“Evaluating the progress of the Integrated Vulnerability Assessments in Kiribati”.

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ABSTRACT

Climate Change impacts which result in sea level rise and rising temperatures, on coastal communities continue to affect the livelihood dimensions of people, their environment, and natural resources on which they rely on. The Pacific Small Island Developing States have turned towards stringent adaptation planning process which must be informed through sound evidence. Using Climate vulnerability assessments as the medium to provide information and analysed results to support decision making for adaptation. This study will consider relevant literature, research and cases studies on climate vulnerability and adaptation planning, using IPCC guideline and contextualised approached adopted and fit for purpose. The succession of ideologies and the shift of approaches demonstrates the need for adaptation to continuously consider the issues and challenges which shape the vulnerability context of PSIDS. The core focus of this study is on the Integrated Vulnerability Assessment adopted by Kiribati and the progress that the Government of Kiribati has undertaken to support the integrated approach for assessing climate vulnerability meanwhile ensuring that the integrity of information, the analysis of data and share experiences from island community stakeholders are well captured. The results point towards gaps identified in terms of the application of the methodology developed by Kiribati. These issues further provide insight on the underlying reasons for the IVA assessment methodology because of limited capacities, financial constraints and the technical and analytical capabilities of the assessors to provide adequate information and results to support adaptation planning. The results further show inadequacies within the methodologies applied, the information interpreted and the shared results through the IVA reports to decision makers which may alter how communities, governance structures and leaders interact with adaptation and resilience efforts. Using Kiribati as a case study, an evaluation of the progress of the Integrated Vulnerability Assessment (IVA) methodology will demonstrate how these shifts in concepts and additions of all relevant and vulnerable sectors and parameters show consistency with the movement towards multi-sectoral and multi-dimensional vulnerability assessment frameworks and methodologies. As part of this evaluation, this research paper will also identify challenges affecting the progress of adaptation planning and provide recommendations based on best practices adopted in Kiribati.

ACRONYMS

SIDS – Small Island Developing States

PSIDS – Pacific Small Island Developing States

IPCC – Intergovernmental Panel on Climate Change

IVA – Integrated Vulnerability Assessment

AR – Assessment Report

2AR - Second Assessment Report

TAR – Third Assessment Report

AR4 – Fourth Assessment Report

AR5 – Fifth Assessment Report

AR6 – Sixth Assessment Report

BOM – Australian Bureau of Meteorology

CBA – Community Based Adaptation

CVA – Climate Vulnerability Assessment

CROP – Council of Regional Organizations in the Pacific

EU – European Union

ENSO – El Nino Southern Oscillation

FRDP – Framework for Resilient Development in the Pacific

GCF – Green Climate Fund

GEF – Global Environment Facility

GIZ – German Development Cooperation

GOK – Government of Kiribati

GMST – Global Mean Surface Temperature

GSML - Global Sea Mean Level

HH – Household Survey

HSO – Human Security Objectives

JNAP – Joint National Adaptation Plans

KJIP – Kiribati Joint Implementation Plan for Climate Change and Disaster Risk Management

KMS – Kiribati Meteorological Services

LA – Livelihood Assets

LDC – Least Developed Country

NAP – National Adaptation Plan

PIFS – Pacific Island Forum Secretariat

PRA – Participatory Rural Appraisal

PSIDS – Pacific Small Island Developing States

RCF – Reasons For Concerns

SLR – Sea Level Rise

SPC – South Pacific Commission

SPREP – South Pacific Regional Environment Program

SROOC- Special Report on Oceans and Cryosphere in a change climate

SWOT – Strength, Weakness, Opportunities and Threats

UNDP – United Nations Development Program

UNEP – United Nations Environment Program

UNFCCC – United Nations Framework Convention on Climate Change

USAID – United States Assistance for International Development

DECLARATION

I certify that this thesis does not incorporate without acknowledgment any material previously submitted for a degree or diploma in any university; and that to the best of my knowledge and belief it does not contain any material previously published or written by another person except where due reference is made in the text.

Signed 

Date 17/12/2024

ACKNOWLEDGEMENTS

I would like to dedicate this research paper to my family who have been part of this journey with me. It has been a tough and rocky journey, equally with its ups and downs, but we have made it! To Raabwa, Winnie (Robwatia) and Agnes – *I tangiri ngkami ao aio tokanikaira ni kabane!*

I would also like to dedicate this research paper to my mentors: Mr Andrew Teem and Mr Michael Sarbane Foon. Two exceptional men in their own rights and both pioneers in Kiribati in climate change. The true champions in Climate Change and Disaster Risk Management for our beloved country Kiribati. May you both rest in peace.

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With these acknowledgements, I would also like to share the blessing of my beloved country, Kiribati of Te Mauri (Peace), Te Raoi (Health) ao Te Tabomoa (Prosperity).

CHAPTER 1- INTRODUCTION

1.1 Problem statement

Climate change and increasing carbon emissions continues to threaten the livelihoods of communities around the world. As a result of increased sea level rise and temperature increase witnessed and felt across the Pacific region have affected the livelihoods of coastal communities in terms of food security, water security, health risks and security of place. (Donner & Webber, 2014, p. 1616; Ford et al., 2018; Gravelle & Mimura, 2008; IPCC, 2019; Wairiu et al., 2012)

Leaders from the Pacific Small Island Developing States (PSIDS) region have long voiced concerns over the threat that climate change poses to Pacific coastal societies as it disturbs the social, environmental, and economic pillars of Pacific coastal resilience and sustainability (Boe Declaration, Pacific Island Forum Leaders, 2018, Nunn et al., 2021; Piggott-McKellar et al., 2019; Teaiwa, 2019).

The Pacific SIDS are the most vulnerable group of countries due to their inability to respond to climate change (Kench et al., 2018; Walter Leal et al., 2021). Due to low economic status, Pacific Pacific Small Island Developing States are characterised based on the lack of institutional capabilities to respond to climate risks (technical capabilities and financial capacities), limiting their ability to put in place appropriate adaptation and resilience measures (Nunn et al., 2021; Walter Leal et al., 2021; Warrick et al., 2017b)

Climate change impacts within the Pacific region have become more complex to deal with, for low-lying atolls and coastal communities, reports show that these impacts will become more frequent and intense (IPCC, 2021; IPCC, 2014, Chapter 29, pp. 1616). An increase in sea level of 10-15cm will have cross cutting impacts affecting the coastal protection and livelihoods of people living in coastal areas (BoM &KMS, 2011; IPCC, 2021; IPCC, 2014).

To mitigate these risks and impacts, adaptation measures to strengthen the resilience and adaptive capacities of coastal communities have been undertaken by studies widely and have informed government adaptation planning process across the world. (Annah E. Piggott-McKellar et al., 2020; Piggott-McKellar et al., 2019; Reid, 2016). The first step towards informing the necessary adaptation solutions require sound scientific and evidence-base for efficient response measures to be put in place (Gero et al., 2011; Parry, 2007; Smit & Wandel, 2006)

To inform coastal adaptation planning processes, four Pacific islands (Fiji, Kiribati, Tuvalu, and Solomon Islands) have pioneered an integrated approach to inform decisions on what the main issues affecting community resilience (social, economic and environmental) and where to target adaptation actions. Since its adoption in 2012, the Integrated Vulnerability Assessment (IVA) has been adopted by many Pacific Island countries (Fiji, Tuvalu, Solomon Islands).

The IVA takes precedence from earlier type of climate risk and hazard vulnerability assessment methodologies developed by the IPCC and applied by various researchers and practitioners according to specific needs and purpose (e.g Impacts of climate change on Agriculture, Health, Water) (Hahn et al., 2009; Hay & Mimura, 2013; Pandey & Jha, 2012). With continued climate impacts affecting all levels of development (vertically and horizontally), the shift towards evidence-based decisions making is taking prominence in the scheme of national and sub-national development planning, including adaptation and resilience. (Basel et al., 2020; Chand et al., 2023; Foley, 2018; Hay & Mimura, 2013)

An IVA measures vulnerability by taking into account the socio-economic dimensions (E.g. income generation, daily catch, community well-being) and environmental data and information (E.g sea level rise, temperature change, climate variability, coastal flood maps, biodiversity loss, impacts on ecosystems land and terrestrial) and also captures village and community experience to support framing on climate vulnerability. The IVA captures experiences and perceptions of vulnerability, which take into issues and challenges faced at the community level, at the household level, sector level and individual livelihoods.

The IVA provides information and results which determine the level of vulnerability of certain assets or sectors such as coastal protection, health, water, food, income generation, fisheries, etc., The overall purpose of the IVA is to support adaptation planning processes and ensure that evidence-based decisions making for adaptation are appropriately considered. Furthermore, IVA results support national adaptation planning processes and allows for the consideration of prioritized adaption actions for investments purposes by external partners and donors. With a clear understanding of the specific issues matched with the needs of the people being affected, allows for meaningful actions to be supported (e.g. sea wall construction, water and vector borne disease monitoring, desalination systems, rainwater harvesting catchments)

The need for assessing the progress of Integrated Vulnerabilities is important because the IVAs currently serve as the main source of information for climate change adaptation planning in Kiribati. The results from the IVA are used for strategic planning process and reflected across many policies and plans within Government sectors and for sub-national governments (island councils). The evaluation of the progress of IVAs will include an assessment of the methods and the reporting and will determine whether the IVA has served it purpose in the context of supporting the evidence base for adaptation planning.

The IVA methodology and the IVA reports which have been developed, currently serve as the main source of information which informs adaptation planning process at the national government level. In Kiribati, climate change and disaster risk information which are sourced from IVA reports, are featured in sector policies, plans and strategies. The IVA is an important tool to support adaptation

planning but also inform investment opportunities for adaptation actions for the government and for the islands in Kiribati.

As adaptation planning process continue to rely on the IVA method and IVA results, appropriate methodologies, analysis of results and the formulation of IVA reports must be done appropriately.

Since 2012, 15 IVAs have been developed in Kiribati. In 2012 the pilot IVA was conducted for Abaiang Island. It was completed in 2013. It was the first ever integrated climate assessment report to include all sectors, experts, and international partners in its development. Much of the success of the pilot was a result of a thorough methodology implemented by governments sectors and supported financially and technically by external partners. The IVA report for Abaiang is a success due to thorough approach undertaken and the completeness of the results and findings. For this paper, Abaiang will be used as a model comparison to three other IVAs.

The expectation from this thesis paper is that the results and findings based on the evaluation conducted will allow policymakers and practitioners of climate vulnerability assessments in Kiribati and in the Pacific region to note the importance of evidence-based decision-making and to elevate the level and quality of decisions being made for adaptation and resilience strengthening in future.

1.2 Research Aim & Objectives

Aim

To investigate the quality of four Kiribati IVAs to establish if they serve their purpose of providing a sufficient evidence base for adaptation planning and decision making.

Objective 1 – Conduct a review of concepts and literature around climate vulnerability assessments, adaptation, and resilience to establish best-practice criteria for the IVA evaluation.

Objective 2 – To create an evaluation framework for comparing each IVA report against the original IVA (Abaiang)

Objective 3 – Apply the evaluation framework to three completed IVAs (Tabiteuea Meang, Butaritari and Kiritimati) to identify the likely effectiveness of these IVAs to support decision making for adaptation.

Objective 3- Provide lessons and recommendations based on the evaluation of the IVA methods and IVA report.

CHAPTER 2 -LITERATURE REVIEW

2.1 Climate change impacts in Pacific Small Island Developing States (PSIDS)

Global climate change is seen as a threat to the livelihoods and security of Pacific Small Island Developing States (PSIDS) (Teaiwa, 2019). As a result of increased sea level rise and temperature increase across the Pacific region (IPCC, 2021). The Livelihood of PSIDS measured through indicators which connect sustainable development, adaptive capacity, and resilience are at put at stake.

The vulnerability of Pacific SIDS is characterized by the economic status, low Gross Domestic Products, and often labelled as developing (Duvat et al., 2017; Petzold & Magnan, 2019). In addition to their economic vulnerability, Pacific SIDS are also vulnerable due to the inability to address climate change impacts on food security, water security, health, and coastal protection. The inability of Pacific SIDS to address climate impacts and vulnerabilities is associated with the technical capacities, systems, governance, and financial means for implementation (Petzold & Magnan, 2019; A. E. Piggott-McKellar et al., 2020)

The majority of PSIDS urban centres and settlement are located in low lying and exposed coastal areas which places their exposure to these impacts very high (Foley, 2018; Nurse et al., 2014) The dependency of coastal communities on natural resources (coastal fisheries, local plants and root crops, underground water for drinking and livestock enhances the exposure levels of coastal habitants (Duvat et al., 2017; Narayan et al., 2020) (Duvat et al., 2021)

> *"Coastal cities are affected by compounding climate and ocean-driven impacts, because of the exposure of multiple assets, economic activities and large populations concentrated in narrow coastal zones (high confidence), with about a tenth of the world's population and physical assets in the Low Elevation Coastal Zone (less than 10 m above sea level)"* (IPCC, 2022 AR6 WGII Technical Summary. p.54)

PSIDS are vulnerable due to the projected frequency and severity of extreme weather events such as prolonged drought, tropical cyclones, coastal flooding and storm surges (Ford et al., 2018; IPCC, 2019, 2021)

IPCC reports (2022) highlight that PSIDS are faced Sea Level Rise (SLR) and Temperature increase, which directly and indirectly impacts biodiversity, ecosystems, natural resources and well-being. The scale at which these impacts are faced is dependent on the exposure levels of the recipient communities, the sensitivity of their natural environment and the ability to overcome or mitigate the associated risk affecting overall resilience and sustainability.

Furthermore, the succession of reports which highlight the situation faced by Small Island States continues to be featured in the IPCC reports and demonstrates the level of importance to how vulnerable coastal communities and small islands are. While each country is at risk of adverse climate change impacts, the low lying, small islands and coastal communities are placed at the forefront of these impacts. Table 3 below demonstrates the succession of IPCC reports which refer to Small Islands over the iterations of the IPCC reports.

Table 1: Succession of IPCC reports highlighting "Small Islands"

Year	IPCC report name	Key features highlighting climate vulnerability and impacts
1990	First Assessment Report (FAR)	- No specific reference was made to small islands or the Pacific - References to the pacific islands and the pacific region was discussed under chapter "World Oceans and coastal zones" (Tsyban et al, 1990) - Evidence provided on 30-50cm sea level rise by 2050 ; 1m rise by 2100
1995	Second Assessment Report (SAR)	- Provided a confirmation on the vulnerability of small island discussed under "coastal zones and small islands" (Bijlsma et al, 1996) - Reference to the impacts of climate change and human activities which would lead to greater impacts respectively.
2001	Third Assessment Report (TAR)	- A specific chapter on "Small Island States" - Two factors were also highlighted in this chapter: sustainability (Nurse et al., 2001, p. 845) and compounded challenges in light of climate change (Nurse et al., 2001, p. 846)
2007	Fourth Assessment Report (AR4)	- Sea level rise seen as the main challenge affecting small island states - Discussion on taking a multidimensional approach towards addressing climate is explicitly mentioned. E.g socio-economic and environmental approach (Hay, 2013)
2014	Fifth Assessment Report (AR5)	- High confidence in terms of the global temperature will continue to increase even if greenhouse gas emissions are drastically reduced and will escalate the vulnerability, impacts and multiple interrelated risks experienced by small islands

		- Sea level rise and Extreme Sea level rise are featured into the report to depict severity of impacts - Climate projections demonstrate th
2022	Sixth Assessment Report (AR6)	Medium- High confidence levels for: - Loss of terrestrial, marine and coastal biodiversity and ecosystem services - Loss of lives and assets, risk to food security and economic disruption due to destruction of settlements and infrastructure - Economic decline and livelihood failure of fisheries, agriculture, tourism and from biodiversity loss from traditional agroecosystems - Reduced habitability of reef and non-reef islands leading to increased displacement - Risk to water security in almost every small island

Source: (IPCC AR4, 2007; IPCC AR5, 2014; IPCC AR6, 2022)

The IPCC reports' chapter on Small Islands or the Pacific region only came into the picture in the second report of the IPCC; further iterations have seen more specific and elaborate findings for Small Islands, PSIDS and the Pacific region.

The level of confidence reported by the IPCC demonstrates that small islands are vulnerable because of various economic, social and environmental factors. Furthermore, the level of vulnerability is expected to increase overtime for the PSIDS . AR5 further confirms "the high level of vulnerability of small islands to multiple stressors, both climate and non-climate", given their "inherent physical characteristics" (Nurse et al., 2014, p. 1616). This means that the PSIDS region is expected to notice more frequent and severe climate impacts. The mitigation measures will need to be enhanced to counter these projections and the implementation of adaptation measures must factor in time-bound interventions in accordance with the time periods identified in the IPCC assessment reports (Nurse et al., 2014; IPCC, 2014).

2.2 Impacts of Sea level rise (SLR)

Coastal communities and environments are threatened by sea levels rising and accelerating in terms of rate of increase. The Special report on Oceans and Cryoshpere in a changing climate (IPCC) reported that global mean sea level (GMSL) is expected to increase by 0.48m to 0.92m for low lying coastal atolls in the Pacific if adaptation measures are not put in place (IPCC, 2019)

Figure 1 shows the Sea level change according the sea level change proejction tool. The projections by NASA show that for SSP scenarios resulting from processes in whose projection there is *medium confidence*. Two *low-confidence* scenarios, indicating the potential effect of low-likelihood, high-impact ice sheet processes that cannot be ruled out, are also provided. Shaded ranges show the 17th-83rd percentile ranges. Projections are relative to a 1995-2014 baseline. The plot below shows the projection and uncertainties for 'Total Sea Level Change' (NASA, 2023). Sea levels will continue to increase based on the various projections simulated (highest possible scenario and lowest possible scenario).

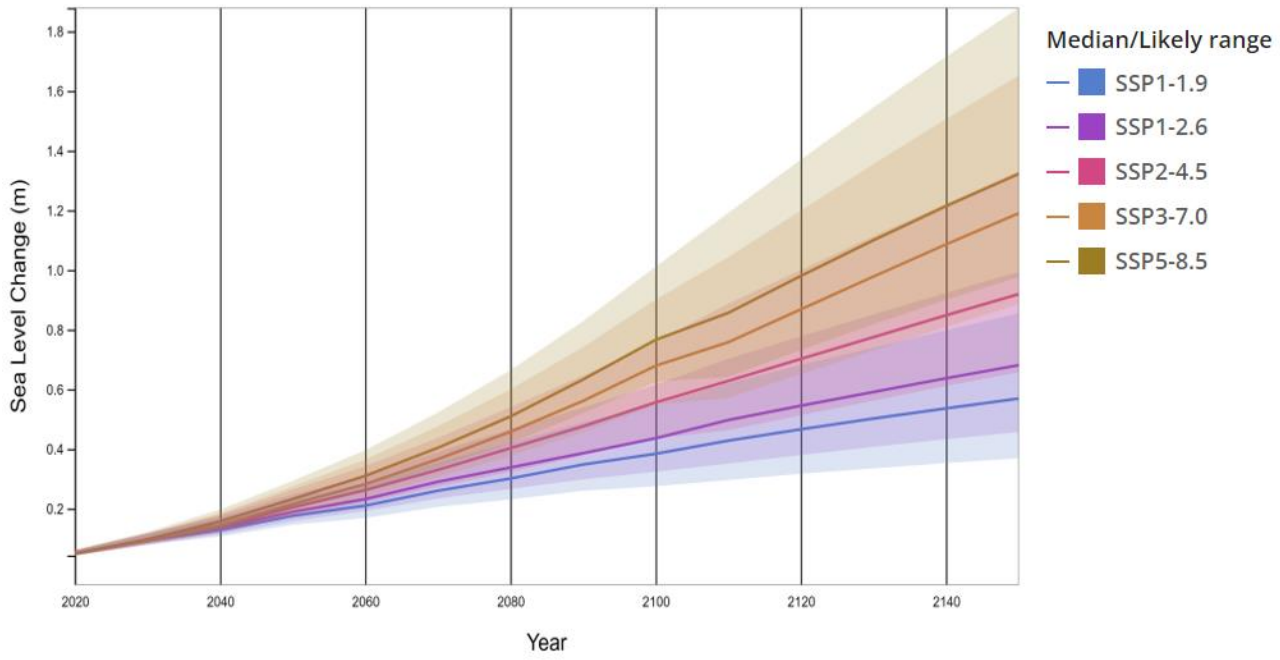

Figure 1 - Sea Level Rise projections (NASA, 2023)

With expected increase in GMSL, Pacific coastal communities need to enhance coastal adaptation and resilience through hard and soft measures (Duvat, 2013; Giardino et al., 2018; Gravelle & Mimura, 2008) . The occurrences of exacerbated impacts (sea level rise, tropical cyclone and coastal flooding happening at one time) will become frequent (KMS and BOM, 2019; IPCC, 2019, 2022). SLR poses one of the greatest threats and challenges for the global community, specifically coastal communities Duvat, 2013; Duvat & Magnan, 2019; McGranahan et al., 2007).

In the context of the Pacific SIDS and low-lying atoll countries such as Tuvalu and Kiribati, climate observations demonstrate that mean sea level will rise by approximately 7–17 cm by 2030 and 38–87 cm by 2090 under the higher emissions scenario (KMS and BOM, 2019;(IPCC, 2019)). While this may be considered low in the global context, for low lying Pacific atolls, a 10cm increase above local thresholds (2.8m) in sea levels means increased frequency and severity of overtopping, coastal erosion, and coastal flooding (Boe Decalaration, 2018; Duvat, 2019)

SLR will exacerbate the intensity and severity of coastal hazards, affecting freshwater supply due to salinity and result in severe erosion, leading to land loss (Albert et al., 2016; Biribo & Woodroffe, 2013; Donner & Webber, 2014; Gravelle & Mimura, 2008).

To respond to sea level rise, the use of an appropriate combination of decision analysis, evidence-based information, land use planning, public participation and conflict resolution is required to address the governance challenges for this problem alone (IPCC, 2019 Chapter 4).

2.3 Temperature increase

Global temperatures are expected to show greater warming moving into 2030 and 2050 (IPCC, 2021). Using 1.5 degrees Celsius as the threshold (Figure 2), the IPCC (2021) demonstrates the likely scenario (based on current anthropogenic warming) that temperatures will exceed the 1.5 degrees Celsius threshold. The observed monthly Global mean surface temperature (GMST) has shown constant increase and further expected to increase moving into 2030, if carbon dioxide emissions level are not urgently reduced (Figure 2)

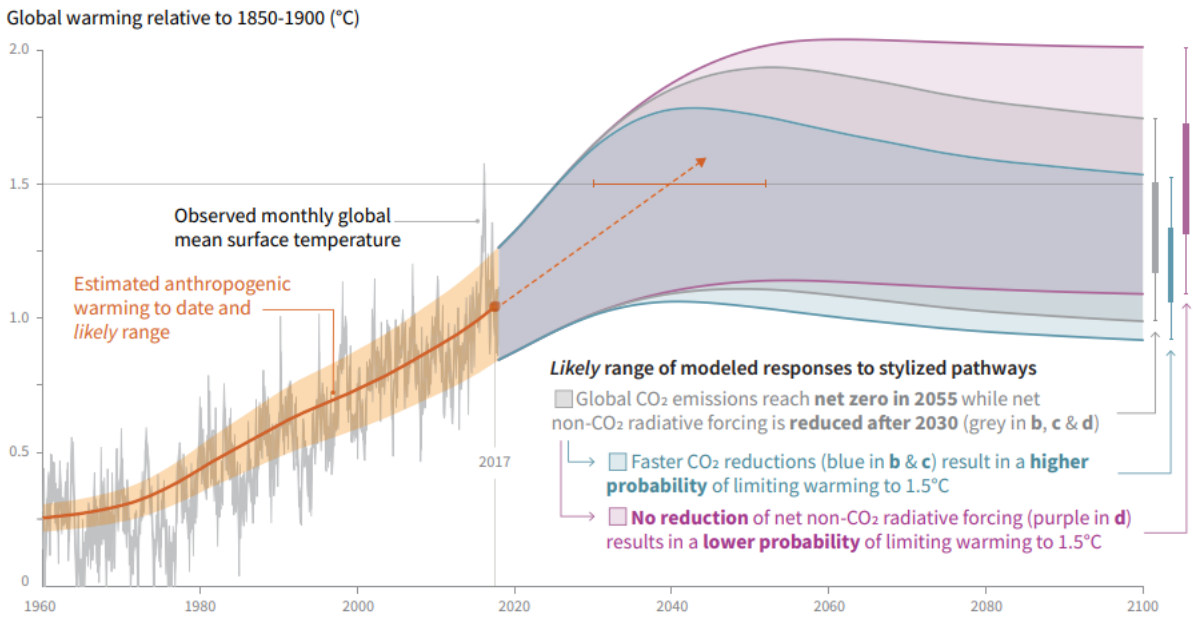

Figure 2 Global mean temperature increase projections relative to global warming (IPCC, 2022)

Increasing temperatures at a global scale will lead to increased level of natural hazards and risks. Climate observations expect to see increased intensity and occurrence of heat waves, bushfires, drought, severity and frequency of tropical cyclones, prolonged climatic conditions (rainfall, dryness), and ocean acidification across the tropics (IPCC, 2018; IPCC, 2022)

For the Pacific SIDS, expected prolonged dry period and drought are expected to be more frequent. Prolonged dry periods and drought lead to water security issues (quality and availability), food security (crop yield and plant health), marine resource depletion because of ocean acidification and coral bleaching (Giardino et al., 2018; Hemanth Kumar et al., 2021; Maucieri & Baum, 2021; Summers & Donner, 2022).The risk potential is high for coastal communities across the PSIDS region who highly depend on natural resources.

