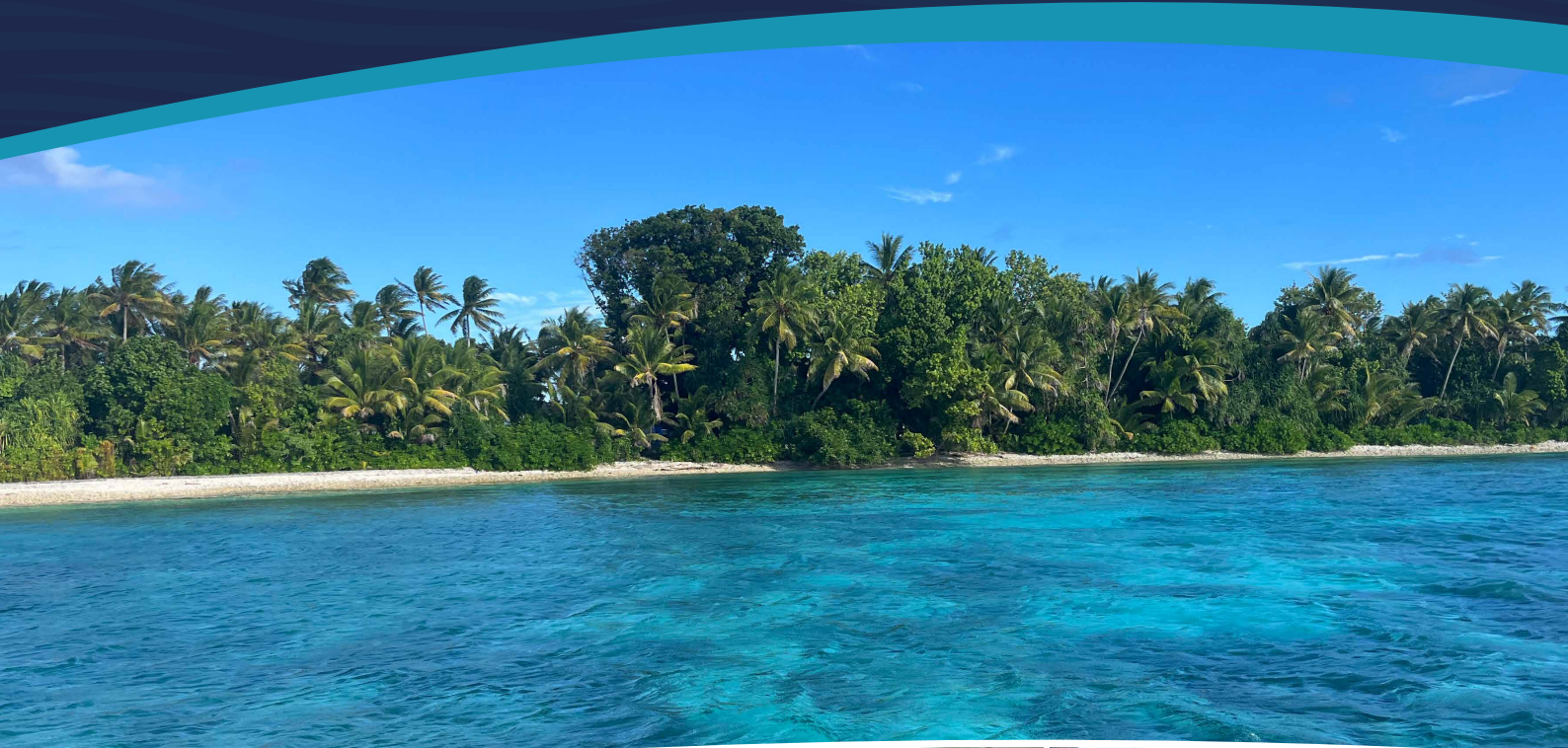


# The Economics of Acting Early

Evidence of climate and disaster actions in the Pacific

February 2024



**Australian  
Aid** 

**Australia Pacific  
Climate Partnership**

## Acknowledgements

This report was developed by the Australia Pacific Climate Partnership in a process led by Jeong Park, with the support of Stephanie Zoll, Anna Cowley, and Daniell Cowley (ANDI Pacific), Anna Gero and Tazrina Chowdhury (Institute for Sustainable Futures, University of Technology Sydney), Aaron Buncle and Buyani Thomy (Outside Partners), Jutta May and Inge Stokkel, with funding from the Australian Government through the Department of Foreign Affairs and Trade. We would like to express sincere appreciation to our experts and the Australian Government for their support.

