals practical needs and builds community ownership/ Bottom up approach encourages community ownership.</td>
<td>Nakalevu (2006b)</td>
<td></td>
</tr>
<tr>
<td>Assessment</td>
<td>Community-based Risk Screening Tool – Adaptation and Livelihoods</td>
<td>CRiSTA L</td>
<td>Community level practitioners</td>
<td>Analytical framework/ Form in MS Excel.</td>
<td>Assist project planners make adjustments on adaptation projects</td>
<td>Prioritizes adaptation/lack of human capacity to carryout assessment</td>
<td>Hammil and Tanner (2011)</td>
</tr>
<tr>
<td>Risk</td>
<td>Assessment Approach</td>
<td>RAA</td>
<td>Project Managers</td>
<td>Links climatic variables</td>
<td>Manage systematic uncertainties</td>
<td>Requires knowledge in biophysical and socio-economic data</td>
<td>Jones et al. (1999)</td>
</tr>
<tr>
<td>Risk</td>
<td>Adaptation</td>
<td>RBA</td>
<td>Decision makers and planners</td>
<td>Assess cost; with or without climate change</td>
<td>Reveals cost of adaptation</td>
<td>Requires knowledge in economic assessment</td>
<td>ADB (2006)</td>
</tr>
<tr>
<td>Locally based Adaptation Assessment</td>
<td>Risk based Adaptation Assessment</td>
<td>Links</td>
<td>Strengthens</td>
<td>Involves all community level stakeholders</td>
<td>Limalevu (2010)</td>
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<tr>
<td></td>
<td>RBA</td>
<td>Local practitioners and community</td>
<td>local conditions with science</td>
<td>community partnership and ownership</td>
<td>Pernetta and Hughes (1990) Hay (1993)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Assessment</td>
<td>NSA</td>
<td></td>
<td></td>
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<tr>
<td>Methodology</td>
<td>IPCC Common Methodology</td>
<td>IPCC- CM</td>
<td>Input of climate data and variables such as sea levels.</td>
<td>Reveals vulnerability to sea level rise.</td>
<td>External consultant required to assess vulnerability</td>
<td>IPCC CZMS (1992)</td>
<td></td>
</tr>
<tr>
<td>Assessment</td>
<td>National Capacity Self-Assessment</td>
<td>NCSA</td>
<td>Project managers and decision makers</td>
<td>Requires data input on UNFCCC, UNCBD and UNCCD</td>
<td>In dept capacity assessment on reporting procedures</td>
<td>GEF (2005)</td>
<td></td>
</tr>
<tr>
<td>Approach</td>
<td>Comprehensibe Hazard and Risk Management</td>
<td>CHAR M</td>
<td>Project managers</td>
<td>Requires historical data on hazards and risks and training of software.</td>
<td>Reveals climate risks and identifies management solutions.</td>
<td>SOPAC (2009)</td>
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<tr>
<th></th>
<th>RBA</th>
<th>Local practitioners and community</th>
<th>links</th>
<th>Strengthens</th>
<th>Involves all community level stakeholders</th>
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<td>SOPAC (2009)</td>
</tr>
<tr>
<td>Assessment</td>
<td>Cost Benefit Analysis</td>
<td>Project Managers and decision makers</td>
<td>Requires economic data</td>
<td>Reveal cost with or without climate change</td>
<td>Gives a value to the climate change impacts</td>
<td>Chadburn et al (2010) Lal et al. (2009)</td>
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