2.4 Adaptation and Resilience

> *"Adaptation is defined by the IPCC as the process of adjustment to actual or expected climate and its effects. In human systems, adaptation seeks to moderate or avoid harm or exploit beneficial opportunities (IPCC AR5, 2014)."*

Contrast to more contemporary definitions, Füssel (2006) considers adaptation and planning together and argues that:

> *"the use of information about present and future climate change to review the suitability of current and planned practices"* Fussel & Klein, 2006 pp268)

To understand or implement adaptation, the contributing element of assessments which provide the information and data on affected systems (human, environment and economic) is required before adaptation can be planned or implemented (Dow, 1992; Orlove, 2022)

Estoque (2022) further adds that adaptation planning is a cyclic process which requires adapting or adjusting to impacts faced and projected. The challenges and issues faced must be addressed in a programmatic manner by using the science provided, the personal experience of people and communities and the prioritization and strategic implementation of actions(Estoque et al., 2023; Orlove, 2022)

Adaptation is featured in national development planning processes, and mainstreamed across various sector-based strategies and frameworks, demonstrating the planned actions required to reduce or address climate related impacts (De Sherbinin et al., 2019; Dow, 1992; Walter Leal et al., 2021; Warrick et al., 2017a)

PSIDS have used adaptation as part of the national processes for planning, complementary to development planning and is used interchangeably in policy discourse.

The IPCC (2012) defines resilience as:

> *"the ability of a system and its component parts to anticipate, absorb, accommodate, or recover from the effects of a hazardous event in a timely and efficient manner, including*

through ensuring the preservation, restoration, or improvement of its essential basic structures and functions"

Literature from various contributors to the field of climate change adaptation and resilience demonstrate that concepts related to resilience are based on considerations of impacts at different scales and in different areas which conform to one set of settings and impacts vary from one place to another (Adger, 2006); Dow (1992); (Füssel & Klein, 2006; Gallopín, 2006). Thes contributions suggest that the understanding of resilience is dependent on where and for what it is applied to. For the Pacific island region, the scale must be looked at in accordance with size of the islands and its population, where impacts are most noticed and whether this alters the social, economiic and environment at the island scale. Example is that resilience for Fiji is different to that of Kiribati due to the size and scale at which it is applied. While there may be similarities in terms of how it applied, context places great importance.

Secondly, great importance is put on understanding the context at which climate vulnerability is understood and informs policy development consistent with adaptation and resilience (Chand et al., 2023; Foley, 2018; Gallopín, 2006)

In the case of Pacific SIDS, the definitions of resilience is different from one region to another as each country interprets resilience differently furthermore while the impacts may be similar and as a result of climate change, the experiences will somewhat differ as well in accordance with context (Beyerl et al., 2018; Klöck & Nunn, 2019). The Pacific SIDS is a region with a multitude of climate hazards (cyclones, tsunami, earthquakes). Each of the Pacific Islands also face different climatic events at different scales and at different times periods from nearby regions (Asia, Europe, Africa, Caribbean). This is one the reasons for which vulnerability is seen differently, experience differently and addressed differently relative to location, time and scale. The Pacific SIDS face unique coastal challenges and therefore resilience and adaptation revolve around the response, conservation, and livelihoods of sustainable coastal living (Barnett & Campbell, 2010)

The Third Assessment report of the IPCC (IPCC, 2001) defines adaptation as

"adjustment in ecological, social, or economic systems in response to actual or expected climatic stimuli and their effects or impacts" (IPCC,2001).

Additions to the definition of adaptation by key renowned contributors in this field were also provided to include

"reduction of vulnerability and enhance resilience" (Adger, 2006)

Resilience in the Pacific SIDS Policy discourse is often associated with Disaster Risk Reduction, Mitigation and the ability of bouncing back from stressor associate with climate change, disasters,

and weather extremes (PIFS FRDP, 2018; Jackson et al., 2017). Examples from other regions such as Indonesia and the Philippines use scientific and traditional knowledge in adaptation planning. The Pacific region developed the guiding Framework for Resilience Development in the Pacific (PIFS, 2018) which has directed high level and technical discussions on coordinated efforts between adaptation, mitigation, disaster risk reduction as key pillars towards resilience in the Pacific SIDS context.

Adger (2006), Fussel and Klein (2006), and Gallopin (2006) demonstrate that concepts surrounding the climate vulnerability have shifted because of research contributions from fields such as human ecology, politics, food security and development studies. In planning processes for development, the outcomes focus on well-being, livelihood, and human security, and secondary consideration is placed on the natural environment, biodiversity and ecosystems (Estoque et al., 2023; Orlove, 2022)

Literature shows that while these concepts and terms are used interchangeably, the approaches and methods used as part of adaptation planning show linkages which follow a circular approach rather than linear. This involves a constant review of data, planned actions and methods. (Füssel & Klein, 2006; Gallopín, 2006; Smit et al., 2001). Figure 3 demonstrates the interlinkages between shared concepts and interlinkages for adaptation and vulnerability and their placing within the field of climate change (science, policy and planning).

According to Janssen and others (2006), vulnerability originated from scholarship and research on natural hazards. Dow (1993) also adds that vulnerability characteristics are drawn from two perspectives: a result of exposure or a measure of coping capabilities.

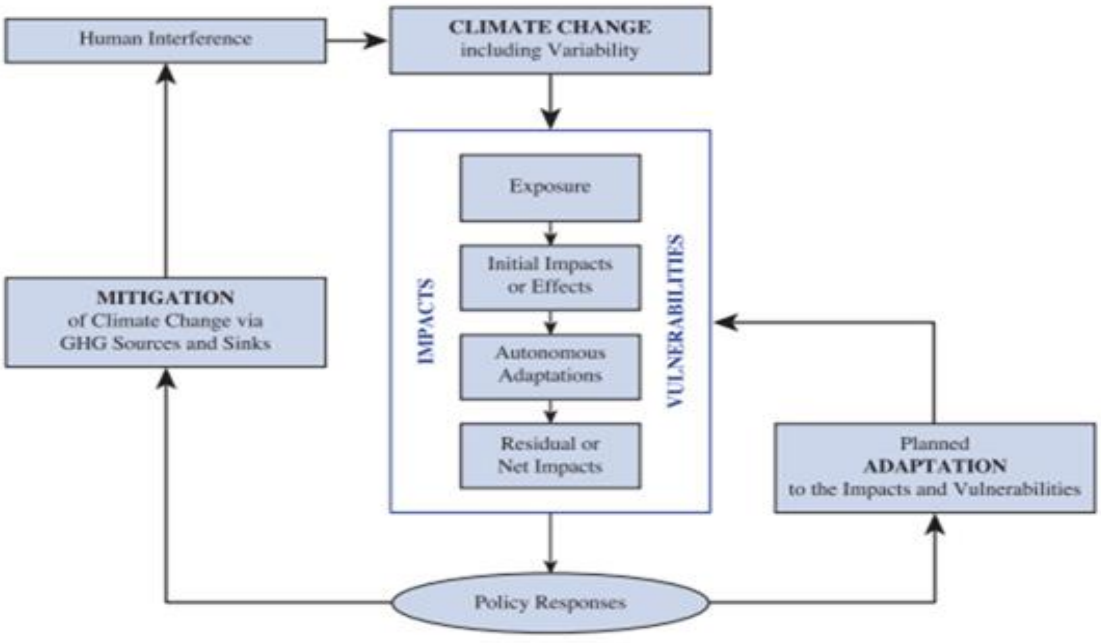

Figure 3 Adaptation and climate vulnerability conceptual linkages

In academia, drawing on contributions from Adger (2006), Gallopin (2006) and Fussell and Klein (2006) on climate vulnerability, climate vulnerability assessments and adaptation: The definitions of vulnerability vary (Dow, 1992) and the interpretation of these concepts in which it is adopted and applied continues to shift (Estoque et al., 2023; Ford et al., 2018; Hay & Mimura, 2013; Orlove, 2022). As countries are expected to become more vulnerable to climate change and its impacts (IPCC, 2021), the evidence-based approaches are being considered will also change and will be tailored according to context, specific needs and purpose (Ford et al., 2018; Orlove, 2022).

Despite the evolution of thinking in the field of climate change adaptation and climate vulnerability, in theory and in practice the definition of vulnerability is closely tied to the impacts faced and experience within settings (in this case the Pacific SIDS). Literature has shown that definitions of adaptation and vulnerability will continue to evolve over time to meet the needs of affected populations. This also applies to the evidence based approach from Ford (2018) and Orlove (2022) where the design of tools to asses vulnerability depend on its intended purpose, the scale at which it is applied to and in response to the needs of people.

2.5 Adaptation as a priority for PSIDS

In its most recent Sixth Assessment Report (IPCC, 2022), the IPCC provided climate projections highlighting the risks for small island states based on high emissions scenarios. The climate projections illustrated the expected impacts concerning sea level rise and rising temperatures leading to the year 2100. Figure 5 below is taken from the Sixth Assessment Report (IPCC, 2022), pp58), highlighting the projected emissions pathways for years to come. One of the alarming statements by the IPCC (2022, pp58) is the level of inaction from regions to adaptation. In (a), the projections for surface temperature will continue to increase into the next century based on all projections provided (SSP1- 1.9 is the low emission scenario; SSP5 -8.5 is the highest emission scenario). Following these concerns, the IPCC also shared tables to highlight ‘Reasons for Concerns’ (b) and the level of risk/ impact if no adaptation is implemented (Figure 5)

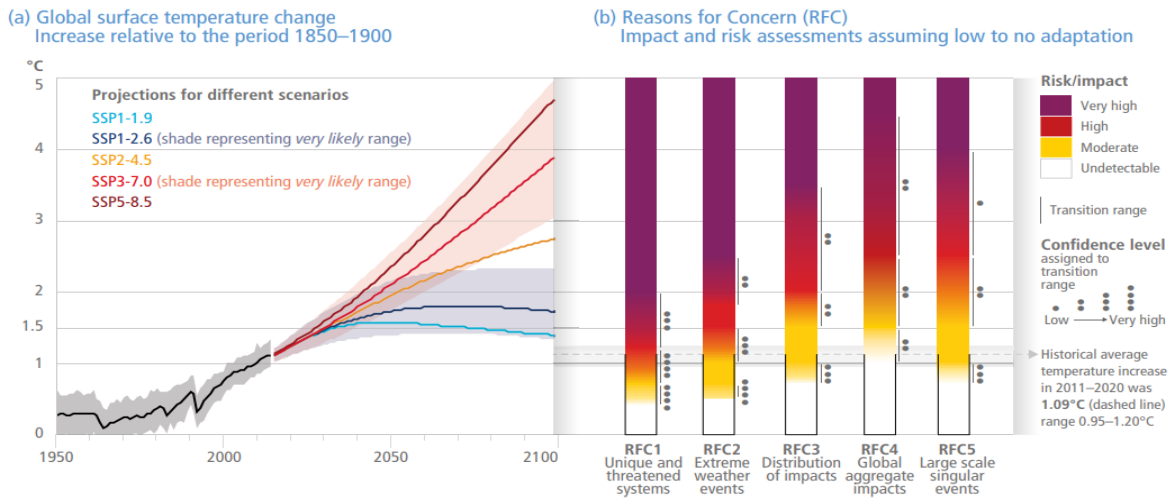

Figure 4 Reasons for Concerns (RCP) based on temperature increase scenarios

The interpretation of Reasons for Concerns diagram (Figure 5) for PSIDS means that while the sea level will rise and growing temperatures will increase, the need for adaptation and resilience is of high importance to mitigate the risk and impacts on natural ecosystems and human systems in place.

Adaptation has been mainstreamed into planning process for most of the Least Developed Countries and Small Island States, the problem however is the lack of implementation of adaptation due to funding constraints (Betzold, 2015; Hayward et al., 2020)

In the Pacific SIDS region, national governments have adaptation plans or have mainstreamed adaptation and resilience into their planning processes. This is demonstrated through the Joint National Adaptation Plan for Tonga (JNAP2, 2018-2028); the Kiribati Joint Implementation for Climate Change and Disaster Risk Management (Government of Kiribati, KJIP, 2019-2028) and the National Strategic Action Plan for Climate Change and Disaster Risk Management (Government of Tuvalu, NSAP, 2012-2016) in Tuvalu. Climate Change Adaptation remains a consistent priority for all PSIDS.

While the science provides the evidence base for the actions required(Nurse et al., 2014), the challenge for all Pacific SIDS is the proactive capabilities, progressive implementation and sustainability of adaptation and resilience efforts at the national government level and the community levels (Hinkel et al., 2014; Weir, 2020; Hayward et al., 2020). Weir (2020) identifies 5 common themes in relation to the challenges and gaps for PSIDS: social issues, sectoral impacts of climate change, community-based adaptation, relocation of communities (internally and externally) and financing for adaptation(Weir, 2020, pp. 45-58).

What do these challenges mean for good practice and responding to climate threats?

The challenges highlight through literatures, research and through the IPCC reports suggest that a shift in policies to accommodate future threats may determine the adaptation capabilities and

capacities of countries, especially vulnerable countries such as Small Island Developing States and Least Developed Countries. Furthermore while adaptation planning is in place and most countries around the world have developed National Adaptation Plans (NAPs) and long terms low emission strategies (LEDS), the provision of support, capacity development and technology transfer is still not up to par with the current risks which have been project (as seen in Figure 4).

While good practice is solely based on what has been achieved by countries collectively, the IPCC reports provide summary of the additional efforts which need to be implemented as opposed to being planned and featured within planning processes. There is sense of urgency which needs to be translated to the adaptation, mitigation and resilience efforts undertaken by all countries. For PSIDS, this poses a greater threat and challenge, where the urgency of mobilising resources for adaptation (finance, technology and capacity) is of great importance if they are to keep up with risks associated by the adverse effects of climate change, weather extremes and natural disasters (IPCC, 2022).

2.6 Climate vulnerability assessments

Climate Change Vulnerability Assessment as a field emerged in the 1990s, drawing on several disparate disciplinary traditions, including natural hazard and disaster planning, climate change effects research, and endangered species conservation (Dow, 1992; Hemanth Kumar et al., 2021). The concepts behind vulnerability were originally and most fully developed in relation to risks from natural hazards to people and communities. Fussel and Klein (2006) also demonstrate that efforts to assess climate vulnerability triggered a process of theory development and assessment methodology by the IPCC. Furthermore, vulnerability and adaption, assessment methodologies have seen an evolution of in terms on conceptual thinking proposed by Adger (2006), Gallopin (2006) and Fussel and Klein (2006).

Climate Vulnerability Assessments provide the technical information required to ensure that decision-making processes are backed with technical findings and results and that all the issues at the island, community, household, and individual levels are considered part of the assessment approach. Kula and others (2013) argue that importance should be placed on the quality of evidence provided (data and information), with critical considerations of strengthening systems in place to provide better evidence(Kula et al., 2013)

Examples of Vulnerability assessment applied in the Solomon Islands focus on domestic crop production and agriculture (Bird et al., 2022)integrated flood vulnerability assessment of the Waimanu river catchment in Fiji (Begg et al., 2021); Infrastructure and climate change impacts in Samoa (Fakhruddin et al., 2015) or even a combination of sector related assessments such as health and food security in Kiribati (Cauchi et al., 2019).

Academic research on climate vulnerability assessments, adaptation and resilience has and will continue to evolve (Hay & Mimura, 2013) However, the need for better data, information, practical

systems and capabilities to record and analyse data and findings are vital to supporting the current institutions leading adaptation planning processes (Kula et al., 2013; Weir, 2020). With climate change impacts affecting all development sectors, ensuring that evidence (data and information) is mainstreamed across planning has been imperative.

Early applications of vulnerability assessments, using the IPCC 2007 and 2014 framework are considered successful due to the practicality of the approach considered in reducing vulnerability by preparedness to risks and by considering projected impacts (Estoque et al., 2023; Orlove, 2022). Exposure, sensitivity and adaptative capacity are key components of a climate vulnerability assessment. These 3 elements help to evaluate how a place (location) or a system (natural or human) is impacted and what the risks lead to in future (Foley, 2018; Gravelle & Mimura, 2008; Orlove, 2022).

The expression (equation) by Gero and others (2011) is articulated or used differently according to context. The three elements are combined to calculate and provide a quantified accounts (ranking system to determined level of risk or impact), where vulnerability is expressed as a rank or weight according to a scale developed by practitioners with the following equation to guide vulnerability assessment is used to determine the weighting or level of vulnerability.

The quantification or measuring of vulnerability however lies within the following expression:

$$\textbf{Vulnerability} = \frac{\textbf{Exposure x Sensitivity}}{\textbf{Adaptive Capacity}}$$

(Gero et al., 2011)

Exposure

"Exposure is the degree to which a system experiences environmental, social political or socio-economic stress" (Füssel & Klein, 2006)

Burton and others (1993), Adger (2006), Gallopin (2006) and Fussel and Klein (2006) provide similar arguments in terms of the characteristics of exposure or stress which include the magnitude, frequency, duration, and extent of the hazard. An example of this is the exposure of coastal communities due to climate change effects such as sea level rise, temperature increase, storm surges, earthquakes, floods and other natural hazards.

Sensitivity

"Sensitivity is defined as the degree to which a human system is modified or affected" (Füssel & Klein, 2006)

An example of sensitivity using a human centric approach isrelative to the impacts on people and well-being or income. Sensitivities refers to the impacts or perceived changes because of a climatic event such as storm surge, tropical cyclone.

Adaptive Capacity

Adger (2006) argues that adaptive capacity involves the ability of a system to evolve and counter stressors. Adaptive capacity is the coping capacity of a system (environment or people) to external influences. Using climate change as an example of the stressor or external influence, the adaptive capacity of environment and people would be the actions undertaken to overcome the associated impacts.

The term adaptation and resilience are often used to describe the coping capacities of systems (Adger, 2006; Füssel & Klein, 2006). While used interchangeably to reflect systems in general (environmental, political, social political, socio-economic) there is a greater importance placed on the human systems and their adaptive capacities considering stressors.

2.7 The Integrated Vulnerability Framework (IVA)When the IVA was developed in 2013, the KJIP (National Adaptation Plan for Kiribati) replaced the NAPA in terms of approach (holistic and multi-sectoral), how communities were involved in the findings and data (data collection, appraisal process of findings, interpretations of information shared and collected), and how disaster risk management and reduction were integrated into the government's approach. While the NAPA served as the foundation for adaptation work in Kiribati, the change saw a more nationally coordinated approach to adaptation replace a sector-specific approach. As a result of this, the KNEG would replace the Climate Change Study Team (NAPA, GoK, 2007).

The government saw the need for data and information to be collected on climate change impacts and vulnerabilities, which would inform local and national decision-making processes translated into plans, strategies, and policies.

The IVA framework developed for Kiribati and the first piloted Integrated Vulnerability Assessment are the result of combined work by technical agencies to coordinate and standardise the vulnerability assessment methodology and tool applied for Kiribati. The IVA framework can be modified or expanded to respond to various objective-driven vulnerability assessments for various thematic purposes (e.g., food security, urban water and sanitation, sustainable forestry) and contexts (e.g., village, ‘whole-of-island’, ‘ridge to reef’, national) while remaining committed to an integrated agenda (IVA Framework, 2013).

The integrated Vulnerability Assessment methodological framework (Table 2) for Kiribati builds on previous methodologies for assessing climate risks posed on different systems (human,

environmental, economic, capacity, hazards, agriculture, fisheries). Furthermore, the IVA framework is a combination of the Sustainable Livelihoods Framework shown in figure 5.

Table 2 IVA Methodology framework for Kiribati

Step 1	• National consultation
Step 2	• Field based studies
Step 3	• Participatory Rural Appraisal
Step 4	• Household Survey
Step 5	• Field assessments
Step 6	• Review of previous scientific studies, policies and reports
Step 7	• Meta-data analysis

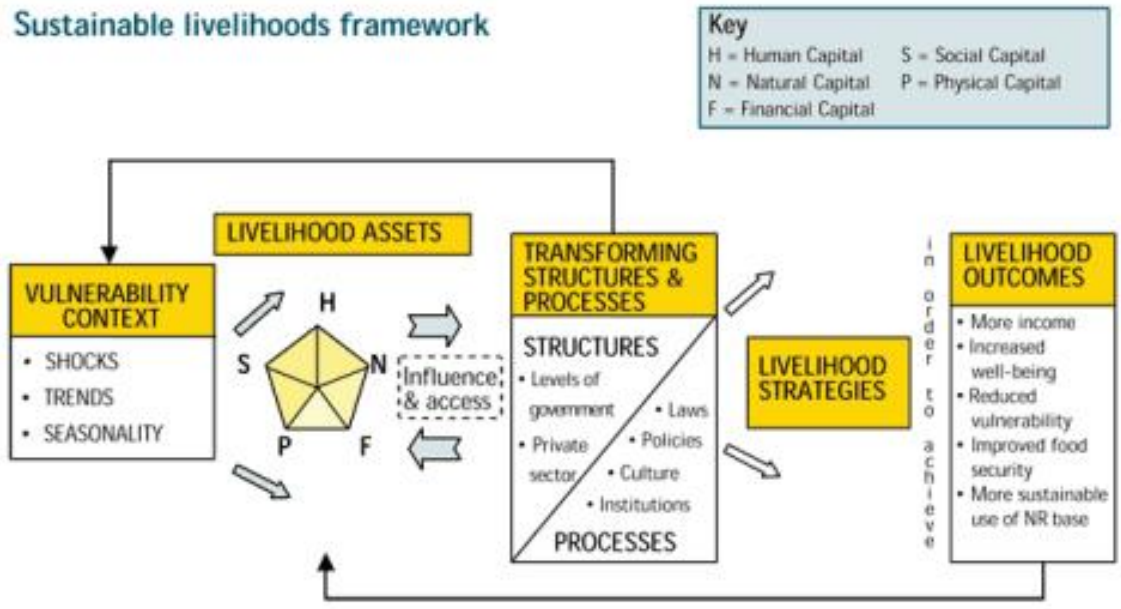

Figure 5 The Sustainable Livelihoods Framework (SLF)

It also builds on the generic vulnerability framework with a more detailed focus on adaptive and coping capacity that is contextualised for local Pacific Island communities that are vulnerable to climate change impacts and disasters. (See Figure 5).

The IVA stems from framework that was developed to guide the assessment approach would further be divided into the following:

- Adaptive and risk-reducing capacity between resources (what a social system has) and institutions (what a social system does).

- Institutional adaptive capacity is defined as the informal mechanisms (values, norms, culture, and customs).

- Formal rules (policies, laws, and regulations) that shape the way people and groups channel livelihood resources.

Livelihood resources (natural, infrastructural, financial, and human) to respond to climate change and disaster risks and impacts. The IVA framework sets out the approach by which understanding the exposure, sensitivity and adaptive capacity must be applied (Füssel & Klein, 2006). It serves as a guide to conducting the assessment required to informing adaptation and resilience actions.

The IVA framework based on the Adaptation Policy Framework shared by Downing and Patwardhanis (2005) in Figure 6 highlights the core elements of a vulnerability assessment and the sub-activities required in a comprehensive climate vulnerability assessment framework.

2.8 The importance of understanding climate vulnerability from an integrated and holistic perspective

Climate Vulnerability is fundamental in the field of climate change, climate adaptation and resilience as it allows for a depth of understanding of the problems, challenges and issues faced by groups or communities affected by the various climate stressors posed. Dow (1992) argues that it is the center point for understanding environmental challenges and supports planning. The overall purpose of climate vulnerability is to understand the problem which can addressed by adaptation solutions (Dow, 1992; Ford et al., 2018)

Similar to concepts shared by Dow (1992), Ford and others (2018), concepts which place the understanding of risk and impacts using vulnerability as one of the key pillars is constantly discussed. On the other hand, Orlove (2022) refers back to the IPCC that introduced the concept of adaptation and vulnerability using a propeller diagram to demonstrate their interlinkages (seen in Figure 6 below). The propeller idea further highlights the placing of impacts (also known as risks) at the center of vulnerability, exposure and hazards.

Figure 6 shows the connections between vulnerability, exposure and hazards and where impacts/ risks are placed at the centre of the diagram highlight the contributing influences and their relationship. There is equal consideration in terms of priority and how they are connected to understanding causes of impacts (using hazard, exposure and vulnerability as contributing factors); (Orlove, 2022; IPCC AR5, 2014).

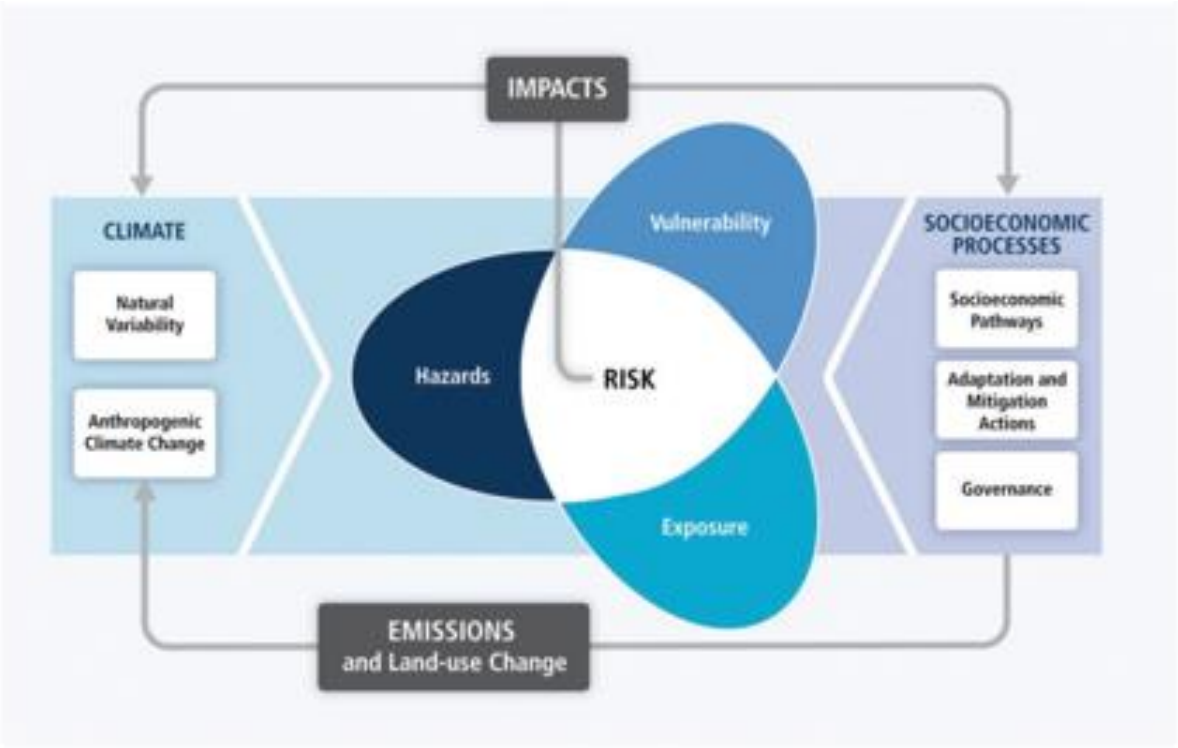

Figure 6 Venn Diagram based on concepts shared by IPCC (modified after IPCC 2012)

Understanding climate vulnerability is important as it sets out the context of what is happening, to who and which areas to target for adaptation. Figure 3 below is adopted from Orlove's (2022) Venn diagram (Figure 6), however the risk propeller places a specific focus on the Vulnerability arm (now placed at the centre (Figure7).

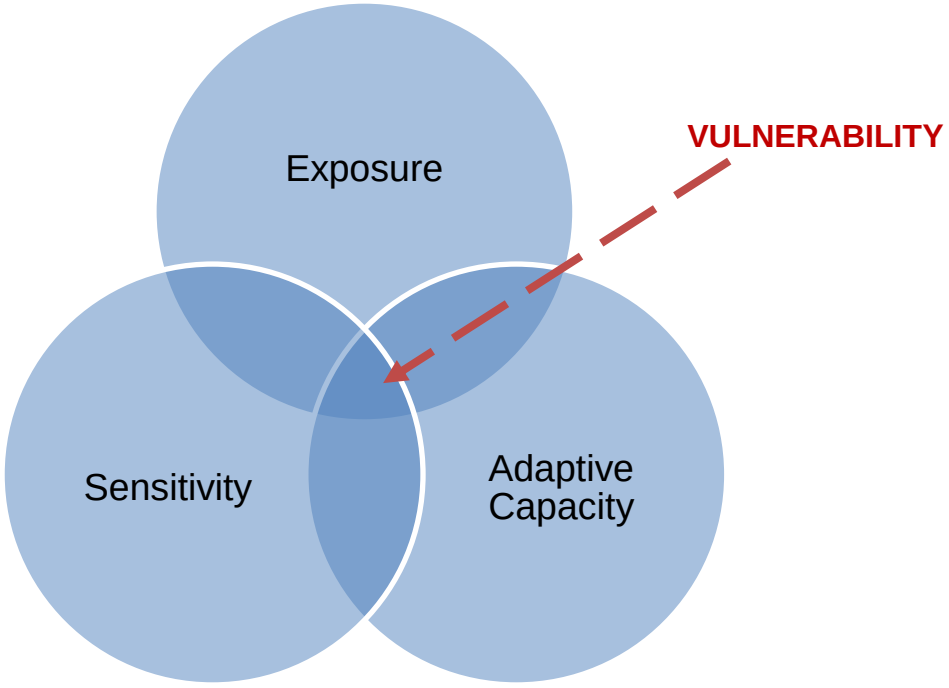

Figure 7 Venn diagram placing vulnerability at the centre of Exposure, Sensitivity and Adaptive capacity

Despite the evolution of terminologies and concepts around climate vulnerability and adaptation, the IPCC initially considered the concepts of Exposure, Sensitivity and Adaptative capacity as its core functions (Estoque et al., 2023; Ford et al., 2018), however it then saw the separation of exposure from vulnerability, as it was seen that only sensitivity and capacity would support coping measures in line the concept of vulnerability.

The concepts and theories within literature on climate change adaptation, climate vulnerability assessment which consider the social, economic and environmental impacts are consistent with research in the field of development and sustainability. Science has produced the information required for evidence-based fields such as agriculture, health, sustainable development, fisheries, and social well-being (Adger, 2006; Füssel & Klein, 2006; Giddens et al., 2022; Hemanth Kumar et al., 2021)

Table 2 is adopted from Hay and Mimura (2013), on the shared climate vulnerability assessments used and adopted in the Pacific. In the table contributing literature and concepts shared by researchers making key and relevant contributions to the field of study have been featured. Table 2 is representative of the evolution on climate vulnerability assessments, used in different contexts and for different purposes.

There is no standard climate vulnerability assessment framework for each country. The methods applied also differ from one context to another Climate vulnerability assessment frameworks depend

on the purpose for which they are developed (e.g agriculture for a specific vulnerable food crop assessing the impacts of climate change to that food crop) (Hemanth Kumar et al., 2021). Climate vulnerability assessment frameworks and methods are not conformed to one standard or format and will be shaped according to its intended purpose and objective (Hemanth Kumar et al., 2021).

Table 3: Succession of climate vulnerability assessments (adopted from Hay and Mimura 2013)

Vulnerability assessment	Characteristics/ features	References
Climate Vulnerability	*Climate, environment, people, well-being*	*Smit and Pilifosova, 2001*
The Livelihood vulnerability Index	*Income, livelihood, well-being*	*Hahn et al., 2009*
Social vulnerability to climate change	*Community level; social vulnerability*	*Urothody and Larsen, 2010; adopted from Klein et al., 2003; Adger, 2006; Gallopin, 2006*
Climate vulnerability framework	*Climate Change, Vulnerability (exposure, sensitivity, risks, adaptive capacity), people*	*IPCC, 2007*
Vulnerability and adaptation assessment and action methodology (CV&A)	*Community level; Climate Change, Disaster Risk Management and Sustainable Development*	*Limalevy and Weir (2005); Kouwenhoven and Cheatham (2006); Nakalevu (2006) Nakalevu (2009)*
Vulnerability reduction assessment (VRA)	*UNDP adopted framework; biodiversity; community based adaptation*	*Droesch et al., 2008; Petrini (2010)*
Vulnerability and Capacity assessment (VCA)	*Risk assessment; community level; method adopted by International Federation of Red Cross Crescent and Societies (IFRCS); urban and rural communities*	*IFRCS (2006; 2007; 2009)*

Risk-based adaptation (RBA)	*Risk to sea level rise and coral reef*	*Elrick and Kay (2009); Jones et al., (1999); GHD and SEA (2005), ADB (2005; 2010), NIWA (2008); Lim and Spanger-Siegried (2004); Hay (2009)*
Cost-Benefit Analysis (C-BA)	*Costs and benefits for climate proofing public infrastructure*	*ADB (2005); Nakalevu (2009)*
Integrated Vulnerability Assessment Model (IAM)	*Impacts, adaptation to climate variability and change.*	*Warrick et al (2005); Warrick (2006)*
VCA Toolkit	*Assess vulnerability, capacity, action planning and implementation, hazard and risk*	*IFRCS (2007) ; Lane and McNaught (2009)*
WWF Climate Witness Toolkit	*Education, awareness, traditional knowledge, participatory, community responses*	*WWF South Pacific Programme (2009)*
National Adaptation Programme of Action (NAPA Guidelines)	*LDCs. Rapid participatory vulnerability assessment, stakeholder consultation, identification of NAPA activities, prioritising criteria and screening and ranking activities, preparing NAPA profiles*	*Government of Samoa (2008); Desanker (2004); LDC Expert Group (2009)*
Local Government climate change adaptation toolkit	*Island council capacity to make decision, interpretation of scientific projections and climate impact models, resource management, land-use planning, infrastructure and transport planning, local economic development, environmental management,*	*ICLEI- Oceania (2008)*

	community issues and emergency services

It is however important to note that the initial design of the Integrated Vulnerability Assessment framework and methodology was adopted from a social vulnerability perspective, livelihoods perspective and now incorporating climate vulnerability perspective which mirror the environmental, social and economic considerations in any development planning process (Pandey and Jha, 2012). The interpretation of climate vulnerability and the use of climate vulnerability assessment tools depend on its intended purpose, location and as seen above (Table 2) through sectors (Hay& Mimura, 2013). Furthermore because of the varying definitions between one Pacific Island country to another and externally (other regions).

Furthermore, climate vulnerability indicators have evolved from a special focus on climatic variabilities and livelihoods considerate of both environmental and social dynamics of change and to more specific indices of vulnerability (Hay & Mimura, 2013; Pandey & Jha, 2012)(McIver et al., 2014; Pearce et al., 2015)

2.9 Integrated Vulnerability Assessments

At the International level, the integrated approach in linking adaptation into sustainable development planning was initiated under the Cancun Adaptation Framework demonstrated by the development of National Adaptation Plans (NAP) The UNFCCC provides technical support and guidance to all members (UN members) on the process of developing adaptation plans and the provision of support (technical and financial) for implementation.

The integrated vulnerability assessment (IVA) targets atoll communities in the Pacific Islands region. It is based on a sustainable livelihoods-based approach that combines the assessment of vulnerability to both climate change and disasters. The IVA shifts from the more sector-based vulnerability assessments. The term ‘integrated’ implies the integration between sectors, scales, disciplines, and space. A continuous and dynamic process of decision-making linked at multi-levels and scales are implied to reflect the long-term iterative learning that is necessary to successfully adapt to climate change.

This approach has helped in bridging the gap or nexus between development and adaptation, resilience, and sustainable development. It is now widely mainstreamed into Regional and National Government development plans.

Climate vulnerability assessments have evolved over time due to the scale, place and context in which its application is conformed to (Bennett et al., 2016; Duvat & Magnan, 2019). Research shows

that a shift towards multidimensional and multi-sectoral approaches have been applied by Governments with less capacities (financial and technical) for implementation of adaptation and resilience actions (Nunn et al., 2021;Bennett et al., 2016; Donner & Webber, 2014; Limalevu et al., 2010)). An example is that more integrated approaches through community-based disaster risk reduction and climate adaptation plans (Giardino et al., 2018; Jackson et al., 2017; Walter Leal et al., 2021), coastal risk assessments and disaster risk reduction in the Marshall Islands (Giardino et al., 2018) and the integration of traditional knowledge and western science in climate change plans (Holland et al., 2012)

The Integrated Vulnerability Assessment should frame key characteristics based on the analysed results, of vulnerability of a sector, assets, and livelihoods of people within the communities that are being assessed. The IVA provides detailed analysis of results which combine science and share experienced of local communities to bridge the gap of understanding on vulnerability for the area or island studied. The IVA should respond to the purpose of objectives set out in its development meanwhile encompassing a multi-sectoral approach in terms of the methods applied and the level of information that is presented which considers sector implications as a results of climate change impacts. An IVA is successful if the report is completed in terms of all elements of the framework and method have been applied. Secondly, the analysis of results must provide all sector relevant information to be able to provide guidance for adaptation planning and lastly an IVA report must also provide adaptation options based on the analysis of vulnerability studied. (Gero et al., 2011; Giardino et al., 2018)

CHAPTER 3 - KIRIBATI CASE STUDY

3.1 Background

The Republic of Kiribati comprises three island groups: the Gilbert, Phoenix, and Line islands and one isolated raised limestone island, Banaba (Ocean Island). The whole of Kiribati comprises 33 scattered atoll islands dispersed across 3.5 million square kilometres in the central Pacific Ocean (Figure 8)

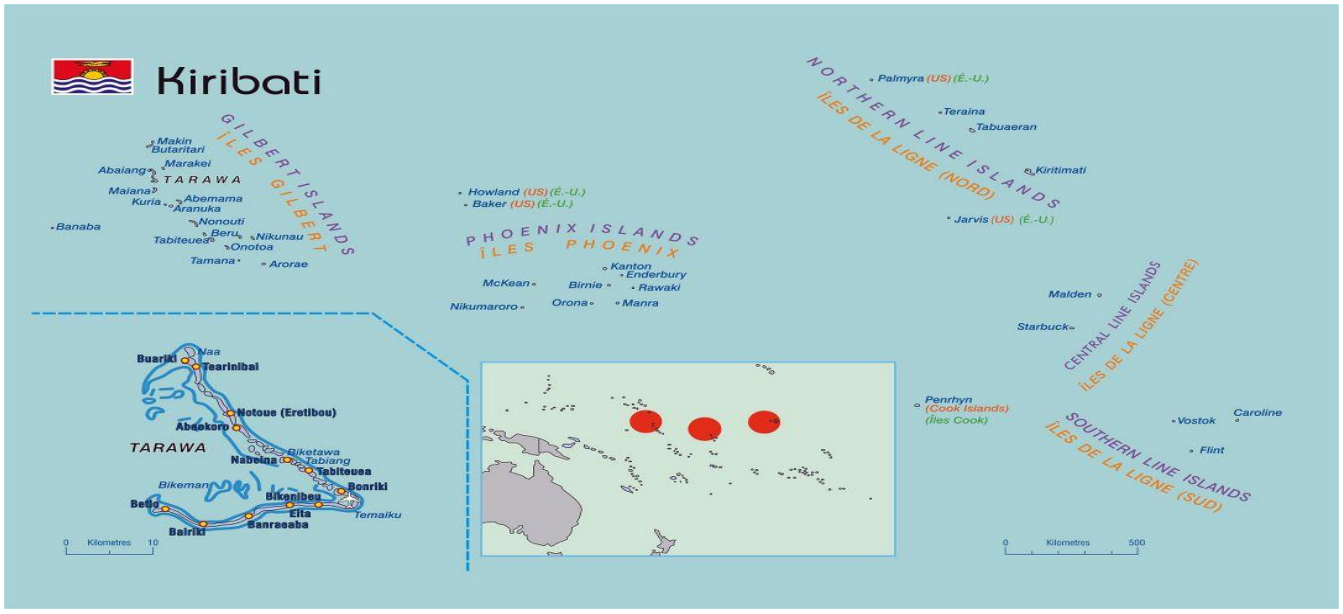

Figure 8 Map of Kiribati (Source: KJIP 2013-2024)

Kiribati is situated within the tropics and experiences warm and tropical conditions year-round. The climate of Kiribati is hot and humid year-round. The tropical climate is closely associated with the temperature of the oceans surrounding the atolls and small islands. However, its seasonal rainfall is highly variable yearly, primarily due to the El Nino Southern Oscillation (ENSO) (KMS & BoM, 2011).

3.2 The social, economic, and environmental context of Kiribati

The population Kiribati stands at 115,000 (Census report, 2018), where more than 60% (+/- 60,000) of this population resides in South Tarawa (Tarawa). Rapid population growth, land scarcity across the Tarawa Atoll leading to overcrowding, and natural resource issues due to overharvesting or overconsumption placing pressure on decision makers.

Kiribati is a sovereign country having gained its Independence in 1979 from the British colonial power. The Government adopts a Westminster approach to its Parliamentary debates and upholds the principles of democracy in decision making processes. At the community level, the traditional Maneaba system plays an influential role in decisions being made, only discussed by elders and decided upon by elders of the village or community. Community living in villages across Kiribati

uphold the traditional governance structures in place with elders (Men) making decisions on behalf of the villages through consensus building dialogues.

3.3 Climate Observations for Kiribati

Based on climatic research and observation of Kiribati from 1950 to 2009 by the Kiribati Meteorological Services and the Bureau of Meteorology (Australia), observed trends show that air temperature, sea surface temperature, rainfall, droughts, sea level rise, ocean acidification, and severe weather extremes will continue to increase and become more frequent (KMS, BoM, & CSIRO, 2011).

The IPCC reiterates these findings by highlighting a high confidence level and emphasising the confidence levels associated with the rate, frequency, and severity of these impacts using 2100 as the baseline (IPCC, 2019, 2022).

Table 3 reflects on the current observations shared in light of the project changes for years to come in line with climate variables: sea level rise, sea surface temperatures, rainfall, drought and ocean acidification. The adverse impact that has been projected for Kiribati using the best available science provides the following information:

Table 4 Climate Observation for Kiribati (BOM and KMS, 2019)

Climate variable	**Projected changes**
Sea level	• *The mean sea level is projected to rise (with very high confidence).* • *Sea level to rise by 5–15 minutes by 2030 and 20–60 cm by 2090 under higher emission scenarios* • *Increased impact of storm surges and coastal flooding to occur annually.*
Sea-surface temperature	• *Sea surface temperature to increase (very high confidence)* • *Sea surface temperatures will increase by 0.6–0.8 degrees by 2030 and 1.2–2.7 degrees by 2100 (Bell et al., 2011).*
Rainfall	*Rainfall patterns will change.*

	• *The wet season, dry season, and annual average rainfall will increase (high confidence).* • *Annual and seasonal mean rainfall will increase by >5% by 2030.* *The majority of model simulat a large increase (>15%) by 2090 (low confidence)*
Drought	*The incidence of drought will decrease (moderate confidence):* • *In the Gilbert, Phoenix, and Line Islands, mild droughts will occur approximately seven to eight times every 20 years by 2030, decreasing to six to seven times by 2090 (low confidence).* • *The frequency of moderate drought is projected to decrease from two or three times every 20 years by 2030 to once or twice by 2090 (low confidence).* • *Severe droughts will occur approximately once or twice every 20 years by 2030, decreasing to once every 20 years by 2055 and 2090 (low confidence).*
Ocean acidification	*The acidification of the ocean will continue to increase (very high confidence):* • *The annual maximum aragonite saturation state will reach values below 3.5 by about 2045 in the Gilbert Islands, by about 2030 in the Line Islands, and by about 2055 in the Phoenix Islands. Aragonite saturation will continue to decline thereafter (moderate confidence).* • *Ocean pH will decrease by -0.1 units by 2035 and by -0.2 to -0.3 units by 2100 (Bell et al., 2011).* • *Coral reefs are projected to degrade progressively, with losses of live coral of > 25% by 2035 and > 50% by 2050 due to rising sea-surface temperatures and more acidic oceans (Bell et al. 2011).*

Air temperature	*Surface air temperature will continue to increase (very high confidence):* • *Annual and seasonal mean temperatures will increase by 0.3–1.3°C for the Gilbert Islands and by 0.4–1.2°C for the Phoenix and Line Islands by 2030 (high confidence).* • *Annual temperature increases could be greater than 3°C by 2090 (moderate confidence).*

Source: KMS, BoM, and CSIRO (2011); Bell et al. (2011)

Table 3 provides climate observations from the Kiribati Meteoroloigical Service (Kiribati). The information shared in the table is consistent with the IPCC reports of 2007 and 2014. A mere centimetre increase may not seem too much; however, for low-lying atoll nations like Kiribati, with the highest elevation of only 3 metres above level, a slight increase in sea level will lead to issues of overtopping, coastal flooding, saltwater intrusion to the main water lens, high salinity for soils, and further impacts on the health of coastal communities (people and current infrastructure in place).

3.4 Coastal communities

All communities in Kiribati reside along the coast, and therefore, Kiribati and its people are highly vulnerable to coastal climate change (IPCC, 2014; KMS and BOM, 2019). The level of exposure for coastal communities is high due to the low-lying topographic characteristics of atolls. Kiribati' highest elevated point stands at 3m above sea levels. Waves in Kiribati have a threshold break of 2.8m (KMS and BOM, 2019), during king tide events wave breaks and sea levels exceed this threshold causing overtopping on coastal areas across the islands. Storm surges are known to have direct impacts to coastal settlements, housing and infrastructure which also surpass the 2.8m threshold break (KMS and BOM, 2019)

Atolls are not only low lying and often characterized as thin strips of land. The average width of an atoll island in Kiribati is 430-450 metres from Ocean side to the Lagoon side.

Coastal communities are therefore at risk from impacts such coastal erosion and coastal inundation (direct impacts). The indirect impacts to water sources, housing, coastal infrastructure and agriculture productivity would also carry great risks in terms of availability, access to or inadequate response measures in place. (Bell & Bahri, 2018; Berry et al., 2018; Cauchi et al., 2019)

3.5 Adaptation needs of atoll communities

To address the impacts of climate change (sea level rise and rising temperatures), the Government of Kiribati has mainstreamed adaptation as a priority across its sector plans, strategies, and policies. Furthermore, the government has also adopted a holistic and multi-sectoral approach towards

adaptation, and Kiribati's adaptation priorities are aligned with the following means of implementation and actions (GoK NAPA, 2007; GoK KJIP, 2019–2028):

- Infrastructure development
- Technical capacity building
- Technological developments

The need for infrastructure development, technical capacity, and technology provides the basis for adaptation action (Hay & Mimura, 2013). Kiribati, a small island developing state and least developed country, looks towards external support to implement the required actions efficiently and through coordinated efforts both at the sub-national and national level to ensure coordinated planning and implementation (Government of Kiribati – Climate Change Policy, 2019)

3.6 The limitations to adaptation planning in Kiribati

Kiribati developed its National Adaptation Programme of Action (NAPA) in 2007 as a reporting obligation to the United Nations Framework Convention on Climate Change (UNFCCC). The NAPA for Kiribati was a report highlighting Kiribati's status in relation to climate change impacts, vulnerabilities, and mitigation efforts undertaken by the government, local authorities, and experts.

The NAPA serves as a report and outlines key actions in terms of adaptation that can be used in high-level political dialogue, development cooperation, and bilateral partnerships. For Kiribati, adaptation has always been a priority (NAPA, 2007). Actions such as infrastructure development, capacity building, and technology form part of the three core actions required at the national level (government and institutional level) to adapt to the adverse effects of climate change.

The NAPA's climate change study team, serving as the technical experts group for the NAPA drew on sector-based information, data, and expertise. There were however fragmented approaches and methods applied in terms of coordinating information, data and resourcing. The view at the time was that a more practical and simplistic approach towards adaptation planning and implementation was required. The NAPA and the CCST set in place a structure which could be further approved.

In 2012, a restructuring occurred within the Government allowing national coordination of Climate Change and Disaster Risk Management. The review of the NAPA and the implemented actions were seen as superseded and the newly introduced National framework for climate change and climate change adaptation was developed, accompanied by the Kiribati National Experts Group. The role of the KNEG was to support evidence-based adaptation planning using a multi-sectoral approach.

Figure 9 shows the placing of The Integrated Vulnerability Assessment with the succession of adaptation planning in Kiribati. The IVA method became the national approach for determining cross-sectoral impacts and vulnerabilities across the islands. The development of the IVA method was

consistent with the establishment of the KNEG to support national adaptation planning process (research and formulation of IVAs).

Currently the Kiribati Joint Implementation Plan for Climate Change and Disaster Risk Management stands as the National adaptation plan for Kiribati (GoK KJIP, 2019). With the enacted Climate Change and Disaster Risk Management Act (2019). This confirmed the role and responsibility of the KNEG in coordinating nation wide IVAs and the coordination of climate change and disaster risk management projects and programmes for Kiribati. The KNEG serves as the technical advisory body for matters related to climate change and disaster risk management.

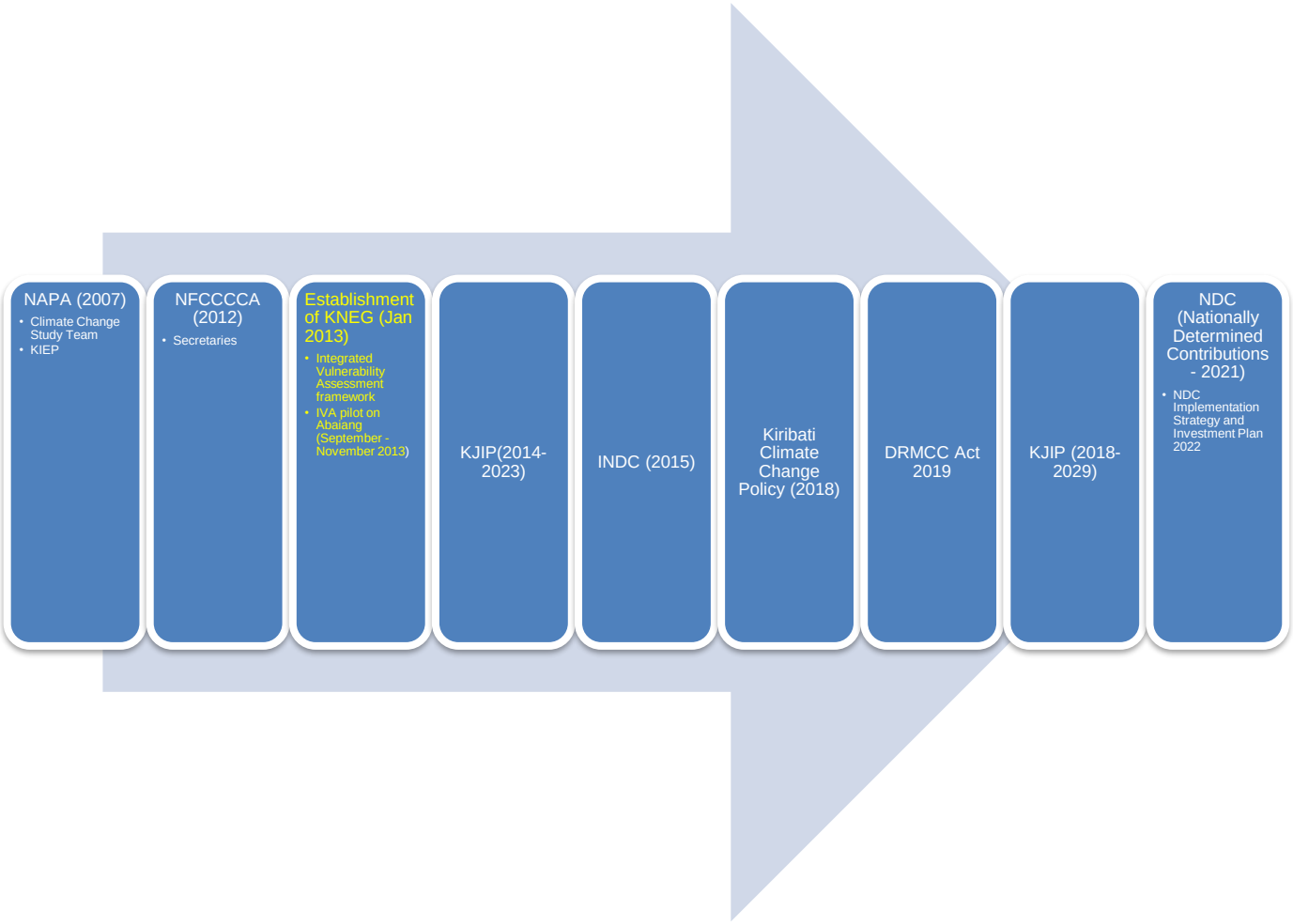

Figure 9 The establishment of the IVA process within the succession of adaptation planning in Kiribati

However due to constant limitations with budget and the lack of technical capabilities, the Government of Kiribati looks towards its development partnerships, climate funds, projects, and programmes to support adaptation and resilience efforts based on community perspectives of vulnerability(Donner & Webber, 2014; Hinkel et al., 2014; Piggott-McKellar et al., 2019).

Adaptation planning and prioritisation of adaptation solutions provide a clear stream of where financing should be directed based on bilateral, multilateral, and developmental partnerships. The

issues, however, have always been accessing climate finance and efficiently implementing actions due to a lack of capacities and capabilities(Donner & Webber, 2014; Hinkel et al., 2014; Piggott-McKellar et al., 2019).

3.9 Kiribati IVAs

The KNEG and the Government of Kiribati have jointly produced 1 IVAs since the first piloted island of Abaiang (between 2013 and 2021 – Table 5). The first pilot saw a collective approach of technical personnel from within the Pacific region, national experts from the Kiribati Government. Abaiang was seen as a success due to the thoroughness of the IVA framework being applied and the first IVA report for Kiribati. The Abaiang IVA was developed through consultations with communities, thorough analysis of results and findings and comprised of scientific evidence, community experiences and shared challenges which were validated through a consultative process by experts and locals from the community. The IVA for Abaiang aimed at bridging local and technical knowledge in relation to climate risks and vulnerability through an integrated approach (multi-stakeholder/ multi-sectoral). The IVA for Abaiang was financially supported by numerous partners supporting the Integrated and cross sectoral approach towards adaptation planning.

Table 5 Succession of IVAs in Kiribati (2013-2021)

Integrated Vulnerability Assessment Reports	Date of IVA mission
Abaiang	September – November 2013
Tabiteuea Meang	29th August – 8th September, 2016
Nonouti	24th October – 2nd November, 2017
Maiana	31st October – 7th November, 2017; 12th -16th November 2020
Tabuaeran	20th November- 14th December, 2017
Teraina	20th November -14th December, 2017
Kiritimati	18th -31st July, 2018
Butaritari	12th -16th November, 2018; 20th -29th March, 2020
Aranuka	16th – 23rd June, 2019
Banaba	29th September- 5th October, 2019
Beru	11th – 18th November, 2019
Nikunau	2-9th December, 2019

Tamana	23rd – 30th October, 2019
Tabiteuea Maiaki	1st- 15th November, 2021

The initial planning and design of the Integrated Vulnerability Assessment Framework occurred in early 2012 and 2013 based on the Government of Kiribati's request to simplify and ensure practicality in its assessment methodology for climate change.

The first IVA was piloted on Abaiang Atoll in September – November, 2013, which saw the KNEG and the regional technical organizations, along with projects and initiatives, fully supporting the assessment. The piloted approach consisted of using empirical data from sectors, focus group discussions, and a survey using a participatory rural appraisal approach, followed by a validation process with communities and island council representatives on the data and information shared and the data and information assessed by the KNEG and the regional technical experts. The IVA for Abaiang serves as the best practice model because of the sectors which were covered to determine the vulnerability of the island itself. The study on Abaiang used the integrated vulnerability framework and methodologies with complete thoroughness. Furthermore, the data that was collected and analysed provided a clear picture of vulnerability in terms of the impacts that climate change and disasters caused at the sector level (e.g health, food security, water security, coastal protection, energy, transportation, income etc). The piloted study served as the basis for comparison against other IVAs which were to be replicated across Kiribati in the years to come. Since then a total number of 14 IVAs have been developed by the Government of Kiribati through the Kiribati National Experts Group on climate change and disaster risk management.

The Office of Te Beretitenti (President's Office) established the Kiribati National Experts Group in 2013 on Climate Change and Disaster Risk Management (KNEG) as the first step towards achieving its aim of appropriately and efficiently coordinating climate change and disaster risks using an integrated and holistic approach.

Table 6: Abaiang supported project and programmes linked to IVA on Abaiang

Programs and Projects	***Focus area in Kiribati***	***Focus area: Abaiang***	***Duration of the project***
SPC/GIZ *Coping with Climate Change in the Pacific Island Region (CCCPIR) on behalf of the BMZ (German Development Cooperation)*	*Strategy development (KJIP, development of WOIA), good governance, education,*	*Integrated vulnerability assessment, development and adaptation planning,*	*2011-2015*

	energy, fishing, and livestock	*education, and fisheries*	
***SPC/AUSAID** International Climate Change Adaptation Initiative: Building Resilience in Fisheries, Agriculture, and Health Implemented by SPC and funded by the Australian Agency for International Development (ICCAI) project*	*Food security (resilient crops, fisheries)*	*Climate-ready crop collection*	*2012-2013*
***SPC/IFAD POETCOM**: Pacific Organic and Ethical Trade Community*	*Organic Farming*	*Organic farming*	*2012-2014*
***SPC/USAID** Vegetation and Land Cover Mapping and Improving Food Security for Building Resilience to a Changing Climate in Pacific Island Communities*	*Agriculture, Livestock, and GIS (Development of a Whole Island Approach)*	*Integrated Vulnerability Assessment, Development and Adaptation Planning, Agriculture, Livestock, GIS*	*2012-2015*
***Kiribati/SPREP/USAID** Climate Change Adaptation Partnership*	*Water (development of a whole island approach)*	*Integrated vulnerability assessment, development and adaptation planning, water*	*2012-2015*
***SPC/Global Climate Change Alliance (EU)**: Pacific Small Island States (SPC/GCCA:PSIS)*	*Health (national and local level), public finance management, communication, and coordination (national level)*	*Implementation of selected health and climate change-related measures*	*2012-2015*
***SPC/SOPAC EU** African Caribbean Pacific Natural Disaster Facility*	*Disaster preparedness and response strategy development (KJIP, NDRMP)*	*Integrated vulnerability assessment, disaster preparedness, and response*	*2013-2016*

*Coastal Communities Adaptation Programme (**USAID/C-CAP) funded by USAID***	*Community level: climate change vulnerable infrastructure (risk assessment, cataloguing, and prioritisation)*	*Community-based infrastructure projects identified by the IPI in Borotiam, Ewena, and Taniau (Tebwanga)*	*2014-2017*

(source: GoK, IVA Abaiang report, 2012)

Table 6 (above) provides a list of supporting agencies through their sector based projects which helped the Government of Kiribati to realise the IVA of Abaiang. The Government provided initial investment to apply the methodologies of the IVA which were then supported by regional and international projects with funding contributions to sector specific activities (e.g Kiribati/SPREP USAID Climate Change Adaptation Partnership supported the water components of the IVA study and the implementation of the recommendations based on the results and findings of the IVA for Abaiang).

While the initial Abaiang IVA was complete and implemented through the support of various development partners and projects. IVAs following Abaiang had less support from regional technical agencies, and saw less financial and technical support. The responsibility was then on the Government of Kiribati to continue with in carrying out IVAs for the others islands.

CHAPTER 4 – RESEARCH METHODOLOGY

In order to achieve the aims and objectives of this paper, the adoption of evaluation methodswere used: strategy evaluation; comparative analysis of the quantitative and qualitative results, coding and the SWOT analysis will form part of the evaluations framework for the IVAs in this paper. Due to time constraints and having to study abroad from Kiribati. The methodologies presented below refer to a desk-top study that were selected to investigate the IVA's completed in Kiribati.

4.1 Program and Strategy Evaluation

Program evaluation is a process that critically examines programs, which are inclusive but not limited to, projects, policies, processes and/or plans against their stated objectives. The process involves collecting and analysing information about the activities, characteristics, and outcomes of a program (Greene, 1994). Evaluation identifies whether, and how effectively, a program has reached the intended goals and objectives. The purpose of evaluation is to make judgements about a program to improve its effectiveness or inform decisions. Evaluation outcomes can improve future iterations of a program's design and implementation, as well as demonstrate program impact (Posavac, 2015). Although the purpose and process of evaluation is similar for varying types of programs, this study focuses on a report and the methodologies from secondary data and completed results (IVA reports) (Stufflebeam, 2001)

4.2 Comparative analysis

Secondly, the comparative analysis methodology is used in scholarship and academia to determine their appropriateness and efficiency (Rihoux, 2006; Collier, 1993). One of the goals of comparative analysis is to assess rival explanations (Collier, 1993), in this case the first pilot IVA stands as the modelled IVA which will be compared to 3 other IVAs as a means to highlight the effectiveness of the Abaiang IVA; secondly to contrast the IVAs in terms of content and approach and lastly to allow for the interpretation of the shared findings according to each methodology applied for the IVAs (PRA and HH Survey).

There are multiple methods for encoding data, ranging from attribute coding to magnitude coding. The first component aims to provide a description of the fieldwork setting, including factors such as age, gender, and country. On the other hand, the magnitude coding system utilises alphanumeric or symbolic codes to represent the frequency, intensity, or presented evaluation of the material. For instance, coding = 3, suggests that the content is clearly sighted, 2= It is partially sighted; 1= It is present, but ambiguous or 0/blank= absent from the content (Saldana, 2009).

For this study the associated codes are 0=not met; 1= partially met; 2= fully met.

4.3 An evaluation framework for Comparing the IVAs

To achieve the aim the of this research paper, 3 different approaches have been applied to evaluate the progress of adaptation planning of the IVAs and to measure how successful the IVA methodology is being applied across the 3 islands. The basis of this evaluation methodology is assessing the completed results of the PRA, HH and IVA report. The purpose of this research is to not scrutinize the quality of data collected but to assess whether the IVA framework adopted for Abaiang has been consistent and if there are areas or elements of the approach that can either be reviewed, shortened, or enhanced.

Firstly, the Participatory Rural Appraisal (PRA) and Household surveys (HH) will be analysed using a color coding system (red = not met; yellow=partly met and green= full met) as part of the analysis of the approach that has been followed. Using the Abaiang PRA, a comparison against the other 3 islands will be addressed. The coding system will also include values for interpretation of the PRA as whole and provide a quantification in terms of the approach being undertaken.

Secondly for each of the PRA and HH surveys, a qualitative analysis using the SWOT method will be used to determine the level of efficiency to which the approach has been applied for each of the 3 Islands.

The third approach consists of a comparative analysis which will allow the determination of the efficiency of each IVA report to meeting its intended purposes. The analysis of each component of the IVA reports (content) against established codes. Each code will use a grading system (0=not met; 1= partly met; 2=fully met). Using the adopted Strategy evaluation approach from Carrick et al (2022), the core principles for evaluating any type of strategy will entail the following areas: Consistency, Consonance, Advantage and Feasibility. The following is used:

4.6 Kiribati IVA evaluation strategy

To evaluate the effectiveness of the IVA reports for this study, the use of mix methods for evaluation will be undertaken in excel spreadsheet:

i. PRA analysis using color codes and SWOT analysis
ii. Household survey using color codes and SWOT analysis
iii. IVA reports content comparison using the evaluation framework

i. Participatory Rural Appraisal (PRA)

The PRA is seen as an essential component of the IVA as it allows for community inputs through perceived changes and experiences in relation to the parameters sets for the PRA (weather, plan and animal behaviour, sensitivity, and adaptive capacity).

The PRA table consists 4 categories: 'Exposure (Seasonal Weather Calendar)', 'Exposure (Seasonal plant and animal behaviour calendar)', 'Sensitivity' and 'Adaptive Capacity'. Each parameters has detailed characteristics:

- Exposure (Seasonal Weather Calendar) parameter consists of 5 characteristics: 'weather parameter', 'times scales', 'Periods', 'perceived changes' and 'scale of change'
- Exposure (Seasonal Plant and animal behavior) has 5 characteristics: 'plants and fruits parameters', 'time scales', 'periods', 'perceived changes' and 'scale of change'
- Sensitivity has 8 characteristics: 'important livelihood parameters from community perspectives on Fisheries, Agriculture, food Security, forests and biodiversity; 'Hazards these parameters are exposed to', 'perceived changes' and 'scale of change'
- Adaptive capacity has 10 characteristics: 'Human assets of the village', 'Natural assets of the village', 'Financial assets of the village', 'social assets of the village', 'physical assets of the village', 'strengths', 'weaknesses', 'opportunities', 'threats' and 'rating of importance'

Using the coding system and the associated values for each for code, a comparison of each of the PRA approach will be analysed. To address the second and third objective of this study, A SWOT analysis will be used to determine the different features of the PRA applied for each of the 3 islands. The comparison aims at responding to the following questions.

1. Has the PRA approach been fully met?
2. Are there differences between the PRAs applied?

Table 7 Consistency analysis framework for PRAs

Category	PRA Tabiteuea Meang	Butaritari	Kiritimati
Consistency	• Consistency is analysed here in terms of the elements of the PRA to collect information on Exposure, Sensitivity and Adaptive Capacity • The approach using focus groups discussions and community engagement		

	A	B	C	D	E
1	**Participatory Rural Appraisal comparison table**				
2					
3		**Abaiang IVA**	**Tabiteuea Meang IVA**	**Butaritari IVA**	**Kiritimati IVA**
4	**Assessment Parameters**				
5	**Exposure (Seasonal Weather Calendar)**				
6	weather parameter				
7	time scales (before and today)				
8	Periods (months or seasons during a year)				
9	Percieved changes as along as community remembers				
10	scale of change				
11					
12	**Exposure (Seasonal plant and animal behaviour calendar)**				
13	plant and fruit parameters (varieties and behaviour such as fruiting and spawning)				
14	time scales (before and today)				
15	periods (months and seasons during a year)				
16	percieved changes				
17	scale of change				
18					
19	**Sensitivity**				
20	important livelihood paramaters from community perspective on Fisheries				
21	important livelihood paramaters from community perspective on Agriculture				

Figure 10 Snapshot of PRA comparison table

Each PRA will be assessed using the colour coding (red=met; yellow= partly met; green= fully met). Each colour code will correspond to analysis of whether the PRA approach has been applied for each of the islands or not.

The second part of this evaluation for the PRAs consists of using a SWOT analysis to determine the Strengths, Weaknesses, Opportunities and Threats in accordance with the PRA approach applied for each of the islands (See Table 9, page 37). To do this, a review of the report against the level of data and information collected will be analysed using SWOT. The SWOT analysis allows for better interpretation of the applied PRA methodology based on the quality of information provided.

Table 8 SWOT analysis framework for PRAs

	Tabiteuea Meang PRA	Butaritari PRA	Kiritimati PRA
Strengths	Strengths in terms of the approach applied and the overall PRA results in the IVA report		
Weakness	Were there missing elements to the PRA approach and or results		
Opportunities	Has the approached changed? Are there elements of the PRA approach used which		
Threats	What the limiting factors?		

ii. Household Survey analysis (HH)

The HH survey used in the IVA method is adopted from the national statistics office's (NSO) demographic approach, such as a national census or a household income and expenditure survey. The household survey for the IVA is based on survey questionnaires that were designed to capture key information and data based on household-level survey responses.

The HH survey provides the quantitative components (data and information) for numeric interpretation purposes. The data and information collected are then interpreted against the qualitative results (PRAs) and other sources include national statistics such as census data, household income expenditure reports, sector-specific assessment reports and findings, island reports, and national reports relevant to climate change, climate adaptation, population, and means of subsistence.

For this study, a comparison table using Microsoft Excel has been developed for each HH survey collected using each HH Survey questionnaire. The survey questionnaires consist of the following 10 main survey questions and their sub-sections (refer to Figure 13):

- Background information

- Household profile, skills and movement
- ‘General climate change and vulnerability awareness and consists of 5 questions.
- ‘Security of Place’ consisting of 3 questions
- ‘Water Security’ consisting of 9 questions.
- ‘Food Security’ consisting of 6 questions.
- ‘Household income security’ consisting of 7 questions.
- ‘Transport and communications’
- ‘Household health’ consisting of 14 questions.
- ‘Community norms, values, beliefs and inclusiveness in decision making consisting of 10 questions.

A comparison table has been developed in Excel which will analysis the various components of the HH survey (Figure 13). The method for analysis the HH surveys will use the same framework as the PRA method (Refer to Table 1,2 above and Table 3 and 4 below). Note that the analysis questions will be tailored to the HH survey with the aim to provide the qualitative results based on comparative elements identified.

	B	C	D	E	F	G
1	**Household Survey comparison table**					
2						
3		**IVA Abaiang**	**IVA Tabiteuea Meang**	**IVA Butaritari**	**IVA Kiritimati**	
4	**Household Surveys Questions**					
5	**Section1: Background Information**					
6	**Section 2: Household profile, skills and movements**					
7						
8	**Section 3: General climate change and vulnerability awareness**					
9	What do you think are the most significant problems or challenges faced by your community?					
10	What do you think may be causing the changes in climate?					
11	What do you think will be the three most significant effects of climate change in your community?					
12	Would you consider migrating due to the increase impact of climate change?					
13	IF “YES” then would you prefer migrating?					
14						
15	**Section 4: Security of place**					
16	Please indicate the level at which your dwelling is at risk from the following events					
17	What can you do to reduce the respond to the risk?					
18	Are you confident that your local leaders can work well with other agencies to help your community deal with these risks?					
19						
20	**Section 5: Water security**					
21	Please tick the following boxes (walk around the property to identify water sources, ask selected questions.					
22	Source (Well or Rainfall)					
23	Use					
24	Other sources than well or rainfall					
25	Does your household experience problems accessing drinking water?					
26	Is the water supply sufficient to meet your households needs (quantity)?					
27	Which events can create problems for accessing household drinking water?					
28	During period of drought or water shortage, what do you rely on for water?					
29	Please indicate the type of toilet you use (tick more than one box if needed): Bush, Beach, Flush, Compost, Pit Latrine, Other					
30						
31	**Section 6: Food security**					
32	Does your household have access to land to grow food for the household?					
33	Does your household grow fruits, vegetables and crops?					
34	If yes, how fertile is the soil to crops and vegetables?					
35	Does your household raise livestock?					
36	Does anyone in the household go fishing?					
37	If yes, please indicate the purpose?					
38						
39	**Section 7: Household income security**					
40	What are the main sources of cash income for your household (tick the box that best matches answers. If ‘others’, describe them and rank the 3 main sources of income.)					

Figure 11 Snapshot of HH survey comparison table

Table 9 SWOT analysis framework for HH surveys assessed

	Tabiteuea Meang	**Butaritari**	**Kiritimati**
Strengths	Strengths in terms of the HH survey method		
Weakness	Were there missing elements to the HH survey method		
Opportunities	Has the approached changed? Are there elements of the HH survey which can be shortened or enhanced?		

Threats	What the limiting factors to the HH survey?

iii. Kiribati IVA reports comparison

The Abaiang IVA report consists of 86 chapters with detailed information and results highlighting issues and challenges based on the assessment conducted for Abaiang in 2013. The Abaiang IVA report includes the following: 'Context' ; 'Adaptive capacity' 'Adaptation options' sub-headings. Altogether there are 12 context characteristics: 59 adaptive capacity characteristics (including environmental, social and economic features and 12 adaptation options.

The IVA reports will be checked for completeness by taking Abaiang as the model. Spreadsheet 1 (Outline and content) lists all the chapters of the Abaiang IVA report which will be compared to the other 3 IVA reports (Tabiteuea Meang, Butaritari and Kiritimati):

	A	B	C	D	E	F
1		IVA Reports content and structure comparison table				
2						
3		Outline and content of report	IVA 1 - Abaiang	IVA 2 - Tabiteuea Meang	IVA 3 - Butaritari	IVA 4 - Kiritimati
4	1	CONTEXT				
5	2	Physical geography				
6	3	Demography				
7	4	Local resource use				
8	5	Exposure to climate change and disasters: comparison of technical and local observations				
9	6	Air and sea surface temperature				
10	7	Rainfall				
11	8	Droughts				
12	9	Sea level rise				
13	10	Ocean acidification				
14	11	Other hazards				
15	12	Tsunami				
16	13	Epidemics				
17	14	Maritime disasters (including oil spills)				
18	15	THE ADAPTIVE CAPACITY OF ABAIANG AND THE SENSITIVITY OF LIVELIHOOD RESOURCES TO CLIMATE CHANGE AND DISASTERS				
19	16	Ecosystem capacity to support livelihoods needs and sensitivity to climate change and disasters				
20	17	Settlement, housing and local sources of energy				
21	18	Sensitivity of settlements to climate and disasters				
22	19	local perceptions of coastal risk				
23	20	Natural water resources				
24	21	Accessibility of freshwater resources				
25	22	Well types				
26	23	Abstraction method from well				
27	24	Roofing construction				

Figure 12 Snapshot of the IVA report content comparison table

The assessment considers content of the reports and uses a colour coding system to identify if Abaiang content is mirrored or not (0= not met ; 1= partly met; 2 = fully met).

0 = Not met	1= Partly met	2= Fully met

Table 10 Evaluation criteria for IVA reports

Evaluation criteria for IVA reports				
Principles	**Coding**	**IVA – Tabiteuea Meang**	**IVA Butaritari**	**IVA Kiritimati**
Consistency	(0-2)	(0-2)	(0-2)	(0-2)
Strengths	Identified completeness as a strength to the IVA report (outline and content)			
Weaknesses	Identified limitations in each IVA report in terms of outline and content			
Opportunities	Identified elements of the IVA that can shortened or enhanced			
Threats	Identified challenges for completing the IVA reports			

4.7 Limitations of evaluation methodology for Kiribati

The use of secondary data and information drawn from the results gathered by the Government of Kiribati is used for this comparative method. There are therefore limitations in terms of the interpretation and understanding of data, interpretation of the information and how these reports were formulated.

CHAPTER 5: RESULTS

This study set out to evaluate the progress of IVAs for Kiribati. In this chapter, IVAs completed for Tabiteuea Meang, Butaritari and Kiritimati are assessed using Abaiang IVA as a model. A seven-step method will be used to compare the three IVAs with Abaiang (Table 2). Each of the IVAs will be compared to the Abaiang IVA methodology and report.

5.1 Abaiang IVA Summary

The island-wide IVA for Abaiang IVA report was developed in 2013 (refer to table 5 page 29). The methods that contributed to the formulation of the IVA for Abaiang were done over time between 2011 to 2017. (Table 5 page 29 – Succession of IVAs in Kiribati). The IVA process for Abaiang was led by the Kiribati National Experts Group (KNEG) and supported by regional technical agencies. The regional technical agencies provided technical assistance and financial support to the IVA and various organizations from the Pacific SIDS region known as the CROP (Council of Regional Organisations in the Pacific) contributed.

CROP agencies within the Pacific SIDS consist of Forum Fisheries Agency (FFA); Pacific Aviation Safety Office (PASO); Pacific Island Development Programme (PIDP); Pacific Island Forum Secretariat (PIFS); Pacific Power Association (PPA); The Pacific Community (SPC); Secretariat of the Pacific Regional Environment Programme (SPREP); South Pacific Tourism Organisation (SPTO); The University of the South Pacific (USP). The other technical agencies within the Pacific serving include the World Bank (WB), the Asian Development Bank (ADB), German Development Corporation (GIZ); the European Union (EU).

Table 11 Projects and programmes contributing to the IVA methods and IVA report for Abaiang (2011-2017)

Programme Lead	Project title	Sector	Focus area: Abaiang	Duration of the project
SPC/GIZ	*Coping with Climate Change in the Pacific Island Region (CCCPIR) on behalf of the BMZ (German Development Cooperation)*	*Governance, Education, Fisheries and Livestock*	*IVA method support :data for governance, education, education, fisheries and livestock)*	*2011-2015*
SPC/Ausaid	*International Climate Change Adaptation Initiative: Building Resilience in Fisheries, Agriculture, and Health Implemented by SPC and funded by the Australian Agency for International Development (ICCAI) project*	*Food security*	*Data collection, and analysis on Climate-ready crop collection; cosatal fisheries*	*2012-2013*

SPC/IFAD POETCOM	*Pacific Organic and Ethical Trade Community*	*Agriculture*	*Organic farming, data collection, awareness and training on agriculture best practices, organic farming*	*2012-2014*
SPC/USAID	*Vegetation and Land Cover Mapping and Improving Food Security for Building Resilience to a Changing Climate in Pacific Island Communities*	*Agriculture, Livestock, and GIS*	*Integrated Vulnerability Assessment, Development and Adaptation Planning, Agriculture, Livestock data collection and analysis, GIS mapping*	*2012-2015*
Kiribati/SPREP/USAID	*Climate Change Adaptation Partnership*	*Water*	*Integrated vulnerability assessment, methodology and adaptation planning, water data collection and analysis*	*2012-2015*
European Union	*SPC/Global Climate Change Alliance (EU): Pacific Small Island States (SPC/GCCA:PSIS)*	*Health; public finance management, capacity building and institutional strengthening*	*Environmental health data and information collection, awareness, IVA methodology support, training to locals on water and vector borne diseases and outbreaks.* *Institutional strengthening for island councils*	*2012-2015*

European Union	*SPC/SOPAC EU African Caribbean Pacific Natural Disaster Facility*	*Disaster management.*	*Disaster preparedness, risk mapping; early warning systems*	*2013-2016*
USAID	*Coastal Communities Adaptation Programme (USAID/C-CAP)*	*Coastal infrastructure and coastal protection*	*Coastal hazard mapping; coastal infrastructure assessment; support to IVA methodology; data analysis*	*2014-2017*

To coordinate climate change and disaster risk programmes in Kiribati, the KNEG was established in 2013, and serves as the technical advisory group for climate change and disaster risk management in Kiribati. It comprises of technical officers from within the Government who work on adaptation, climate resilience and mitigation related activities within their Ministry (e.g Agriculture, Environmental Health, Water, Coastal Fisheries, Coastal Protection, Meteorology), Non-Governmental Organisations (NGOs) involved in climate related actions and Civil Society organisations (CSOs) that support adaptation and mitigation related projects and programmes in Kiribati.

The IVA for Abaiang was developed with supported from CROP agencies consisting of SPC, SPREP, PIFS and GIZ and projects and programmes listed in Table 1. Activities funded by multilateral organisations were implemented through these CROP agencies.

The KNEG was represented by different sectors within the Government of Kiribati (e.g Water and sanitation Engineering Division; Agriculture; Environmental Health sector; Coastal protection; Women and Youth; Coastal Fisheries). KNEG members taking part in Abaiang IVA were supported by funding from their sector budget and or from CROP and technical organisations. The IVA mission was well supported (financially and technically).

Table 12 highlights the seven steps of the IVA methodology. The preparatory steps 1 to 4 of the IVA consist of the local consultation, field-based studies, the development of the PRA approach and the HH survey questionnaires. Once the IVA team were on the island, the PRA and HH surveys and Field assessments (step 3,4 and 5) formed part of the main data and information gathering methods. Upon return of the KNEG from the IVA mission, the review of external scientific sources, studies, policies and reports and the analysis of the PRA and HH survey data (steps 6 and 7) are then used to formulate the IVA report.

Table 12 IVA method for Abaiang

Step 1. Local Consultation	•Local protocols being met by meeting the Island Council (Mayor, Deputy Mayor and Island Clerk)
Step 2. Field Based studies	•A review of sector-based assessments and reports
Step 3. PRA	•8 Village consultations; focus group discussions with village participants (elders, men, women, youth)
Step 4. HH survey	•Houesehold visits and survey with household 17 villages covering 10% of the islands 425 Housholds This process is led by National statistics officers who are part of the KNEG
Step 5. Field assessments	•A rapid assessment of vulnerable and or affected areas according to reports and share local experiences.
Step 6. Review of previous scientific studies, policies and reports	•Reviewing external sources and information relatable to Abaiang (e.g climate projections, Sea Level Rise, weather observations, sector specific best practices for ecosystem based adaptation etc..)
Step 7. Meta-data analysis	•The KNEG analysis the data which goes through an internal review and validation processes

Step 1. Local Consultations

The preparatory work for the Abaiang IVA were led by the KNEG (Secretariat) which involved communicating the IVA mission to the Island council (Mayor, Deputy Mayor, and the Island Clerk), ensuring that the island councillors, village elders and village members were aware of the team visit. This first step aimed at ensuring that the local protocols in place had been addressed prior the visit and allowing time for village members to respond to the notification (either by sharing approval or discontent of the proposed visit).

Upon arrival on the island, the KNEG members met with the Island Council and then with the full Island council (which involves all village heads and the Island council members) and discussed the objectives of the IVA mission and the expectation of the consultations. This was part of the traditional protocol to be welcomed onto the island by getting the approval of village heads (elders or village heads).

Step 2. Field based studies

The field-based studies were also part of the preparatory work completed by the KNEG. This involved a review of sector-based assessment and reports which had been conducted previously for Abaiang. This allowed KNEG members to frame the context and note existing challenges reported previously for Abaiang.

The KNEG members provided all previous reports conducted on Abaiang (e.g water assessment reports; agriculture and livestock assessment reports; fisheries management report; island statistics; project progress reports; island council strategic plans; meteorological weather observation reports). These reports provided the background information and profiling of the Island prior to the IVA mission.

Step 3. Participatory Rural Appraisal

The PRA was an essential part of the IVA as it allowed for community inputs through perceived changes and experiences in relation to the parameters sets for the PRA (weather, plant and animal

behaviour, sensitivity, and adaptive capacity). This was one of the main data and information collection methods of the IVA.

The Participatory Rural Appraisal involved the development of data collection methods by the KNEG to capture the experiences and perceptions of Abaiang communities. The PRA were conducted in 18 villages on Abaiang and consisted of focus group discussions with elders, men, women and youth.

The PRA explored 5 parameters: 'Exposure (Seasonal Weather Calendar)', 'Exposure (Seasonal plant and animal behaviour calendar)', 'Sensitivity' and 'Adaptive Capacity' and a 'SWOT' (refer to Figure 13). Each parameter had detailed themes which were used in the focus group discussions:

- **Exposure (Seasonal Weather Calendar) parameter consists of 5 themes**: 'weather parameter', 'times scales', 'Periods', 'perceived changes' and 'scale of change'
- **Exposure (Seasonal Plant and animal behavior) has 5 themes**: 'plants and fruits parameters', 'time scales', 'periods', 'perceived changes' and 'scale of change'.
- **Sensitivity has 8 themes**: 'important livelihood parameters from community perspectives on Fisheries, Agriculture, food Security, forests and biodiversity; 'Hazards these parameters are exposed to', 'perceived changes' and 'scale of change'.
- **Adaptive capacity has 5 themes**: 'Human assets of the village', 'Natural assets of the village', 'Financial assets of the village', 'social assets of the village', 'physical assets of the village'.
- **The SWOT** identifies the Strengths, Weaknesses, Opportunities and Threats within the context of the village and the impacts of climate change and disasters. Which are then rated in terms of importance.

Assessment		Tool	Groups were to identify
Exposure	1.	Seasonal weather calendar	• weather parameters • time scales (before and today) • periods (months or seasons during a year) • perceived changes as long as community remembers • scale of change (high, medium, low)
	2.	Seasonal plant and animal behaviour calendar	• plant and fruit parameters (varieties and behaviour such as fruiting and spawning) • time scales (before and today) • periods (months or seasons during a year) • perceived changes • scale of change
Sensitivity	3.	Sensitivity template	• important livelihood parameters from community perspective, such as agriculture and fisheries and food security, forests and biodiversity, infrastructure, water and health • hazards these parameters are exposed to • perceived changes • scale of change
Adaptive capacity (but also exposure through threats and sensitivity through weaknesses)	4.	Strengths, Weaknesses, Opportunities and Threats (SWOT) based on livelihood assets (human, natural, financial, social and physical)	• human, natural, financial, social and physical assets of the village • strengths, weaknesses, opportunities and related to their assets • rating of importance
Organisational and stakeholder identification	5.	Network template	• Organisations or networks that are of relevance • Rate importance by placing them farther or closer to the village centre

Figure 13 - PRA parameters

Data from the PRA focus group discussions supported the narrative of the IVA report framed around the three key determinants of vulnerability: Exposure, Sensitivity and Adaptive Capacity.

Step 4. Household Surveys

The household survey (HH) used in the Abaiang IVA is an extension of the national statistics office's (NSO) demographic approach. It follows as the format of a national census or a household income and expenditure survey. The household survey for the Abaiang IVA provided detailed household data and information contributing to the analysis of the IVA results and the IVA report.

The goal of the HH survey was to quantitatively evaluate each household's condition using metrics that show how each respondent's or households deal with the challenges, issues, and stressors brought on by climate change and disaster risk.

Before the mission a sample size of 10% of the total number of households on Abaiang was agreed to. This is a credible sample size according to NSO). Based on the sample size, the NSO determined the number of households to be surveyed per village. On Abaiang, 10% of the total number of households were surveyed (total number of households on Abaiang = 425). The NSO officers (KNEG members) led this process with the help of locally trained enumerator. The training of the local enumerators focused on the interpretation of the questionnaires and the entry of data manually or using tablets (small, handheld computers).

Figure 14 provides a summary of the HH survey questionnaire and its 10 sections (background; profile; general climate change and vulnerability awareness; security of place; water security; food security; household income security; transport and telecommunications; household health; and community norms, values beliefs and inclusiveness in decision making). Each of these sections have a set of sub-questions which are both open ended or closed. The survey provides detailed and numerical data to help analyse the vulnerability of households within each village.

Household Surveys Questions

Section1: Background Information

Section 2: Household profile, skills and movements

Section 3: General climate change and vulnerability awareness

What do you think are the most significant problems or challenges faced by your community?

What do you think may be causing the changes in climate?

What do you think will be the three most significant effects of climate change in your community?

Would you consider migrating due to the increase impact of climate change?

IF “YES” then would you prefer migrating?

Section 4: Security of place

Please indicate the level at which your dwelling is at risk from the following events

What can you do to reduce the respond to the risk?

Are you confident that your local leaders can work well with other agencies to help your community deal with these risks?

Section 5: Water security

Please tick the following boxes (walk around the property to identify water sources, ask selected questions.

Source (Well or Rainfall)

Use

Other sources than well or rainfall

Does your household experience problems accessing drinking water?

Is the water supply sufficient to meet your households needs (quantity)?

Which events can create problems for accessing household drinking water?

During period of drought or water shortage, what do you rely on for water?

Please indicate the type of toilet you use (tick more than one box if needed): Bush, Beach, Flush, Compost, Pit Latrine, Other

Section 6: Food security

Does your household have access to land to grow food for the household?

Does your household grow fruits, vegetables and crops?

If yes, how fertile is the soil to crops and vegetables?

Does your household raise livestock?

Does anyone in the household go fishing?

If yes, please indicate the purpose?

Section 7: Household income security

What are the main sources of cash income for your household (tick the box that best matches answers. If 'others', describe them and rank the 3 main sources of income.)

How many in the household are employed?

What is your average monthly cash income?

Please indicate and rank the top 3 obligations or expenses of the household, with 1 being the 'highest impact'.

Do you usually need cash to prepare for and recover from disasters or emergencies such as severe storms, droughts or floods?

If yes or sometimes, do you usually have sufficient household cash to prepare for and recover from disasters or emergencies such as severe storms, droughts or floods?

If yes or sometimes, what is the cash needed for?

Section 8: Transport and telecommunications

Section 9: Household health

Do you or anyone in your household over 5 years of age have difficulty seeing, even if wearing glasses?

How many people?

Do you or anyone in your household over 5 years of age have difficulty hearing, even if using a hearing aid?

How many people?

Do you or anyone in your household over 5 years of age have difficulty walking or climbing steps?

How many people?

Do you or anyone in your household over 5 years of age have difficulty remembering or concentrating?

How many people?

Do you or anyone in your household over 5 years of age have difficulty (with self-care such as) washing all over or dressing?

How many people?

Using your usual (customary) language, do you or anyone in your household over 5 years of age have difficulty communicating, for example understanding or being understood?

How many people?

How many members of your household have any of the following health problems? [Pause after each] [Read out: Diabetes, Heart disease, hypertension/high blood pressure, Cancer , serious anxiety or Depression, serious lower back pain or neck pain]

In the last 12 months, how many TIMES have people in this household have been diagnosed by a health professional as having one of these illnesses? [pause after reading each] - dengue, zika, chikungunya and/or yellow fever

Section 10: Community norms, values, beliefs and 'inclusiveness' in decision-making

We have no control over our future

Taking actions now will prevent problems in the future

New ways of solving problems are always accepted by the community

The community often plans for the future

My household adheres to community traditional values of collective action (Te aba)

My community values traditional practices of collective action and cooperation

Decision-making processes in my community supports traditional values

Women participate actively in decision making processes

Young people participate actively in decision making processes

Conflicts within the community are usually resolved adequately

Figure 14 - outline of HH survey questionnaire

Data collected in the HH survey illustrated the characteristics or features of vulnerability observed on Abaiang.

Results of the HH survey (Abaiang)

Abaiang, serving as the model example had been given a perfect score for the HH survey (Figure 15). The green column with a value of '2' illustrates that Abaiang is a good model for the range of information collected about people on the island. Like the PRA, this table showcases the wide range of data that were collected from villagers to help build a comprehensive understanding of local capacity and vulnerability.

	IVA Abaiang
Household Surveys Questions	
Section1: Background Information	2
Section 2: Household profile, skills and movements	2
Section 3: General climate change and vulnerability awareness	
What do you think are the most significant problems or challenges faced by your community?	2
What do you think may be causing the changes in climate?	2
What do you think will be the three most significant effects of climate change in your community?	2
Would you consider migrating due to the increase impact of climate change?	2
IF "YES" then would you prefer migrating?	2
Section 4: Security of place	
Please indicate the level at which your dwelling is at risk from the following events	2
What can you do to reduce the respond to the risk?	2
Are you confident that your local leaders can work well with other agencies to help your community deal with these risks?	2
Section 5: Water security	
Please tick the following boxes (walk around the property to identify water sources, ask selected questions.	2
Source (Well or Rainfall)	2
Use	2
Other sources than well or rainfall	2
Does your household experience problems accessing drinking water?	2
Is the water supply sufficient to meet your households needs (quantity)?	2
Which events can create problems for accessing household drinking water?	2
During period of drought or water shortage, what do you rely on for water?	2
Please indicate the type of toilet you use (tick more than one box if needed): Bush, Beach, Flush, Compost, Pit Latrine, Other	2
Section 6: Food security	
Does your household have access to land to grow food for the household?	2
Does your household grow fruits, vegetables and crops?	2
If yes, how fertile is the soil to crops and vegetables?	2
Does your household raise livestock?	2
Does anyone in the household go fishing?	2
If yes, please indicate the purpose?	2
Section 7: Household income security	
What are the main sources of cash income for your household (tick the box that best matches answers. If 'others', describe them and rank the 3 main sources of income.)	2
How many in the household are employed?	2
What is your average monthly cash income?	2
Please indicate and rank the top 3 obligations or expenses of the household, with 1 being the 'highest impact'.	2
Do you usually need cash to prepare for and recover from disasters or emergencies such as severe storms, droughts or floods?	2
If yes or sometimes, do you usually have sufficient household cash to prepare for and recover from disasters or emergencies such as severe storms, droughts or floods?	2
If yes or sometimes, what is the cash needed for?	2
Section 8: Transport and telecommunications	2
Section 9: Household health	
Do you or anyone in your household over 5 years of age have difficulty seeing, even if wearing glasses?	2
How many people?	2
Do you or anyone in your household over 5 years of age have difficulty hearing, even if using a hearing aid?	2
How many people?	2
Do you or anyone in your household over 5 years of age have difficulty walking or climbing steps?	2
How many people?	2
Do you or anyone in your household over 5 years of age have difficulty remembering or concentrating?	2
How many people?	2
Do you or anyone in your household over 5 years of age have difficulty (with self-care such as) washing all over or dressing?	2
How many people?	2
Using your usual (customary) language, do you or anyone in your household over 5 years of age have difficulty communicating, for example understanding or being understood?	2
How many people?	2
How many members of your household have any of the following health problems? [Pause after each] [Read out: Diabetes, Heart disease, hypertension/high blood pressure, Cancer , serious anxiety or Depression, serious lower back pain or neck pain]	2
In the last 12 months, how many TIMES have people in this household have been diagnosed by a health professional as having one of these illnesses? [pause after reading each] - dengue, zika, chikungunya and/or yellow fever	2
Section 10: Community norms, values, beliefs and 'inclusiveness' in decision-making	
We have no control over our future	2
Taking actions now will prevent problems in the future	2
New ways of solving problems are always accepted by the community	2
The community often plans for the future	2
My household adheres to community traditional values of collective action (Te aba)	2
My community values traditional practices of collective action and cooperation	2
Decision-making processes in my community supports traditional values	2
Women participate actively in decision making processes	2
Young people participate actively in decision making processes	2
Conflicts within the community are usually resolved adequately	2

Figure 15 Snapshot of HH survey questionnaire analysis

Step 5. Field assessments

This step of the process was conducted by KNEG members. Following the shared perceptions and vulnerabilities that were identified in the PRA and the HH surveys. The field assessment involved

viewing and observing the vulnerable sites and locations identified by locals. An example of this was, If constant experiences by locals point towards a specific location being severely eroded or at risk of constant inundation. The KNEG team visited the site, took photographs, and entered GIS coordinates which would then be revisited in a follow up mission.

This step was important as part of matching the experiences of the locals and viewing vulnerable sites that had been identified. This part of the process contributed to the IVA report and may at times inform the prioritisation of adaptation options for the island of Abaiang.

Step 6. Review of previous scientific studies, policies and reports

The review of previous and scientific studies, policies and reports is conducted upon return from the IVA mission. The KNEG reviews external sources of information to support the analysis of the data and information collected (PRA and HH survey). These sources included the IPCC reports, climate and weather observations, adaptation planning processes from within the Pacific region, adaptation priorities for atolls.

This part of the process aimed at providing further substance or supporting evidence towards the IVA report.

Step 7. Meta data analysis

The data analysis for the IVA was done in three parts. Firstly, the NSO leads the process of checking and analysing all data collected from the HH surveys. The local enumerators who had been trained on Abaiang are then brought to Tarawa and worked with the NSO officers to correct errors and review data and information (this process is also known as data processing). Once all HH survey data had been processed, the NSO provides all results to the KNEG based on the processing and analysis of the results.

The second part of this process involves the review of all PRA data and information collected. This is analysed for ease of interpretation and the results were drawn up by assigned sectors of the KNEG.

The third step involves all data and information collected from the mission (HH and PRA) and external sources of information to viewed together. This last step involves the formulation of the Abaiang IVA report. Fortunately for Abaiang, this was well supported technically and financially by the supporting technical agencies from within the Pacific region (CROP and technical agencies). The level of analysis was thorough. It was firstly viewed by KNEG and then by I specialists from these regional organisations. The process of formulating the whole report was led and finalized by KNEG.

The Abaiang IVA report

The purpose of the reporting on vulnerability is to support decision making process and adaptation planning and to ensure that prioritized actions are directed to villages or areas of Abaiang which are more vulnerable than the others. The formulation of the IVA report for Abaiang was led by the KNEG.

The Abaiang IVA report consisted of four main chapters and a total of 82 sections forming the whole report . These sections were separated into 4 main headings:

1. **Context** *(physical geography; demography; local resource use)*
2. **Exposure to climate change and disasters: comparison of technical and local observations** *(Air and sea surface temperature; rainfall; drought; sea level rise; ocean acidification; other hazards; Tsunami; Epidemics; Maritime disasters (including oil spills)*
3. **The adaptive capacity of Abaiang and the Sensitivity of livelihood resources to climate change and disasters** *(Ecosystem capacity to support livelihood need and sensitivity to climate change and disasters; settlement, housing and local sources of energy; sensitivity of settlements to climate and disasters; local perceptions of coastal risk; natural water resources; accessibility of freshwater resources; well types; Abstraction method from well;*

roofing construction; Abstraction method from rainwater tank; Quality of water resources; Groundwater test sites; Physical and microbiological results of samples collected; Effects of various human activities on quality of groundwater; Sensitivity of natural water resources; Natural Food resources; Natural land based food resources; Poor soil conditions; Limited availability and quality of water; Narrow genetic base; Limited and decreasing access to fruits and vegetables; Pests and diseases; Challenges for livestock; Sensitivity of natural land-based food resources; Natural marine-based food resources; Coral reef types and habitats; Sensitivity of coral reefs to climate change and disasters; Natural resource-based commodities for household income; Sensitivity of natural resource-based land commodities to climate and disasters; Infrastructure capacity to support livelihood needs and sensitivity to climate change and disasters; Housing and public buildings; House ownership; Materials used for floors, roofs and walls; Sensitivity of housing and public infrastructures to climate and disaster risks; Water and sanitation infrastructure; Water infrastructure; Toilets and waste disposal facilities; Economically enabling infrastructure ; transport; Communication; Energy; Education infrastructure; Education infrastructure sensitivity; Health infrastructure sensitivity; Human capabilities to support livelihood needs and sensitivity to climate change and disasters; Productive population and dependency ratio; Knowledge and skills; Formal education; Population Health; Sensitivity of people to the effects of climate change and disasters; Financial capacity to support livelihood need and sensitivity to climate change and disaster; The institutional adaptive capacity of Abaiang; Abaiang governance structure; Leadership and collective; Inclusiveness in decision-making; Managing networks; Management of livelihood assets

4. **Adaptation options** *(Proposed adaptation options for marine and coastal ecosystems; Proposed adaptation options for natural water resources; Proposed adaptation options for land-based food resources; Proposed adaptation options for housing; Proposed adaptation options for transport; Proposed adaptation options for communications; Proposed adaptation options for energy; Proposed adaptation options for local skills development; Proposed adaptation options for health; Proposed adaptation options for traditional knowledge; Proposed adaptation options for formal education; Proposed adaptation options for livelihood commodities; Proposed adaptation options for institutions)*

The main chapters for Abaiang IVA focused on the elements of vulnerability: Exposure (Chapter 2), Sensitivity (Chapter 3) and Adaptive Capacity (Chapter 3), followed by the proposed adaptation options (Chapter 4) based on the analysis conducted by KNEG. The above mentioned sections of the IVA report outline a complete and thorough IVA report structure and format based on the IVA method which was fully followed (using steps 1 to 7).

Conclusion

Abaiang was considered as a model IVA in terms of process and outcome for several reasons: firstly the IVA framework was fully implemented and led by local experts (the KNEG). Success was also due to the support of external partners who provided technical expertise (access to climate observation data and information, interpretation of external data sources and metadata analysis)

Second, funding from donor agencies and CROP agencies within the Pacific region (refer to Table 1), from beginning to completion covered the costs for all seven steps in the IVA method. This included community consultation, field missions, the PRA and HH surveys and report preparation. Furthermore, the funding support from external partners for the IVA and its projects and programmes allowed for continuous review of data collection and information gathering.

Third, the detailed and thorough approach to data collection served as a solid foundation in the production of the IVA report. The combination of locally derived and informed data and external field data and mapping helped to generate a report that was recognised by the local communities of Abaiang. The participatory nature of the methodology was an important feature of the IVA.

Finally, the results combine the results from the PRA and HH surveys into vulnerability characteristics based on Exposure, Sensitivity and Adaptive Capacity. The report is easy to navigate and understand in the context and understanding of vulnerability. The analysis of data and information was thorough and provided for a wide spectrum of vulnerability information for locals The final report has actionable adaption actions.

The Abaiang IVA applied a multi-sectoral approach and integrated approach which worked and provided relevant information on the challenges and the adaptation options for consideration in adaptation planning processes.

5.2 Tabiteuea Meang IVA Summary

The Tabiteuea Meang IVA mission took place from the 13 to 23 March 2017. The process was led by the KNEG (local experts). The IVA team was formed of officers from within Government: 9 members in total (2 from the Climate Change and Disaster Risk Unit; 2 from the National Statistics Office; 1 from the Ministry of Education; 2 from the Ministry of Environment; and 1 from the Water and Engineering Unit).

Table 13 provides a summary outline of the IVA methods applied for Tabiteuea Meang. This includes the seven steps taken by the KNEG team during the research consultation on Tabiteuea Meang.

Table 13 IVA Methods applied for Tabiteuea Meang

Step 1 - Local Consultation	•The notification of the IVA mission was made to the Mayor and Island Clerk. This information was further conveyed to village elders in preparation for the IVA mission.
Step 2- Field Based studies	•Field based studies were not conducted during the 10 day mission, however photographs of impacted sites were taken
Step 3- PRA	•The PRA was conducted simultanously with the HH survey due to the tight schedule of mission. A total number of 12 villages were consulted starting from the islets and then to the main land villages
Step 4 - HH survey	•A total of 163 households were surveyed. This process was led by 2 National Statistics Officers
Step 5 - Field assessments	•Due to the limited time on the island, field assessments were not fully captured and sectors that were part of the IVA mission only conducted sector specific assessments.
Step 6 - Review of previous scientific studies, policies and reports	•This part of the process was undertaken upon return from the IVA mission, and in support of the final analysis and intepretation of data and information.
Step 7 - Meta-data analysis	•The analysis of the HH surveys and PRA were led by the KNEG. two groups were established 1 for the PRA and 1 for the HH surveys (led by the NSO)

The Tabiteuea Meang IVA was supported by 2 external partners (GIZ – German Development Cooperation and the World Bank). The funding support would only support a 10-day mission to Tabiteuea Meang to collect PRA and HH survey data.

Step 1. Local Consultations

Upon arrival of the research team on Tabiteuea Meang on 13th of March 2017 a meeting was held with the Mayor, Deputy Mayor and Island Clerk. Due to conflicting schedules and costs associated with bringing all representatives to the Island's council office, no full council meeting (Island council and representatives of each village) was held. Thus, the local consultations were constrained, and time bound.

The mayor directed the research team about who they should visit. The islets were the first to be consulted by the IVA team. This required taking boats to the three inhabited islets: Aiwa, Bangai, Tenatoorua) where the community PRAs and Household surveys commenced simultaneously and because of the 10-day mission that had been planned for Tabiteuea Meang.

Step 2. Field based studies

Part of the preparatory work of the KNEG was to ensure that previous sector-based studies and assessments were reviewed before the IVA mission. This allowed the IVA team to understand the context of the island, the sector-based issues and challenges faced at the village and community level. Some of the issues reported previously for Tabiteuea Meang were related to food security (fisheries and agriculture) and challenges associated with harvesting coastal resources or the deplete of certain fish species.

Step 3. PRA

The PRA for Tabiteuea Meang was led by the KNEG which involved 9 members of the research team for the IVA mission. The Tabiteuea Meang IVA framed its PRA according to criteria cited in Figure 14 in page 43. It used the same 5 assessment criteria, as Abaiang (Exposure 'Seasonal Weather Calendar'; Exposure 'Seasonal plant and animal behaviour calendar'; Sensitivity; Adaptive Capacity; and SWOT analysis)

Figure 17 summarizes the 5 parameters of the PRA. Of these 5, Figure 17 shows that the PRA for Tabiteuea Meang meets the criteria for 1 to 4. However, much of the information about adaptive capacity is missing specifically for human, natural, financial, social and physical assets. There was no SWOT analysis conducted as part of the PRA method for Tabiteuea Meang.

	Abaiang PRA	Tabiteuea Meang PRA
Assessment Parameters		
Exposure (Seasonal Weather Calendar)		
weather parameter	**2**	**2**
time scales (before and today)	**2**	**2**
Periods (months or seasons during a year)	**2**	**2**
Percieved changes as along as community remembers	**2**	**2**
scale of change	**2**	**2**
Exposure (Seasonal plant and animal behaviour calendar)		
plant and fruit parameters (varieties and behaviour such as fruiting and spawning)	2	2
time scales (before and today)	2	2
periods (months and seasons during a year)	2	2
percieved changes	2	2
scale of change	2	2
Sensitivity		
important livelihood paramaters from community perspective on Fisheries	2	2
important livelihood paramaters from community perspective on Agriculture	2	2
important livelihood paramaters from community perspective on food security	2	2
important livelihood paramaters from community perspective on forests	2	2
important livelihood parameters from community perspective on biodiversity	2	2
hazards these parameters are exposed to	2	2
percieved changes	2	2
scale of change	2	2
Adaptive capacity		
Human assets of the village	2	1
Natural assets of the village	2	1
financial assets of the village	2	1
social assets of the village	2	1
physical assets of the village	2	1
strengths	2	0
weaknesses	2	0
opportunities	2	0
threats	2	0
rating of importance	2	0

Figure 16 PRA parameters used for Tabiteuea meang compared to Abaiang.

Step 4. HH surveys

The HH survey was led by two National Statistics Officers (KNEG members) and with the support of locally trained enumerators. The enumerators had been trained specifically for the HH survey in terms of the approach and the interpretation of questions within the survey's questionnaire.

The HH survey for Tabiteuea Meang was the same as that of Abaiang. A total number of 163 households were surveyed and accounted for 23% of the total number of households on Tabiteuea Meang. This is the same as the 2015 census report.

Due to the limited time to conduct field work, the NSO team worked simultaneously with the PRA team led by other KNEG members.

Figure 18 provides a snap shot of the outcome of the Tabiteuea Meang is consistent and with Abaiang. All elements of the survey questionnaires for the HH surveys have been completed (green code = fully met).

Household Surveys Questions	IVA Abaiang	IVA Tabiteuea Meang
Section1: Background Information	2	2
Section 2: Household profile, skills and movements	2	2
Section 3: General climate change and vulnerability awareness		
What do you think are the most significant problems or challenges faced by your community?	2	2
What do you think may be causing the changes in climate?	2	2
What do you think will be the three most significant effects of climate change in your community?	2	2
Would you consider migrating due to the increase impact of climate change?	2	2
IF "YES" then would you prefer migrating?	2	2
Section 4: Security of place		
Please indicate the level at which your dwelling is at risk from the following events	2	2
What can you do to reduce the respond to the risk?	2	2
Are you confident that your local leaders can work well with other agencies to help your community deal with these risks?	2	2
Section 5: Water security		
Please tick the following boxes (walk around the property to identify water sources, ask selected questions.	2	2
Source (Well or Rainfall)	2	2
Use	2	2
Other sources than well or rainfall	2	2
Does your household experience problems accessing drinking water?	2	2
Is the water supply sufficient to meet your households needs (quantity)?	2	2
Which events can create problems for accessing household drinking water?	2	2
During period of drought or water shortage, what do you rely on for water?	2	2
Please indicate the type of toilet you use (tick more than one box if needed): Bush, Beach, Flush, Compost, Pit Latrine, Other	2	2
Section 6: Food security		
Does your household have access to land to grow food for the household?	2	2
Does your household grow fruits, vegetables and crops?	2	2
If yes, how fertile is the soil to crops and vegetables?	2	2
Does your household raise livestock?	2	2
Does anyone in the household go fishing?	2	2
If yes, please indicate the purpose?	2	2
Section 7: Household income security		
What are the main sources of cash income for your household (tick the box that best matches answers. If 'others', describe them and rank the 3 main sources of income.)	2	2
How many in the household are employed?	2	2
What is your average monthly cash income?	2	2
Please indicate and rank the top 3 obligations or expenses of the household, with 1 being the 'highest impact'.	2	2
Do you usually need cash to prepare for and recover from disasters or emergencies such as severe storms, droughts or floods?	2	2
If yes or sometimes, do you usually have sufficient household cash to prepare for and recover from disasters or emergencies such as severe storms, droughts or floods?	2	2
If yes or sometimes, what is the cash needed for?	2	2
Section 8: Transport and telecommunications	2	2
Section 9: Household health		
Do you or anyone in your household over 5 years of age have difficulty seeing, even if wearing glasses?	2	2
How many people?	2	2
Do you or anyone in your household over 5 years of age have difficulty hearing, even if using a hearing aid?	2	2
How many people?	2	2
Do you or anyone in your household over 5 years of age have difficulty walking or climbing steps?	2	2
How many people?	2	2
Do you or anyone in your household over 5 years of age have difficulty remembering or concentrating?	2	2
How many people?	2	2
Do you or anyone in your household over 5 years of age have difficulty (with self-care such as) washing all over or dressing?	2	2
How many people?	2	2
Using your usual (customary) language, do you or anyone in your household over 5 years of age have difficulty communicating, for example understanding or being understood?	2	2
How many people?	2	2
How many members of your household have any of the following health problems? [Pause after each] [Read out: Diabetes, Heart disease, hypertension/high blood pressure, Cancer , serious anxiety or Depression, serious lower back pain or neck pain]	2	2
In the last 12 months, how many TIMES have people in this household have been diagnosed by a health professional as having one of these illnesses? [pause after reading each] - dengue, zika, chikungunya and/or yellow fever	2	2
Section 10: Community norms, values, beliefs and 'inclusiveness' in decision-making		
We have no control over our future	2	2
Taking actions now will prevent problems in the future	2	2
New ways of solving problems are always accepted by the community	2	2
The community often plans for the future	2	2
My household adheres to community traditional values of collective action (Te aba)	2	2
My community values traditional practices of collective action and cooperation	2	2
Decision-making processes in my community supports traditional values	2	2
Women participate actively in decision making processes	2	2
Young people participate actively in decision making processes	2	2
Conflicts within the community are usually resolved adequately	2	2

Figure 17 Assessment of HH surveys for Tabiteuea in comparison to Abaiang

Step 5. Field assessments

Due to the small research team members and limited time, there was no time to conduct field assessments for the Tabiteuea Meang IVA. Data collection relied entirely of the PRA and HH surveys.

Step 6. Review of previous scientific studies, policies and reports

Upon return from the mission to Tabiteuea Meang, the KNEG reconvened to review external sources of information which would have value and contributions to the framing of vulnerability for Tabiteuea Meang. The information included household income expenditure reports, climate observations, project and programme progress reports and sector-based technical assessment reports relevant to the context of Tabiteuea Meang.

Step 7. Meta-data analysis

The analysis of data for the PRA was led by KNEG and the analysis of HH survey data and processing of data was conducted by the National Statistics Office. For the Tabiteuea Meang IVA, KNEG members led the analysis of all results to be used in the IVA report.

SWOT analysis of IVA method (Tabiteuea Meang)

To analyse the HH survey approach used for Tabiteuea, the SWOT analysis method is applied which depict the similarities or differences amongst each HH survey conducted. The Tabiteuea Meang SWOT analysis results are as follows:

Table 14 SWOT Analysis table of Tabiteuea IVA methods

SWOT Analysis	Tabiteuea Meang IVA method
Strengths	- Sample size is representative of more than 10% of the total Households (credibility of data) - The amount of data collected (sample size is very large according to the total population and total number of households) - Locally trained enumerators (transfer of knowledge and capacity development for the HH surveys)
Weakness	- Cost of HH survey and training for local enumerators - Awareness and knowledge of locals contributing to focus group discussion - Data analysis capacities of KNEG - HH surveys were conducted manually (on paper) - Limited funding
Opportunities	- Translation and simplification of questions for each survey - Shortened questions and clustered categories or questions - Use of tablets for HH surveys - Logistical arrangements and phases of missions to be considered as opposed to one mission
Threats	- The lack of understanding of each category - Misinterpretation of results - Credibility of sample size - Logistical issues with completing surveys - Data entry issues due to manual records (error checking required) - Funding

Based on the SWOT analysis (Table 14) and using the comparative analysis (Figure 17 and Figure 18), the results provide both a narrative of the comparisons, while the approach is the same as Abaiang, there is areas which can be improved according to context (geographical location, cultural values, the number of village and the total population number).

The Tabiteuea Meang IVA report

The Tabiteuea Meang IVA follows that of Abaiang. Tabiteuea Meang's HH survey was completed , however the PRA was missing elements.

By comparing the IVA report of Tabiteuea Meang to that of Abaiang in Figure 19 , the proposed adaptation options are missing sections which are of great importance to supporting decision making and supporting adaptation planning are not featured in the IVA report for Tabiteuea meang.

The IVA report was developed by the KNEG upon completion of the 10-day mission to Tabiteuea Meang which closed on the 23 March, 2017. The IVA report for Tabiteuea Meang was framed using data and information collected from the PRA and HH surveys.

The KNEG's objective was to replicate a similar report to the Abaiang IVA report for Tabiteuea Meang. Tabiteuea Meang's IVA report was also going to include 82 sections; however, many sections are missing.

As seen in Figure 19. The comparison of the IVA reports shows that the Tabiteuea Meang IVA includes 34 of 82 sections.

Of the 82 sections, 11 provide partial information: *Tsunami, Epidemics, Maritime disasters (including oil spills), Effects of various human activities on quality of groundwater, Sensitivity of natural water resources, Poor soil conditions, Limited availability and quality of water, Pests and diseases, Sensitivty of natural land-based food resources, Natural marine-based food resources, and Coral reef types and habitats.*

And 37 sections are completely missing from the report: *Local resource use, Ecosystem capacity to support livelihoods needs and sensitivity to climate change and disasters, Settlement, housing and local sources of energy, Groundwater test sites, Physical and microbiological results of samples collected, Narrow genetic base, Limited and decreasing access to fruits and vegetables, Challenges for livestock, Sensitivity of coral reefs to climate change and disasters, Housing and public buildings, House ownership, Materials used for floors, roofs and walls, Sensitivity of housing and public infrastructures to climate and disaster risks, Water and sanitation infrastructure, Water infrastructure, Toilets and waste disposal facilities, Energy, Health infrastructure sensitivity, Human capabilities to support livelihood needs and sensitivity to climate change and disasters, Productive population and dependency ratio, Knowledge and skills , Formal education, Financial capacity to support livelihood need and sensitivity to climate change and disasters, The institutional adaptive capacity of Abaiang, and the proposed adaptation options for marine and coastal ecosystems, natural water resources, land-based food resources, housing, transport, communications, energy, local skills development, health, traditional knowledge, formal education, livelihood commodities and institutions*

The comparison of the Abaiang IVA report and that of Tabiteuea Meang shows that not all elements of the reports have been featured. Of the missing information, the Tabiteuea Meang IVA report does not propose any adaptation options to support adaptation planning processes and decision making for Tabiteuea Meang (sections 74-86, refer to Figure 19)

	Outline and content of report	IVA 1 - Abaiang	IVA 2 - Tabiteuea Meang
1	CONTEXT		
2	Physical geography	2	2
3	Demography	2	2
4	Local resource use	2	0
5	Exposure to climate change and disasters: comparison of technical and local observations		
6	Air and sea surface temperature	2	2
7	Rainfall	2	2
8	Droughts	2	2
9	Sea level rise	2	2
10	Ocean acidification	2	2
11	Other hazards	2	2
12	Tsunami	2	1
13	Epidemics	2	1
14	Maritime disasters (including oil spills)	2	1
15	THE ADAPTIVE CAPACITY OF ABAIANG AND THE SENSITIVITY OF LIVELIHOOD RESOURCES TO CLIMATE CHANGE AND DISASTERS		
16	Ecosystem capacity to support livelihoods needs and sensitivity to climate change and disasters	2	0
17	Settlement, housing and local sources of energy	2	0
18	Sensitivity of settlements to climate and disasters	2	2
19	local perceptions of coastal risk	2	2
20	Natural water resources	2	2
21	Accessibility of freshwater resources	2	2
22	Well types	2	2
23	Abstraction method from well	2	2
24	Roofing construction	2	2
25	Abstraction method from rainwater tank	2	2
26	Quality of water resources	2	2
27	Groundwater test sites	2	0
28	Physical and microbiological results of samples collected	2	0
29	Effects of various human activities on quality of groundwater	2	1
30	Sensitivity of natural water resources	2	1
31	Natural Food resources	2	2
32	Natural land based food resources	2	2
33	Poor soil conditions	2	1
34	Limited availability and quality of water	2	1
35	Narrow genetic base	2	0
36	Limited and decreasing access to fruits and vegetables	2	0
37	Pests and diseases	2	1
38	Challenges for livestock	2	0
39	Sensitivty of natural land-based food resources	2	1
40	Natural marine-based food resources	2	1
41	Coral reef types and habitats	2	1
42	Sensitivity of coral reefs to climate change and disasters	2	0
43	Natural resource-based commodities for household income	2	2
44	Sensitivty of natural resource-based land commodities to climate and disasters	2	2
45	Infrastructure capacity to support livelihood needs and sensitivity to climate change and disasters	2	2
46	Housing and public buildings	2	0
47	House ownership	2	0
48	Materials used for floors, roofs and walls	2	0
49	Sensitivity of housing and public infrastructures to climate and disaster risks	2	0
50	Water and sanitation infrastructure	2	0
51	Wate infrastructure	2	0
52	Toilets and waste disposal facilities	2	0
53	Economically enabling infrastructure	2	2
54	transport	2	2
55	Communication	2	2
56	Energy	2	0
57	Education infrastructure	2	2
58	Education infrastructure sensitivity	2	2
59	Health infrastructutre sensitivity	2	0
60	Human capabilities to support livelihood needs and sensitivity to climate change and disasters	2	0
61	Productive population and dependency ratio	2	0
62	Knowledge and skills	2	0
63	Formal education	2	0
64	Population Health	2	2
65	Sensitivty of people to the effects of climate change and disasters	2	2
66	Financial capacity to support livelihood need and sensitivity to climate change and disasters	2	0
67	The institutional adaptive capacity of Abaiang	2	0
68	Abaiang governance structure	2	2
69	Leadership and collective	2	2
70	Inclusiveness in decision-making	2	2
71	Managing networks	2	2
72	Management of livelihood assets	2	2
73	Adaptation options		
74	Proposed adaptation options for marine and coastal ecosystems	2	0
75	Proposed adaptation options for natural water resources	2	0
76	Proposed adaptation optionss for land-based food resources	2	0
77	Proposed adaptation options for housing	2	0
78	Proposed adaptation options for transport	2	0
79	Proposed adaptation options for communications	2	0
80	Proposed adaptation options for energy	2	0
81	Proposed adaptation options for local skills development	2	0
82	Proposed adaptation options for health	2	0
83	Proposed adaptation options for traditional knowledge	2	0
84	Proposed adaptation options for formal education	2	0
85	Proposed adaptation options for livelihood commodities	2	0
86	Proposed adaptation options for institutions	2	0

Figure 18 Comparison of IVA reports and outlines between Abaiang and Tabiteuea Meang

Nor does the IVA report for Tabiteuea provided the same level of detail as the Abaiang report. While there are results from the PRA and the HH surveys highlighted in the IVA report, the level of detail and analysis compared to that of the Abaiang is not the same.

The KNEG's objective was to replicate a similar report which highlights consisted of similar sections and as detailed as the Abaiang IVA report. The report would be framed using 82 sections (refer to Abaiang IVA), however much of these sections are missing for the Tabiteuea Meang IVA report.

As seen in Figure 18. The comparison of the IVA reports shows that the Tabiteuea Meang IVA fully reports on 34 out of 82 of the sections being featured in the report : *Demography, local resources, air surface temperature, rainfall, drought, Sea level rise, Ocean acidification , Other hazards Settlement, housing and local sources of energy, Sensitivity of settlements to climate and disasters, local perceptions of coastal risk, Natural water resources, Accessibility of freshwater resources, Well types, Abstraction method from well, Roofing construction, Abstraction method from rainwater tank, Quality of water resources, Natural Food resources, Natural land based food resources Natural resource-based commodities for household income, Sensitivity of natural resource-based land commodities to climate and disasters, Infrastructure capacity to support livelihood needs and sensitivity to climate change and disasters, Economically enabling infrastructure, transport, Communication, Education infrastructure, Education infrastructure sensitivity, Population Health, Sensitivity of people to the effects of climate change and disasters, Abaiang governance structure, Leadership and collective, Inclusiveness in decision-making, Managing networks, and Management of livelihood assets*

Out of the 82 sections, 11 sections partly provide information: *Tsunami, Epidemics, Maritime disasters (including oil spills), Effects of various human activities on quality of groundwater, Sensitivity of natural water resources, Poor soil conditions, Limited availability and quality of water, Pests and diseases, Sensitivity of natural land-based food resources, Natural marine-based food resources, and Coral reef types and habitats.*

And 37 sections are completely missing from the report: *Local resource use, Ecosystem capacity to support livelihoods needs and sensitivity to climate change and disasters, Settlement, housing and local sources of energy, Groundwater test sites, Physical and microbiological results of samples collected, Narrow genetic base, Limited and decreasing access to fruits and vegetables, Challenges for livestock, Sensitivity of coral reefs to climate change and disasters, Housing and public buildings, House ownership, Materials used for floors, roofs and walls, Sensitivity of housing and public infrastructures to climate and disaster risks, Water and sanitation infrastructure, Water infrastructure, Toilets and waste disposal facilities, Energy, Health infrastructure sensitivity, Human capabilities to support livelihood needs and sensitivity to climate change and disasters, Productive population and dependency ratio, Knowledge and skills , Formal education, Financial capacity to support livelihood need and sensitivity to climate change and disasters, The institutional adaptive capacity of Abaiang, and theProposed adaptation options for marine and coastal ecosystems, natural water resources, land-based food resources, housing, transport, communications, energy, local skills development, health, traditional knowledge, formal education, livelihood commodities and institutions*

The comparison of the Abaiang IVA report and that of Tabiteuea Meang showed that not all elements of the reports have been featured. Of the missing information, the Tabiteuea Meang IVA report does not propose any adaptation options to support adaptation planning processes and decision making for Tabiteuea Meang (sections 74-86, refer to Figure 18)

The Tabiteuea Meang IVA report has 7 sections:

1. ***The IVA framework section*** *provides an overview of the IVA framework applied for the Tabiteuea Meang IVA*

2. ***Sustainable Livelihoods framework section*** *provides reference to the IVA framework and the importance of the Integrated Vulnerability Assessment method adopting the SLF framework*
3. ***Preparatory meeting*** *highlights the preparatory work of the KNEG prior to the mission for Tabiteuea Meang (budgeting, schedule, protocols, review of reports and assessments, team formulation)*
4. ***KNEG workplan*** *provides a brief description of the schedule for the IVA mission (protocols, PRA, HH survey)*
5. ***PRA table of results*** *provides brief information based on the framing of the*
6. ***Household survey results*** *provides analysed results based on the HH survey questionnaires. (refer to comparison Figures 18)*
7. ***Key findings and results***

Contrast to the Abaiang IVA report, the Tabiteuea Meang IVA does not have a section which provides adaptation options. The level of detailed results for the PRA was missing elements related to exposure, sensitivity and adaptive capacities of ecosystems, assets and infrastructure. The HH survey results have not been assessed completely against the PRA results. Each of the results are presented separately.

Conclusion

The Tabiteuea Meang IVA followed the same method as Abaiang. By carrying out the PRAs and HH surveys across all the villages on Tabiteuea. The expectation of providing a thorough analysis based on the level of data and information were not present in the IVA report. Missing elements and sections of the IVA results were noticeable across the whole report.

The IVA mission for Tabiteuea Meang was only financially supported by 2 partners, no technical support or expertise was provided to KNEG in leading the mission, and in the analysis of data and information collected for the PRA and HH surveys. This may provide a reason for the lack of detail to the findings and results for the Tabiteuea Meang IVA report.

5.3 Butaritari IVA Summary

The Butaritari IVA was conducted from the 20th -29th March 2020. The KNEG members led this nine-day IVA mission. The IVA was supported through national budget from the Climate Change and Disaster Risk Management unit and from the World Health Organisation (WHO). WHO's main area of interest was the health risks components resulting from climate change, this included the Water and Sanitation sector and Environmental health sector. WHO provided financial support for the KNEG mission and also provided technical assistance upon return from the mission for the review of external sources of information and for the meta-data analysis. Apart from WHO supporting the Ministry of Health and Medical Services officers (MHMS) trip for the IVA, the rest of the KNEG members used their sector budgets to partake in the IVA mission and conducted sector specific activities on the islands (e.g Mangrove planting by the Ministry of Environment officers; valuating copra-based products by Tourism officers).

Table 15 provides a summary of the IVA method applied for Butaritari Island. This method is framed from the Abaiang IVA method which takes 7 steps.

Table 15 IVA methods and the 7 steps applied in Butaritari

Step 1 -Local Consultation	The local council and village heads were informed of the IVA mission to Butaritari. This information was communicated by the KNEG Secretariat.
Step 2- Field Based studies	Members of the KNEG team were tasked with reviewing existing reports and assessments from from their sectors which would contribute to the development of the profile and background information for Butaritari Island
Step 3 -PRA	The PRA was conducted in all 10 villages on Butaritari using focus group discussions. The PRA identified common issues and impacts of climate change against Human Security Objectives (HSOs)
Step 4- HH survey	The HH survey was led by the National Statistics Office and supported by four locally trained enumerators on the HH survey. The Household survey was captured using tablets.
Step 5- Field assessments	During the IVA mission, each KNEG member held their own field assessments to collect further information and data specific to their sector (e.g Tourism Business Inventory Survey)
Step 6 -Review of previous scientific studies, policies and reports	KNEG reviewed external sources of information which would contribute to the IVA report results (analysis and interpretation)
Step 7 - Meta-data analysis	The KNEG led this process by analysing PRA and HH survey data as part of the formulation of IVA report for Butaritari.

Step 1. Local consultation

The protocols were addressed by meeting with members of the island council upon arrival on Butaritari Island. This process was led by the KNEG comprised of 10 members. The team planned a nine-day mission which required doing both HH surveys and PRA simultaneously.

Step 2. Field based studies

This part of the process was conducted prior to the visit to Butaritari Island. The KNEG met and reviewed relevant reports and studies which had been conducted on Butaritari through sector level projects and programmes. This allowed the KNEG to prepare beforehand an island profile based on existing studies and research, project reports of the situation for Butaritari.

Step 3. PRA

The PRA for Butaritari were conducted by KNEG member using focus group discussions. The PRA showed different results (Table 1 above), where the color-coded red corresponds to missing data and information in relation to the PRA approach being used. The results in Table 6 below provide the results and findings for Human Security Objectives (HSO): Forest Health, coastal health, water security, community, income security, food security and energy security.

Table 16 showed that the PRA took a more direct approach by allowing community participants to provide their rating (level of risk – 1 being the highest; 5 being the lowest) according to the HSO's sought (which would complement Household survey findings) against Livelihoods hazards posed on Ecosystem, Infrastructure and services, Finance, Human resources and Institution and Governance.

Table 16 PRA ratings in Butaritari using Human Security Objectives and Livelihood Assets

		Livelihood Hazards					
		Ecosystem	**Infrastructure & Services**	**Finance**	**Human Resource**	**Institution & Governance**	**Average ratings**
Human Security Objectives	**Forest Health**	3.1	2.9	2.6	3.3	3.1	3.0
	Coastal Health	2.0	2.3	2.3	3.0	2.9	2.5
	Water Security	2.5	2.4	3.0	3.1	3.2	2.8
	Security of Place	1.7	2.3	3.2	2.9	4.6	2.9
	Energy Security	2.1	1.9	2.0	1.8	2.1	2.0
	Income Security	2.3	1.9	2.3	2.1	2.0	2.1
	Community Health	2.8	2.3	2.6	3.1	3.1	2.8
	Food Security	2.1	2.1	2.4	2.8	3.7	2.6
		2.3	**2.3**	**2.6**	**2.7**	**3.1**	**2.6**

The methodology has shifted from the PRA approach to identifying Human Security Objectives (HSOs) at the community level. The IVA report for Butaritari applied a different methodology which consisted of rating exercises with the community members to determine the level of impact noticed and by using the HSOs and Livelihood hazards (LAs) as parameters or point of discussion.

Furthermore, this alternative approach used the rating systems to assess the community perspectives in relation to Exposure (Table 17), Sensitivity (Table 18) and Adaptive Capacity (Table 19) and used collected justifications or experiences to support the ratings provided by the community representatives. Focus group discussion and getting experiences shared according to the initial approach for the PRA (refer to PRA method - Abaiang) were not the same as for Butaritari.

Table 17: Exposure Table - Butaritari PRA

Human Security Objectives	Parameters	rating 1-5	Justification
Forest Health	Wet climatic system	2.7	sea & heavy rainfall damage
Coastal Health	wind speed & sea level	2.8	Coastal erosion
		2.7	Overtopping
		2.4	inundation
Water Security	infrastructure	3	lack/poor infrastructure of water sources
Security of place	Wet climatic system	2.5	flooding
	wind speed & sea level	2.8	sea intrusion (erosion, inundation
Energy Security	Wet climatic system	1.5	impact of weather (rainny days)
Income Security	Wet climatic system	2.6	impact of natural hazards
		2.6	

Table 18: Sensitivity table - Butaritari PRA

Human Security Objectives	Parameters	rating 1-5	Justication
Forest Health	Forest and biodiversity	2	pest and disease & rat damage
		2.7	senile of plants
		3	limited space for forest
Coastal Health	food security	2.5	decline of marine resources
Water Security	water resources	4	water salinity (selected sites)
	wet climatic system	2.3	overflow & flooding (heavy rainfall)
Energy Security	electricity	2	Solar kits all damage
Income Security	Biodiversity	1.9	decline of resources (fish, fruits, coconut)
Community Health	Quality of education	4	Education issue (pre-school Notiruru)
Food Security	Forest and biodiversity	2.1	Pest and disease & Rat damage

		2.3	decline of marine resources
		2.6	

Table 19: Adaptive Capacity table - Butaritari PRA

Human Security Objective	Parameters	rating 1-5	Justification
Forest Health	Forest health	1.2	limited agricultural & cleaning tools
		2	limited # of seeds/plant distributed
Water Security	infrastructure	2.1	limited # of water tanks
		2.7	Accessibility issue
Security of place		3.3	lack of adaptation skills/knowledge
	Communication	3	internet issues (accessibility/ availability
		3.1	Transport (for people and cargoes
Energy Security	Training & Knowledge	2.3	higher cost for repairment (solar kit)
		1.9	lack of training (maintenance & repairement)
Income Security	Training & Knowledge	2.6	lack of knowledge (budget & business)
		1.7	lack of storage & market (products & catches)
		2.3	lack of tools (agricultural & fishing)
Community Health	infrastructure	2.9	issue with clinic services
		3.7	lack of sanitation
		3.9	poor infrastructure of clinic
		3.9	Poor management of village fund

The three tables (17,18,19) provide the ratings according to each village where the IVA had been conducted. Information and ratings were collected only using HSO's as headings for each discussion with the village members / community. There is however no indication of who was consulted (gender of the respondents).

While the outputs for each of the assessed parameters (Exposure, Sensitivity and Adaptive Capacity) have been provided. Table 20 highlights that specific elements of the initial PRA approach (e.g Seasonal weather calendar; seasonal plant and animal behaviour calendar) do not feature in the new PRA method applied in Butaritari.

The red zone corresponds to no featured results based on the original PRA method applied on Abaiang.

Table 20 PRA assessment parameters using Exposure, Sensitivity and Adaptive Capacity - Comparing Butaritari to Abaiang

	Abaiang PRA	Butaritari PRA
Assessment Parameters		
Exposure (Seasonal Weather Calendar)		
weather parameter	**2**	0
time scales (before and today)	**2**	0
Periods (months or seasons during a year)	**2**	0
Percieved changes as along as community remembers	**2**	0
scale of change	**2**	0
Exposure (Seasonal plant and animal behaviour calendar)		
plant and fruit parameters (varieties and behaviour such as fruiting and spawning)	2	0
time scales (before and today)	2	0
periods (months and seasons during a year)	2	0
percieved changes	2	0
scale of change	2	0
Sensitivity		
important livelihood paramaters from community perspective on Fisheries	2	0
important livelihood paramaters from community perspective on Agriculture	2	0
important livelihood paramaters from community perspective on food security	2	0
important livelihood paramaters from community perspective on forests	2	0
important livelihood parameters from community perspective on biodiversity	2	0
hazards these parameters are exposed to	2	0
percieved changes	2	0
scale of change	2	0
Adaptive capacity		
Human assets of the village	2	0
Natural assets of the village	2	0
financial assets of the village	2	0
social assets of the village	2	0
physical assets of the village	2	0
strengths	2	0
weaknesses	2	0
opportunities	2	0
threats	2	0
rating of importance	2	0

Step 4. HH surveys

The HH survey applied as part of the IVA approach in Kiribati aims at collecting quantitative data and information based on a set of questions. These questions have been categorised into 10 sections.

Using the two identified evaluation methods (Chapter 4): the results highlighted below for each islands has the overall aim of determining the consistency of the applied approach compared to the pilot IVA (Abaiang). By using the excel spreadsheet below (Table 21), Color coding with the assigned values (0=not met; 1=partially met; 2= Fully met). All 3 of the Islands (Tabiteuea Meang, Butaritari and Kiritimati) have been compared against the Abaiang HH survey approach.

The second part of the results for each of the Island HH surveys analysed here will highlight a narrative to the HH survey approach using the SWOT analysis method. To analyse the results for SWOT analysis, a review of the data and information collected for each of the islands (refer to Chapter 4 – Methods) using the evaluation framework (Chapter 4) for highlighting the consistency, strengths, weakness, opportunities, and threats in relation to the HH survey carried out.

Table 21 provides a comparison of each HH survey methods applied for Abaiang and Butaritari. The green zones show consistency in terms of the methods applied for both Island.

Table 21 HH Survey comparison table for Abaiang and Butaritari

	IVA Abaiang	IVA Butaritari
Household Surveys Questions		
Section1: Background Information	2	2
Section 2: Household profile, skills and movements	2	2
Section 3: General climate change and vulnerability awareness		
What do you think are the most significant problems or challenges faced by your community?	2	2
What do you think may be causing the changes in climate?	2	2
What do you think will be the three most significant effects of climate change in your community?	2	2
Would you consider migrating due to the increase impact of climate change?	2	2
IF "YES" then would you prefer migrating?	2	2
Section 4: Security of place		
Please indicate the level at which your dwelling is at risk from the following events	2	2
What can you do to reduce the respond to the risk?	2	2
Are you confident that your local leaders can work well with other agencies to help your community deal with these risks?	2	2
Section 5: Water security		
Please tick the following boxes (walk around the property to identify water sources, ask selected questions.	2	2
Source (Well or Rainfall)	2	2
Use	2	2
Other sources than well or rainfall	2	2
Does your household experience problems accessing drinking water?	2	2
Is the water supply sufficient to meet your households needs (quantity)?	2	2
Which events can create problems for accessing household drinking water?	2	2
During period of drought or water shortage, what do you rely on for water?	2	2
Please indicate the type of toilet you use (tick more than one box if needed): Bush, Beach, Flush, Compost, Pit Latrine, Other	2	2
Section 6: Food security		
Does your household have access to land to grow food for the household?	2	2
Does your household grow fruits, vegetables and crops?	2	2
If yes, how fertile is the soil to crops and vegetables?	2	2
Does your household raise livestock?	2	2
Does anyone in the household go fishing?	2	2
If yes, please indicate the purpose?	2	2
Section 7: Household income security		
What are the main sources of cash income for your household (tick the box that best matches answers. If 'others', describe them and rank the 3 main sources of income.)	2	2
How many in the household are employed?	2	2
What is your average monthly cash income?	2	2
Please indicate and rank the top 3 obligations or expenses of the household, with 1 being the 'highest impact'.	2	2
Do you usually need cash to prepare for and recover from disasters or emergencies such as severe storms, droughts or floods?	2	2
If yes or sometimes, do you usually have sufficient household cash to prepare for and recover from disasters or emergencies such as severe storms, droughts or floods?	2	2
If yes or sometimes, what is the cash needed for?	2	2
Section 8: Transport and telecommunications	2	2
Section 9: Household health		
Do you or anyone in your household over 5 years of age have difficulty seeing, even if wearing glasses?	2	2
How many people?	2	2
Do you or anyone in your household over 5 years of age have difficulty hearing, even if using a hearing aid?	2	2
How many people?	2	2
Do you or anyone in your household over 5 years of age have difficulty walking or climbing steps?	2	2
How many people?	2	2
Do you or anyone in your household over 5 years of age have difficulty remembering or concentrating?	2	2
How many people?	2	2
Do you or anyone in your household over 5 years of age have difficulty (with self-care such as) washing all over or dressing?	2	2
How many people?	2	2
Using your usual (customary) language, do you or anyone in your household over 5 years of age have difficulty communicating, for example understanding or being understood?	2	2
How many people?	2	2
How many members of your household have any of the following health problems? [Pause after each] [Read out: Diabetes, Heart disease, hypertension/high blood pressure, Cancer , serious anxiety or Depression, serious lower back pain or neck pain]	2	2
In the last 12 months, how many TIMES have people in this household have been diagnosed by a health professional as having one of these illnesses? [pause after reading each] - dengue, zika, chikungunya and/or yellow fever	2	2
Section 10: Community norms, values, beliefs and 'inclusiveness' in decision-making		
We have no control over our future	2	2
Taking actions now will prevent problems in the future	2	2
New ways of solving problems are always accepted by the community	2	2
The community often plans for the future	2	2
My household adheres to community traditional values of collective action (Te aba)	2	2
My community values traditional practices of collective action and cooperation	2	2
Decision-making processes in my community supports traditional values	2	2
Women participate actively in decision making processes	2	2
Young people participate actively in decision making processes	2	2
Conflicts within the community are usually resolved adequately	2	2

Step 5. Field assessments

The KNEG members representing different sectors of the Government viewed vulnerable areas of Butaritari, based on the shared experiences of community members (PRA). The KNEG members had conducted sector related activities (e.g Mangrove planting; copra product valuation, rapid assessment local hotels; coastal resources assessment on the cockles and crustaceans; and water quality sampling). The field assessment contributed to data and information collected for the IVA report formulation.

Using PRA experiences shared on the vulnerable sites identified by village members, the KNEG through the Geo-science division of the Ministry of Fisheries and Marine Resources Development (MFMRD) used GIS to plot and map the vulnerable sites.

Step 6. Review of previous scientific studies, policies, and reports

Upon return from the mission the KNEG held post mission meetings to review external sources of data and information would contribute to the overall formulation of the IVA report.

Step 7. Meta-data analysis

Using data from the PRA, HH survey, field assessment and external sources of information relative to Butaritari, the KNEG held several meetings to analyse data and draft the IVA report. A contribution from the Geo-science division of the Ministry of Fisheries and Marine Resources Development (MFMRD), was the inclusion of Geo spatial maps on coastal vulnerable sites for Butaritari. These results featured as part of the coastal vulnerability mapping analysis within the IVA report.

PRA data was analysed by an assigned group of the KNEG; and the HH survey data was analysed by the National Statistics Officers who had led the HH survey process.

SWOT Analysis for Butaritari

Using the analysis method (mentioned above), the Table 22 (SWOT analysis) provides supporting narratives which outline the consistency of the IVA methods. This analysis only reviews the method in which the HH survey was applied and does not scrutinize the quality of the data entered.

Table 22 SWOT analysis of methods for Butaritari

SWOT Analysis	Butaritari IVA method
Strengths	- IVA report completed using HH survey approach - HH survey covers whole of Island - HH survey was fulfilled by 4 local enumerators (2 covering northern villages, 2 covering southern villages) - Tablets used to conduct HH surveys
Weakness	- Time for HH to be conducted (went over the expected time) - Only 4 local enumerators were trained for the HH survey. - Time and cost issues
Opportunities	- More local enumerators could be trained on the HH survey to match the sample households
Threats	- Data entry (error checking) - While only local enumerator conducted the HH survey, there is no way to check whether all records were checked for errors.

Butaritari IVA report

The IVA report for Butaritari consisted of 7 main chapters:

1. Introduction and background information

2. PRA results using Human Security Objectives (forest health, coastal health, water security, security of place, community health, income security, food security and energy security)
3. HH survey results : Food security; Income Security; Community health;
4. Coastal assessment ; mapping of vulnerabilities results based on PRA
5. Sector specific reports and recommendations
6. Analysis of results (Human Security Objectives against Livelihood Assets)
7. Key findings

The report was developed by the KNEG. As opposed to the original IVA report format (refer to Abaiang IVA).The Butaritari IVA provided information based on the analysis of the PRA and HH surveys only. The additional sections included information from participating sectors in the IVA such as the coastal assessments which were mapped against the PRA results. Much of detailed elements of vulnerability (refer to Abaiang IVA report) are missing.

The level of detail provided for each section of the IVA report reflected only the PRA and HH survey results. No additional or external source of information was used to support the analysis of the results, findings and information featured in the report.

5.4 Kiritimati IVA Summary

Kiritimati Island is in the far east island groups of Kiribati known as the Line and Phoenix Island group. Logistically, there are only 2 flights a week to Kiritimati and would require travelling via Fiji. The IVA mission was fully funded through the World Banks' Third phase of the Kiribati Adaption Programme (KAPIII).

The Kiritimati IVA was led by KNEG members, which included a total number of 7 officers representing different sectors of the Government (Geo-science Division, National Statistics Office, Environmental Health, Lands Division, Agriculture, climate change and disaster risk management and Water). The IVA mission was held from 20th November -14th December, 2017. The total duration of the mission accounts for Kiritimati and IVA missions to Tabuaeran and Teraina.

For Kiritimati, the IVA was conducted over 7 days allowing time for the team to then take the ship to the nearby islands (Tabuaeran and Teraina) to conduct IVAs.

The summary in Table 23 provides an overview of the steps taken by KNEG as part of the IVA mission for Kiritimati. The IVA mission adopts the process outlined in the Abaiang IVA method. However due to a short mission period, the KNEG had made changes to some of the steps within the IVA method.

Prior to the IVA mission, The KNEG team had developed a methodology which included both PRA and HH survey elements into a database using Fulcrum. The aim was to shorten the assessment method while capturing all relevant information for the IVA report.

Table 23 Summary table of the seven step IVA method for Kiritimati

Step 1- Local Consultation	The local council and village heads were informed of the IVA mission to Butaritari. This information was communicated by the KNEG Secretariat.
Step 2 - Field Based studies	Members of the KNEG team were tasked with reviewing existing reports and assessments prior to the Kiritimati IVA mission as per the original framework set out on Abaiang
Step 3 - PRA	The assessment was conducted using Human Security Objectives and Livelihood Assets. Village members scored each HSO (1-5 according their perception of vulnerability)
Step 4 - HH survey	The HH Survey used the original method. However only the first 5 sections were captured for Kiritimati.
Step 5 - Field assessments	No field assessment were conducted due to the limited time of the IVA mission for Kiritimati (one week)
Step 6- Review of previous scientific studies, policies and reports	No additional or external sources of information were used in the formulation of the IVA report. The KNEG used the PRA, HH survey and census data to formulate the IVA report for Kiritimati.
Step 7- Meta-data analysis	The KNEG led this process by analysing PRA and HH survey data and information and national census data for the analysis of results and the formulation of the IVA report for Kiritimati.

Step 1. Local consultation

The KNEG followed the IVA method as part of their planning and preparation for this mission. The notification of the IVA mission was conveyed and agreed to by the Island council. The short time frame for the IVA study of one week was also agreed to by the island council.

Step 2. Field based studies

Members of KNEG team reviewed existing reports prior to the missions as part of their preparation and the development of the profile for Kiritimati and its IVA.

Step 3. PRA

The KNEG members leading the PRA had applied a different methodology for Kiritimati. Instead of the IVA methods assessment parameters using Exposure, Sensitivity and Adaptative. The KNEG used ranking systems which assessed and scored Human Security Objectives (HSOs) against Livelihoods Assets (LA).

The summary in Table 23 of the HSO ratings for Kiritimati provides only the scoring results for each of the 4 villages on Kiritimati (London, Tabwakea, Banana and Poland). This PRA method used village consultations to discuss and score a set of 9 HSOs where a score of 1 to 5 is provided by participants (village members) (1= very vulnerable to 5= less vulnerable). The red scores in the table 24 (below)correspond to the highest vulnerability for the Human Security Objective assessed.

Table 24 Summary of ratings for Kiritimati (HSOs/ LAs)

HSO / Villages	London	Tabwakea	Banana	Poland
Food security	2.4	2.2	2.2	1.2
Water security	2	2.2	1.6	2.6
Income security	3	3	2.6	3
Energy security	2.8	2.6	2.8	3.4
Security of place	2.6	2.2	3.2	3.2
Forest health	2	2.2	2.2	1.6
Coastal health	2.6	2.6	3.6	3.6
Community health	2.2	1.8	1.8	1.6

A comparison of the PRA for Kiritimati and that of Abaiang in Table 25 shows that the PRA method has completely changed and has discarded the parameters identified for Exposure (Seasonal weather calenda); Exposure (seasonal plant and animal behaviour calendar); Sensitivity; Adaptive Capacity and the SWOT analysis).

The red zoning corresponds to the incomplete or missing PRA elements of the Kiritimati PRA compared to the original Abaiang IVA.

the use of the rating system for each HSO complements the formula provided in the literature, in relation to quantifying vulnerability using the following formula:

$$\frac{\text{Exposure X Sensitivity}}{\text{Adaptive Capacity}}$$

The overall vulnerability rating for Kiritimati is 2.5

$$\frac{\text{Exposure X Sensitivity}}{\text{Adaptive Capacity}} \quad \frac{2.6 \text{ X } 2.6}{2.7} \quad = 2.5$$

Table 25 Comparison table of the PRA methods (Abaiang and Kiritimati)

	Abaiang PRA	Kiritimati PRA
Assessment Parameters		
Exposure (Seasonal Weather Calendar)		
weather parameter	**2**	0
time scales (before and today)	**2**	0
Periods (months or seasons during a year)	**2**	0
Percieved changes as along as community remembers	**2**	0
scale of change	**2**	0
Exposure (Seasonal plant and animal behaviour calendar)		
plant and fruit parameters (varieties and behaviour such as fruiting and spawning)	2	0
time scales (before and today)	2	0
periods (months and seasons during a year)	2	0
percieved changes	2	0
scale of change	2	0
Sensitivity		
important livelihood paramaters from community perspective on Fisheries	2	0
important livelihood paramaters from community perspective on Agriculture	2	0
important livelihood paramaters from community perspective on food security	2	0
important livelihood paramaters from community perspective on forests	2	0
important livelihood parameters from community perspective on biodiversity	2	0
hazards these parameters are exposed to	2	0
percieved changes	2	0
scale of change	2	0
Adaptive capacity		
Human assets of the village	2	0
Natural assets of the village	2	0
financial assets of the village	2	0
social assets of the village	2	0
physical assets of the village	2	0
strengths	2	0
weaknesses	2	0
opportunities	2	0
threats	2	0
rating of importance	2	0

Step 4. HH survey

A total of 92 households were surveyed, this accounts for 567 people and represents to 10% of the total households on Kiritimati Island (based on 2015 Population census). However, it is important to note that only sections 1- 5 of the HH survey method were used (see Table 26 – comparison of HH survey methods). The rest of the sections were completely discarded from the HH surveys for Kiritimati. The green codes correspond to information collected using the same questionnaires as the HH surveys (Abaiang), the yellow codes correspond to partial elements of information collected and featured in the IVA report.

The new approach (mentioned above in the SWOT Analysis table) for capturing the HH survey elements for the report uses the PRA Human Security Objectives ranking results to prioritise only 3 key vulnerabilities. For Kiritimati, Community Health, Forest Health and Water Security were ranked as the highest vulnerabilities. Based on these results alone and with the use of other sources (census data, sector reports and findings), the IVA report for Kiritimati was completed.

Table 26 HH survey method comparison (Abaiang and Kiritimati)

Household Surveys Questions	IVA Abaiang	IVA Kiritimati
Section1: Background Information	2	2
Section 2: Household profile, skills and movements	2	2
Section 3: General climate change and vulnerability awareness		
What do you think are the most significant problems or challenges faced by your community?	2	1
What do you think may be causing the changes in climate?	2	1
What do you think will be the three most significant effects of climate change in your community?	2	1
Would you consider migrating due to the increase impact of climate change?	2	1
IF "YES" then would you prefer migrating?	2	1
Section 4: Security of place		
Please indicate the level at which your dwelling is at risk from the following events	2	1
What can you do to reduce the respond to the risk?	2	1
Are you confident that your local leaders can work well with other agencies to help your community deal with these risks?	2	1
Section 5: Water security		
Please tick the following boxes (walk around the property to identify water sources, ask selected questions.	2	1
Source (Well or Rainfall)	2	1
Use	2	1
Other sources than well or rainfall	2	1
Does your household experience problems accessing drinking water?	2	1
Is the water supply sufficient to meet your households needs (quantity)?	2	1
Which events can create problems for accessing household drinking water?	2	1
During period of drought or water shortage, what do you rely on for water?	2	1
Please indicate the type of toilet you use (tick more than one box if needed): Bush, Beach, Flush, Compost, Pit Latrine, Other	2	1
Section 6: Food security		
Does your household have access to land to grow food for the household?	2	0
Does your household grow fruits, vegetables and crops?	2	0
If yes, how fertile is the soil to crops and vegetables?	2	0
Does your household raise livestock?	2	0
Does anyone in the household go fishing?	2	0
If yes, please indicate the purpose?	2	0
Section 7: Household income security		
What are the main sources of cash income for your household (tick the box that best matches answers. If 'others', describe them and rank the 3 main sources of income.)	2	0
How many in the household are employed?	2	0
What is your average monthly cash income?	2	0
Please indicate and rank the top 3 obligations or expenses of the household, with 1 being the 'highest impact'.	2	0
Do you usually need cash to prepare for and recover from disasters or emergencies such as severe storms, droughts or floods?	2	0
If yes or sometimes, do you usually have sufficient household cash to prepare for and recover from disasters or emergencies such as severe storms, droughts or floods?	2	0
If yes or sometimes, what is the cash needed for?	2	0
Section 8: Transport and telecommunications	2	
Section 9: Household health		
Do you or anyone in your household over 5 years of age have difficulty seeing, even if wearing glasses?	2	0
How many people?	2	0
Do you or anyone in your household over 5 years of age have difficulty hearing, even if using a hearing aid?	2	0
How many people?	2	0
Do you or anyone in your household over 5 years of age have difficulty walking or climbing steps?	2	0
How many people?	2	0
Do you or anyone in your household over 5 years of age have difficulty remembering or concentrating?	2	0
How many people?	2	0
Do you or anyone in your household over 5 years of age have difficulty (with self-care such as) washing all over or dressing?	2	0
How many people?	2	0
Using your usual (customary) language, do you or anyone in your household over 5 years of age have difficulty communicating, for example understanding or being understood?	2	0
How many people?	2	0
How many members of your household have any of the following health problems? [Pause after each] [Read out: Diabetes, Heart disease, hypertension/high blood pressure, Cancer , serious anxiety or Depression, serious lower back pain or neck pain]	2	0
In the last 12 months, how many TIMES have people in this household have been diagnosed by a health professional as having one of these illnesses? [pause after reading each] - dengue, zika, chikungunya and/or yellow fever	2	0
Section 10: Community norms, values, beliefs and 'inclusiveness' in decision-making		
We have no control over our future	2	0
Taking actions now will prevent problems in the future	2	0
New ways of solving problems are always accepted by the community	2	0
The community often plans for the future	2	0
My household adheres to community traditional values of collective action (Te aba)	2	0
My community values traditional practices of collective action and cooperation	2	0
Decision-making processes in my community supports traditional values	2	0
Women participate actively in decision making processes	2	0
Young people participate actively in decision making processes	2	0
Conflicts within the community are usually resolved adequately	2	0

Step 5. Field assessment

The KNEG conducted transect walks to plot GIS coordinates of areas affected based on the experiences shared in the PRA. This information was entered onto the tablets and would then be stored onto fulcrum as the database that KNEG would review upon return from the IVA mission.

Step 6. Review of previous scientific studies, policies and reports

The review of the previous scientific studies, policies and reports were not used by KNEG. The IVA for Kiritimati used information from the population census report (2015) and the results from the PRA and HH surveys only.

Step 7. Meta data analysis

Data analysis for the Kiritimati IVA was led by KNEG . The analysis of the PRA scorings matched with their narratives and results from the HH surveys (5 sections only) were analysed for the formulation of the IVA report. Using these three sources which KNEG had produced and source internally to formulate the Kiritimati IVA report.

SWOT analysis for Kiritimati IVA method

Using the SWOT analysis method, the narrative and description of the HH survey approach can be determined. A review of the completed report which highlights the method used and the results for the HH survey component is also used to depict the information in the SWOT analysis (Table 27, below)

Table 27 SWOT analysis of Kiritimati IVA method

SWOT Analysis	Kiritimati IVA method
Strengths	- An IVA report was completed - A new approach was developed and implemented (Livelihood Assets and Human Security Objectives using rating systems only) - Tablet used for HH surveys - New approach has also incorporated transect walks of vulnerable sites
Weakness	- Did not fully follow the HH survey approach (Only 5 sections were covered) - Did not fully capture all sections of the HH survey - New approach may undermine overall IVA methodology and require a total review - There is no record of the number of local enumerators trained (capacity development is essential – transfer of knowledge not applicable in this case)
Opportunities	- A new approach may address efficiency of IVA data collection (PRA and HH survey) - This new approach may or not be effective. - More locals to be trained on the IVA approach and methods
Threats	- Misinterpretation of data and information - Training for local enumerators different from initial HH survey - No records of capacity training of locals for rolling out HH survey component

Kiritimati IVA report

The Kiritimati IVA report consisted of the following chapters and sections:

1. *Introduction*
2. *Background information (Geography and Topography; Meteorology; Natural Environment; Demographic trend; Socio-economic trend)*
3. *IVA framework*

4. *PRA results*
5. *Household surveys (water issues; Health issues)*
6. *Analysis of results and key findings*

The report consisted of 6 sections which were based on the IVA method that the KNEG team had followed. The report shared PRA results and HH survey findings, however compared to the Abaiang IVA, much of the essential information were missing. There were no references or indications as how these results correspond to vulnerability using the three contributing elements of Exposure, Sensitivity and adaptive capacity.

Furthermore, the results the presentation of the results have been selective for the HH surveys with only two sectors being discussed as opposed to highlight all the contributing features based on the results of the HH survey. The prioritization of vulnerable sectors were only featured in the final report.

Lastly, an important feature of the original IVA report (Abaiang) were the adaptation options for each sector assessed in the household surveys. These were not presented in the final IVA report for Kiritimati.

Summary of comparison between Kiritimati IVA and Abaiang IVA

Using the IVA comparison table (Figure 1) to compare each IVA report to the Abaiang Island IVA, the analysis shows that the IVA reports become distant from the original outline. There are many missing elements (sections) to the report which have not been presented. In terms of consistency, the trend shows a decline in the reporting content and outline between all 3 IVA reports. Each report compared has a lower consistency rate than the previous one compared. This means that the content is incomplete in certain sections or not presented at all.

On the other hand, while reports require consistency for ease of reading and as a principle of standardization. It is noted that each island has its differences in terms of context, in this case context was not analysed and the results only depict the findings based on the comparison of the approach undertaken and the IVA report (results based on the IVA approach)

Comparison of four IVAs

The previous sections have presented four IVAs completed in Kiribati between 2013 and 2020. The four IVA show the succession of IVAs over time and indicate that a shift towards more simplified and selective methods to assess vulnerability has been taken. The involvement of external partners supporting different areas and sectors of the IVA process in the Abaiang IVA dwindled with subsequent IVAs. Limited resourcing (funding and technical support) has resulted in changes in process and outcomes. An overview of the main changes are discussed below.

The comparison of the IVAs in terms of the methods (PRA and HH) show that the initial approach, considered to be the most elaborate and complete, was not entirely followed. The variation of approach is likely attributed to the restrictions and limitations in terms of funding and capacities to mimic the same approach and provide the same level of results as for Abaiang.

The study found that the percentage for each IVA showed low percentages in terms of consistency for each of the 3 IVA applied (lower than 50%). This may require a more practical and simplistic approach. The approach undertaken for the last two IVAs (Butaritari and Kiritimati) demonstrate that an IVA report can be produced by only using the HH survey.

Technical team changes and the participation of different IVA research team members may have led to the inconsistencies of reporting for each of the IVAs.

Finances spent on each IVA mission varied. Each island IVA budget varied based on distance, number of research team members (KNEG), the total number of villages to be consulted for the PRA, the number of the HHs to be surveyed and the number of local enumerators to be trained.

The time taken for each IVA also varied and mainly influenced by the amount of funding that the KNEG research had sourced from external partners (donors, projects and programmes). The IVA missions were mainly influenced by the lack of funding available, logistics and the number of villages for each of the four islands.

Methodological shifts were also noticeable across each of the four IVAs. The Household survey method has been shifted from the original method applied on Abaiang. Tabiteuea Meang and Butaritari both used the same HH survey method and approach. However, for Kiritimati Island's IVA, the HH survey method was only partially adopted. Only five sections of the HH survey method were used, therefore capturing information on background information/ context; Household profile, skills, and movements; General climate change and vulnerability awareness; Security of place; and Water security.

In terms of the completeness of the IVA reports, each of the three Islands compared to Abaiang provide shorter and briefer reports as opposed to the thorough assessment report for Abaiang. For the Abaiang IVA report, a total of 82 sections formed the full report whereas for Tabiteuea only 34 sections with information relative to the initial report outline used in the Abaiang IVA report.; Butaritari had only 22 sections with relative information and Kiritimati has only 5 sections. The full extent of the sections for each of the report have not been fully presented and there were missing elements to each of the three reports.

Results, drawn from the SWOT analysis of the IVA methods for each of the three islands assessed, show that the inconsistency and completeness of the IVA report is a result of the lack of funding, the short time frame for conducting the entire mission and the lack of capacity within KNEG in data analysis. Additionally, the shift in methods for Butaritari and Kiritimati for the PRA resulted in brief descriptions of the situation experienced by locals on the Islands, resulting in the lack of information for analysis and interpretation of findings for the KNEG.

Abaiang, only Tabiteuea Meang and Butaritari follow the seven-step approach. However, for Kiritimati, an entirely shortened approach was used. The approach for Kiritimati was shortened due to a change in the IVA method in the PRA.

From the initial Abaiang IVA, the three IVAs which followed had less funding support and only one or two external partners involved in supporting the IVA methods (PRA, HH survey and data analysis).

By comparing all IVAs in this study, results highlight that the IVA reports do not follow the original reporting outline (Abaiang IVA report). There are many missing elements (sections) to each of the IVA reports (Tabiteuea Meang, Butaritari and Kiritimati) which have not been presented. The quality of the analysis and presentation of results has also diminished, and the thoroughness and detailed reporting is missing for the three IVAs compared to Abaiang.

A shift from thoroughness to simplified reporting of IVA results is observed across all three IVAs. The method for fully presenting the vulnerability of the island had changed from using various sources of information and data to only using the PRA and HH survey and sector-based assessments to present the vulnerability of the island assessed. The inconsistency of the reporting format without a clear outline is also observed for the three island IVAs compared to that of Abaiang.

These conclusions suggest that the IVA methods were continuously shifting towards more simplified and selective methods for reporting climate vulnerability. Future IVAs may be conducted in a shorter time frame using only the PRA and HH survey. In terms of the methods used for assessing vulnerability, simplifying the reporting method may take away essential elements of the representing the vulnerability case for each island. The comparison of the IVAs in terms of the methods (PRA and HH) show that the initial approach, considered to be the most elaborate and complete, was not

entirely followed. The variation of approach is likely attributed to the restrictions and limitations in terms of funding and capacities to mimic the same approach and provide the same level of results as for Abaiang.

CHAPTER 6: DISCUSSION/CONCLUSION

Kiribati and other low-lying atolls and coastal communities across the globe continue to be heavily impacted from climate change impacts. It is imperative that evidence-based decision making be well informed through articulated, relevant, and thorough advice. Research in the field of climate change has an obligation to better understand decision making processes based on appropriate methods that serve to guide countries mitigate their risks. As seen in the literature and within the IPCC reports, the succession of the consideration or contextualised understanding of atolls islands and the pacific region are still very broad. To date very little has been done or documented within the Pacific context regarding the progress of IVA processes and reporting. There is a lot to learn from Pacific SIDS and the work taking place to manage the impacts of climate change. The findings of this study are therefore important in the scope of evidence-based decision-making processes for adaptation and in support of adaptation planning. In the case of the Pacific SIDS and using Kiribati as a specific case study the study has tested literature relevant to the field of climate vulnerability by evaluating the progress of Integrated vulnerability assessments in Kiribati.

This study has achieved its intention of analysing a suite of IVAs for Kiribati with the intention of establishing their value for aiding decision-making. This chapter will review the five objectives outlined for research paper and provide details on how they were achieved and how they contribute to innovative thinking.

Integrated Vulnerability Assessment (IVAs) are an important element of adaptation planning, as it provides the evidence based and contextualised local perceptions related to climate impacts. The IVA allows for decisions makers to assess importance and determine priorities to address impacts based on expert options provided. Without evidence-based decision-making processes, this may result in issues such as mal-adaptation or increased impacts and vulnerabilities

This study provides valuable insights to what is known of Pacific SIDS and their progress in addressing the likely impacts of a changing climate. The development of an evaluation framework with its intended purpose of comparing four IVA reports to one another has provided conclusions in terms of how the IVA methods and the IVA reports are applied in Kiribati. These include the different methods applied which have gradually changed over time.

The approach to evaluating the IVAs follows suggestions by Adger (2006); Fussel and Klein (2006) and Gallopin (2006) which demonstrate the evolving nature of concepts, elements and features of vulnerability assessments.

This paper has shared an evaluation on the vulnerability assessments which supports the adaptation planning process for Kiribati. While adaptation planning itself has been well studied through literature and conceptual thinking around the essential contributor of adaptation. As the Pacific region looks

towards sustainable development, resilience and adaptation, the need for more adequate and complete systems that provide evidence-based decision-making process should be highly considered. More research is required on to assess the adequacy, efficiency of reporting through the assessment method adopted and used within the Pacific SIDS region and whether this carries substantial links to solution-based adaptation

The contributions from the IVA report will serve local community decisions making on adaptation; national government processes to determine adaptation priorities; provide the evidence base for financing from regional and international development partners; and will support the evidence base for highlighting the vulnerabilities of PSIDS and based on this specific study, Kiribati. There are many layers to which the IVA and its results can be used. However, the use of the results is only as effective as the quality of the information and results shared and presented.

Kiribati has taken the essential first step to develop the IVA framework for assessing vulnerability and impacts on livelihoods. However, it is also note inadequacies within the methods applied which have been evaluated for the three islands (Tabiteuea Meang, Butarittari and Kiritimati).

This study is an example of the steps that can be taken to not only understand the methods applied in a low-lying atoll nation but to also review through academia the relevance, consistency and placing of the methods applied within the field of climate change adaptation, adaptation planning, Pacific Small Island Developing states and climate vulnerability assessments.

This paper compared three IVAs (Tabiteuea Meang, Butaritari and Kiritimati) against the modelled Abaiang IVA. By assessing the methods applied in each of the three islands, results show that inadequate reporting across the three islands assessed is evident. The shift from a thorough assessment to brief assessments carried out is one of the causes of this inadequacy in reporting. The three IVAs also do not fully capture information and present sufficient information which can be used for adaptation planning, covering all elements and sectors affected.

Lesson Learned and Best Practice

According to the literature on adaptation in the Pacific context, climate vulnerability assessments such as IVAs are a critical element of adaption planning. Best practice in this field consists of a report which provides a complete analysis of all elements of vulnerability to support sector specific adaptation options. A complete report provides analysed information which has taken considered contributors of vulnerability based on external factors (climate observations) and internal factor (PRA and HH surveys). The Integrated vulnerability assessment report for Abaiang captures all the important elements which highlight vulnerability for sectors, people and assets and provide adaptation options for consideration by decision makers. An IVA should combine all these important characteristics.

The integrated approach combines all sectors government, expertise and considers coverage of the human and non-human dimensions of vulnerability is a best practice. The merits of an integrated approach for adaptation which is inclusive of expertise and consists of inclusive methods for assessment (PRA and HH survey) is also a positive characteristic of the IVA.

The evidence basis is critical to informing adaptation-based actions and the consideration of adaptation-based options. There are several elements affecting the quality of IVAs including: time, team composition, capacity, funding, and the application of the assessment methods. These elements are consistent for all three islands reports assessed in this study. For Abaiang, the IVA took two months to complete with constant review and revisits the island. Furthermore, the IVA was well supported by national and international experts from the beginning of the IVA process to the end. The Abaiang IVA was a well-resourced and well supported study. On the other hand, Tabiteuea Meang, Butaritari and Kiritimati used less than then days to complete their IVA mission and were led by national experts comprising of eight to nine team members for each mission. The inconsistent representation of sectors is also contributing factor in terms of the assessment and analysis of results provided within the report.

This is a common issue within Pacific SIDS context, but which have led to innovative and practical approaches led by local experts. Of these practical and innovative approaches, the IVA methods and IVA report apply these best practices but not to its full extent as many missing elements in terms of results capturing sector vulnerabilities.

Integrated approach

The Abaiang IVA is considered as the most completed model for assessing vulnerability in Kiribati. The approach was thorough and inclusive, funding was readily available and allowed for constant review of the finding and results, timing was not a problem and allowed for re-visits to the islands to further confirm results and findings and finally the IVA report was complete and captures all elements of the framework that had been developed. The Abaiang IVA combined various elements and sectors in it process to capture all elements of vulnerability using a multi-sectoral approach.

While in theory the three other IVAs (Tabiteuea Meang, Butaritari and Kiritimati) followed a process that included all the steps shown in the methodology of the IVA (local consultations; field based studies; PRA; HH survey; field assessments; review of existing reports; meta-data analysis) they did not produce reports that will help decision making because of gaps and flaws of the parts of the process.

All three reports (Tabiteuea Meang , Butaritari and Kiritimati), show many missing elements which have been identified and the original nature and format of the IVA report no longer provides the entire extent of parameters for vulnerability across all systems. The reports have become brief and only

capture community perceptions using the PRA method and the HH survey results analysed against one another. The inconsistency of reporting is also noticed across all three reports. The reports are not as thorough as the Abaiang.

Out of the three island IVAs (Tabiteuea Meang, Butaritari and Kiritimati), the use of the HHs was consistent to an extent. The adequacy of field-based methods consisted only of using PRA and HH surveys as opposed to using all the contributing elements in each of the IVA method to produce the IVA. The local consultations were respected and formed part of the initial communications between the KNEG team and the island council; The field-based studies were used to develop the profile of each of the island, however in the case of Kiritimati, the census data was only used; The PRA has been integrated into the results of findings within the reports. While there may have been challenges and constraints during the time of the IVAs for each of the island; The HH surveys for all Islands were completed as this formed part of the essential elements for data and information within the IVA method; The review of existing report and assessment were not always followed by KNEG and finally the adequacy of the results from the meta-data analysis did not fully capture all elements to support adaptation planning and to highlight the elements of vulnerability across the sectors assessed as part of the IVA. The comparative analysis suggests that the initial IVA method has become distant from its original approach for the rest of the IVAs and reporting had also become very brief and did not provide sufficient information.

Financial and technical capacity

A constant challenge observed for all three IVAs is that of funding constraints and the limited technical capacities of local experts in data analysis. Both the challenges limited the time for through assessment and consultations to capture adequate information and data and secondly the lack of capacities for KNEG to analyse results and reflecting these in the final report was consistent with literature shared by Nunn et al. (2021); Walter Leal et al (2021) and Warrick et al (2017).

One of lessons learned from Abaiang is that numerous partners and technical agencies were part of the entire process for formulating the IVA report for Abaiang. The other three IVA did not have the wide support provided through projects and programmes and each of the team members of the IVA mission were funded by their sector budget. While funding may not be the only reason for some of the gaps identified in the IVA process (method, data analysis and reporting), the quality of reporting was also a common issue for the three IVAs assessed (Tabiteuea Meang, Butaritari and Kiritimati).

There are however, still inconsistencies in the process and methods applied (e.g IVA). These inconsistencies seen relate to the methods for the PRA being fully applied, the Field based assessments and review of existing reports were also not fully considered as contributors towards the formulation of the IVA report for each of three island IVAs assessed against Abaiang. It is

however important to note that Kiribati is taking the right steps forward in terms of adaptation planning processes.

Inclusive approach of the IVA methods

The Participatory Rural appraisal conducted through focus groups discussions is an essential feature of the IVA method which allows for gender based and age groups to partake in sharing experiences and perceptions. The nature of this approach is reflective of inclusivity, empowerment and a bottom-up approach within adaptation planning (Shiiba et al., 2023; Piggott-Mackellar et al., 2020)

Across all four islands, consistent approaches to include the voice and views of local villagers provides for positive engagement and open dialogue between the researchers and the participating village members. Furthermore, the focus groups discussions also support gender-based adaptation actions informed by the PRA. The Inclusive approach leads to strengthened engagement between the researchers and the participants (in the case of the IVA, KNEG members and village participants). This further provides the opportunity of ownership where results are provided based on village members' shared views and perceptions.

However, results drawn from the HH survey and PRA methods presented in the three IVAs (Tabiteuea Meang, Butaritari and Kiritimati) have many missing elements. The methods were not applied thoroughly and were incomplete. The results from these methods also have many missing elements which provide an articulate description of the vulnerabilities faced.

Recommendations

According to the challenges and gaps identified in the discussion section of this chapter. There are key elements or parts of the IVA which can be improved and enhanced. This includes data analysis for the PRA and HH survey, how they are analysed against existing scientific reports and assessments so that the final results paint an elaborate and detailed picture of the vulnerability context for the Islands being assessed.

A common issue within the Pacific for carrying out thorough studies and assessment is related to funding limitations. The consideration of practical and low-cost approaches are required in adaptation planning processes such as the IVA. The understanding of interpretation of data and information for each sector involved should be given high importance to ensure adequacy of results of findings. The current IVA methodology and framework for assessing vulnerability in Kiribati provides guidance on the key steps to allow for a thorough study. However, for the three IVAs (Tabiteuea Meang, Butaritari and Kiritimati, the methods keep changing and provide less information and also show inadequacy in terms of the reporting. A shift in the approach and careful consideration of how the results should be presented and how a rapid assessment would capture all the essential elements is important. The quality of the field was limited to only a few days as opposed to conducting

and reviewing collected data and information. Each step of the process in formulating the IVA was consistent however not all steps provided adequate or sufficient data and information to be able to be interpreted and used to shape the entire context in terms of vulnerability for each of the three islands assessed (Tabiteuea Meang, Butaritari and Kiritimati).

For future studies and to improve the IVA method for Kiribati, a substantial review of the methods used, especially the PRA. Whether this would consist of shortening the approach, similar to rapid assessments or by supporting the development of institutional capacities specific to climate data collection and analysis, as a long-term plan.

Conclusion

This study evaluated the methods used in developing IVAs intended to support adaptation planning for Kiribati. This evaluation revealed inconsistencies in the methods applied across the four IVAs. The inconsistent methods may result to two things: 1) concerns about the credibility and completeness of the overall reporting; 2) the attempt to provide brief results using only the essential elements of the IVA method. Despite certain steps of the IVA method not being fully met or consist of insufficiencies in terms of the level of the detail provided from the assessments, it is important that the IVA report meets its intended purpose and objectives.

Noting the findings of this study, the IVA methods are likely to change overtime, there cannot be a single approach for assessing climate vulnerability. However, the shift in methods within the IVA framework must be appropriate and justifiable considering the context and purpose that IVAs are used. This may either do harm to adaptation planning or would lead to challenges of interpretating the validity of the IVA method.

In conclusion, the Pacific SIDS and low-lying atolls continue to be at frontline of climate impacts yet their ability to adapt to climate change should be documented, informed, and then enhanced. Researchers and practitioners have a lot to learn from the Pacific SIDS region which seem to continue to adapt despite limitations in funding, capacities, and technologies. The IVA's provide the technical information and evidence-based elements contributing to the understanding of vulnerability from the context of Kiribati and highlight which sectors are most vulnerable to support decision making for adaptation and adaptation planning, however this must be complemented with enhanced capacities to ensure adequacy of the methods applied and the completeness of results and findings. The IVA will continue to support Kiribati's adaptation planning processes, so it is imperative that measures are put in place to address the essential elements within the methods for reporting on vulnerability, based on the recommendation and discussions presented.

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APPENDICES

1. Participatory Rural Appraisal comparison table
2. Household survey comparison table
3. Integrate Vulnerability Assessment Report comparisons table

Participatory Rural Appraisal comparison table

	Abaiang PRA	Tabiteuea Meang PRA	Butaritari PRA	Kiritimati PRA
Assessment Parameters				
Exposure (Seasonal Weather Calendar)				
weather parameter	**2**	**2**	0	0
time scales (before and today)	**2**	**2**	0	0
Periods (months or seasons during a year)	**2**	**2**	0	0
Percieved changes as along as community remembers	**2**	**2**	0	0
scale of change	**2**	**2**	0	0
Exposure (Seasonal plant and animal behaviour calendar)				
plant and fruit parameters (varieties and behaviour such as fruiting and spawning)	2	2	0	0
time scales (before and today)	2	2	0	0
periods (months and seasons during a year)	2	2	0	0
percieved changes	2	2	0	0
scale of change	2	2	0	0
Sensitivity				
important livelihood paramaters from community perspective on Fisheries	2	2	0	0
important livelihood paramaters from community perspective on Agriculture	2	2	0	0
important livelihood paramaters from community perspective on food security	2	2	0	0
important livelihood paramaters from community perspective on forests	2	2	0	0
important livelihood parameters from community perspective on biodiversity	2	2	0	0
hazards these parameters are exposed to	2	2	0	0
percieved changes	2	2	0	0
scale of change	2	2	0	0
Adaptive capacity				
Human assets of the village	2	1	0	0
Natural assets of the village	2	1	0	0
financial assets of the village	2	1	0	0
social assets of the village	2	1	0	0
physical assets of the village	2	1	0	0
strengths	2	0	0	0
weaknesses	2	0	0	0
opportunities	2	0	0	0
threats	2	0	0	0
rating of importance	2	0	0	0

Household Survey comparison table

	IVA Abaiang	IVA Tabiteuea Meang	IVA Butaritari	IVA Kiritimati
Household Surveys Questions				
Section1: Background Information	2	2	2	2
Section 2: Household profile, skills and movements	2	2	2	2
Section 3: General climate change and vulnerability awareness				
What do you think are the most significant problems or challenges faced by your community?	2	2	2	1
What do you think may be causing the changes in climate?	2	2	2	1
What do you think will be the three most significant effects of climate change in your community?	2	2	2	1
Would you consider migrating due to the increase impact of climate change?	2	2	2	1
IF "YES" then would you prefer migrating?	2	2	2	1
Section 4: Security of place				
Please indicate the level at which your dwelling is at risk from the following events	2	2	2	1
What can you do to reduce the respond to the risk?	2	2	2	1
Are you confident that your local leaders can work well with other agencies to help your community deal with these risks?	2	2	2	1
Section 5: Water security				
Please tick the following boxes (walk around the property to identify water sources, ask selected questions.	2	2	2	1
Source (Well or Rainfall)	2	2	2	1
Use	2	2	2	1
Other sources than well or rainfall	2	2	2	1
Does your household experience problems accessing drinking water?	2	2	2	1
Is the water supply sufficient to meet your households needs (quantity)?	2	2	2	1
Which events can create problems for accessing household drinking water?	2	2	2	1
During period of drought or water shortage, what do you rely on for water?	2	2	2	1
Please indicate the type of toilet you use (tick more than one box if needed): Bush, Beach, Flush, Compost, Pit Latrine, Other	2	2	2	1

Section 6: Food security				
Does your household have access to land to grow food for the household?	2	2	2	0
Does your household grow fruits, vegetables and crops?	2	2	2	0
If yes, how fertile is the soil to crops and vegetables?	2	2	2	0
Does your household raise livestock?	2	2	2	0
Does anyone in the household go fishing?	2	2	2	0
If yes, please indicate the purpose?	2	2	2	0
Section 7: Household income security				
What are the main sources of cash income for your household (tick the box that best matches answers. If 'others', describe them and rank the 3 main sources of income.)	2	2	2	0
How many in the household are employed?	2	2	2	0
What is your average monthly cash income?	2	2	2	0
Please indicate and rank the top 3 obligations or expenses of the household, with 1 being the 'highest impact'.	2	2	2	0
Do you usually need cash to prepare for and recover from disasters or emergencies such as severe storms, droughts or floods?	2	2	2	0
If yes or sometimes, do you usually have sufficient household cash to prepare for and recover from disasters or emergencies such as severe storms, droughts or floods?	2	2	2	0
If yes or sometimes, what is the cash needed for?	2	2	2	0
Section 8: Transport and telecommunications	2	2	2	
Section 9: Household health				
Do you or anyone in your household over 5 years of age have difficulty seeing, even if wearing glasses?	2	2	2	0
How many people?	2	2	2	0
Do you or anyone in your household over 5 years of age have difficulty hearing, even if using a hearing aid?	2	2	2	0
How many people?	2	2	2	0
Do you or anyone in your household over 5 years of age have difficulty walking or climbing steps?	2	2	2	0
How many people?	2	2	2	0
Do you or anyone in your household over 5 years of age have difficulty remembering or concentrating?	2	2	2	0
How many people?	2	2	2	0

Do you or anyone in your household over 5 years of age have difficulty (with self-care such as) washing all over or dressing?	2	2	2	0
How many people?	2	2	2	0
Using your usual (customary) language, do you or anyone in your household over 5 years of age have difficulty communicating, for example understanding or being understood?	2	2	2	0
How many people?	2	2	2	0
How many members of your household have any of the following health problems? [Pause after each] [Read out: Diabetes, Heart disease, hypertension/high blood pressure, Cancer , serious anxiety or Depression, serious lower back pain or neck pain]	2	2	2	0
In the last 12 months, how many TIMES have people in this household have been diagnosed by a health professional as having one of these illnesses? [pause after reading each] - dengue, zika, chikungunya and/or yellow fever	2	2	2	0
Section 10: Community norms, values, beliefs and 'inclusiveness' in decision-making				
We have no control over our future	2	2	2	0
Taking actions now will prevent problems in the future	2	2	2	0
New ways of solving problems are always accepted by the community	2	2	2	0
The community often plans for the future	2	2	2	0
My household adheres to community traditional values of collective action (Te aba)	2	2	2	0
My community values traditional practices of collective action and cooperation	2	2	2	0
Decision-making processes in my community supports traditional values	2	2	2	0
Women participate actively in decision making processes	2	2	2	0
Young people participate actively in decision making processes	2	2	2	0
Conflicts within the community are usually resolved adequately	2	2	2	0

IVA Reports content and structure comparison table

	Outline and content of report	IVA 1 - Abaiang	IVA 2 - Tabiteuea Meang	IVA 3 - Butaritari	IVA 4 - Kiritimati
CONTEXT					
2	Physical geography	2	2	2	2
3	Demography	2	2	2	2
4	Local resource use	2	0	2	2
EXPOSURE TO CLIMATE CHANGE AND DISASTERS: COMPARISON OF TECHNICAL AND LOCAL OBSERVATIONS					
6	Air and sea surface temperature	2	2	1	2
7	Rainfall	2	2	2	2
8	Droughts	2	2	1	1
9	Sea level rise	2	2	1	1
10	Ocean acidification	2	2	1	1
11	Other hazards	2	2	1	1
12	Tsunami	2	1	1	1
13	Epidemics	2	1	1	1
14	Maritime disasters (including oil spills)	2	1	1	1
THE ADAPTIVE CAPACITY OF ABAIANG AND THE SENSITIVITY OF LIVELIHOOD RESOURCES TO CLIMATE CHANGE AND DISASTERS					
16	Ecosystem capacity to support livelihoods needs and sensitivity to climate change and disasters	2	0	2	1
17	Settlement, housing and local sources of energy	2	0	2	1
18	Sensitivity of settlements to climate and disasters	2	2	2	1
19	local perceptions of coastal risk	2	2	2	1
20	Natural water resources	2	2	2	1
21	Accessibility of freshwater resources	2	2	2	1

22	Well types	2	2	2	1
23	Abstraction method from well	2	2	2	1
24	Roofing construction	2	2	2	1
25	Abstraction method from rainwater tank	2	2	2	1
26	Quality of water resources	2	2	2	1
27	Groundwater test sites	2	0	0	1
28	Physical and microbiological results of samples collected	2	0	1	1
29	Effects of various human activities on quality of groundwater	2	1	1	1
30	Sensitivity of natural water resources	2	1	2	1
31	Natural Food resources	2	2	2	1
32	Natural land based food resources	2	2	2	1
33	Poor soil conditions	2	1	1	1
34	Limited availability and quality of water	2	1	2	1
35	Narrow genetic base	2	0	0	0
36	Limited and decreasing access to fruits and vegetables	2	0	0	0
37	Pests and diseases	2	1	1	0
38	Challenges for livestock	2	0	0	0
39	Sensitivty of natural land-based food resources	2	1	1	1
40	Natural marine-based food resources	2	1	1	1
41	Coral reef types and habitats	2	1	1	1
42	Sensitivity of coral reefs to climate change and disasters	2	0	0	1
43	Natural resource-based commodities for household income	2	2	1	0
44	Sensitivty of natural resource-based land commodities to climate and disasters	2	2	1	0
45	Infrastructure capacity to support livelihood needs and sensitivity to climate change and disasters	2	2	0	0
46	Housing and public buildings	2	0	0	0

47	House ownership	2	0	0	0
48	Materials used for floors, roofs and walls	2	0	0	0
49	Sensitivity of housing and public infrastructures to climate and disaster risks	2	0	0	0
50	Water and sanitation infrastructure	2	0	0	1
51	Wate infrastructure	2	0	0	1
52	Toilets and waste disposal facilities	2	0	0	1
53	Economically enabling infrastructure	2	2	0	0
54	transport	2	2	0	0
55	Communication	2	2	0	0
56	Energy	2	0	0	0
57	Education infrastructure	2	2	0	0
58	Education infrastructure sensitivity	2	2	0	0
59	Health infrastructutre sensitivity	2	0	2	0
60	Human capabilities to support livelihood needs and sensitivity to climate change and disasters	2	0	0	1
61	Productive population and dependency ratio	2	0	1	1
62	Knowledge and skills	2	0	0	1
63	Formal education	2	0	0	1
64	Population Health	2	2	2	1
65	Sensitivty of people to the effects of climate change and disasters	2	2	2	1
66	Financial capacity to support livelihood need and sensitivity to climate change and disasters	2	0	0	1
67	The institutional adaptive capacity of Abaiang	2	0	0	1
68	Abaiang governance structure	2	2	0	1
69	Leadership and collective	2	2	0	1
70	Inclusiveness in decision-making	2	2	0	1

71	Managing networks	2	2	0	0
72	Management of livelihood assets	2	2	0	0
ADAPTION OPTIONS					
74	Proposed adaptation options for marine and coastal ecosystems	2	0	1	0
75	Proposed adaptation options for natural water resources	2	0	1	0
76	Proposed adaptation optionss for land-based food resources	2	0	1	0
77	Proposed adaptation options for housing	2	0	0	0
78	Proposed adaptation options for transport	2	0	0	0
79	Proposed adaptation options for communications	2	0	0	0
80	Proposed adaptation options for energy	2	0	1	0
81	Proposed adaptation options for local skills development	2	0	1	0
82	Proposed adaptation options for health	2	0	1	0
83	Proposed adaptation options for traditional knowledge	2	0	0	0
84	Proposed adaptation options for formal education	2	0	0	0
85	Proposed adaptation options for livelihood commodities	2	0	0	0
86	Proposed adaptation options for institutions	2	0	0	0