We would like to thank our project partners who made the Economics of Acting Early research possible – ActionAid Vanuatu, ActionAid Australia, Palau Red Cross Society, Australian Red Cross, International Federation of Red Cross and Red Crescent Societies, World Food Programme, and the United Nations Capital Development Fund.

We also wish to thank field data collectors/volunteers, interview participants and communities for giving their time for interviews and consenting to use their information for this research.

## Disclaimer

This publication has been funded by the Australian Government through the Department of Foreign Affairs and Trade. The views expressed in this publication are the authors' alone and are not necessarily the views of the Australian Government.

This publication is not an academic paper. It is not an evaluation of partner projects or existing instruments already put in place to support the Pacific governments and communities, noting this research is intended to generate more Pacific evidence for informed early actions.

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L to R: Collecting data in the Vuda District, Western Division of Fiji, April 2023. Photograph: Australia Pacific Climate Partnership.

Train the trainer workshops for women community leaders including the Women I Tok Tok Tugeta (Women Talking Together) network in Vanuatu, May 2020. Photograph: ActionAid Australia.

Collecting data on Efate island in Vanuatu, September 2023. Photograph: ActionAid Vanuatu.

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## Abbreviations and Acronyms

AA	Anticipatory Action
ADB	Asian Development Bank
AHP	Australian Humanitarian Partnership
AUD	Australian Dollar
BCR	Benefit-Cost Ratio
BDRCS	Bangladesh Red Crescent Society
CBA	Cost-Benefit Analysis
CCA	Climate Change Adaptation
CCRIF	Caribbean Catastrophe Risk Insurance Facility
CDCCC	Community Disaster and Climate Change Committees [Vanuatu]
CEDAW	Committee on the Elimination of Discrimination Against Women
CERF	Central Emergency Response Fund [United Nations]
COAST	Caribbean Ocean and Aquaculture Sustainability Facility
COSPPac	Climate and Oceans Support Program in the Pacific
CPS	Care and Protection Scheme [Fiji; currently Care and Protection Allowance]
CRAIC	Climate Risk Adaptation and Insurance in the Caribbean [CCRIF]
DL	Damage Level
DREF	Disaster Response Emergency Fund [IFRC]
DRF	Disaster Risk Financing
DRM	Disaster Risk Management
DRR	Disaster Risk Reduction
EUR	European Euro
EWEA	Early Warning Early Action
EWS	Early Warning System
FAIR	Findable, Accessible, Interoperable, Reusable [Data]
FAO	Food and Agriculture Organization [United Nations]
FbA	Forecast-based Action
FbF	Forecast-based Financing
FEMM	Forum Economic Ministers Meeting [Pacific Islands Forum]
FHH	Female-Headed Households
FJD	Fijian Dollar
FRDP	Framework for Resilient Development in the Pacific
GBP	Great Britain Pound
GCF	Green Climate Fund
GDP	Gross Domestic Product
GEDSI	Gender Equality, Disability and Social Inclusion
GFDRR	Global Facility for Disaster Reduction and Recovery
GIS	Geographic Information System
HEA	Household Economy Analysis
IFRC	International Federation of Red Cross and Red Crescent Societies
IG	Information Governance
IMF	International Monetary Fund
IPCC	Intergovernmental Panel on Climate Change
LPP	Livelihood Protection Policy [CCRIF]
MHEWS	Multi-Hazard Early Warning Systems
ML	Most Likely
MRCS	Mongolian Red Cross Society



NDMO	National Disaster Management Office
NEC	National Emergency Committee [Palau]
NEMO	National Emergency Management Office [Palau]
NGO	Non-Government Organisation
NPV	Net Present Value
OCHA	[United Nations] Office for the Coordination of Humanitarian Affairs
PBS	Poverty Benefit Scheme [Fiji; currently Family Assistance Scheme]
PCRAFI	Pacific Catastrophe Risk Assessment and Financing Initiative
PDNA	Post-Disaster Needs Assessment
PIC	Pacific Island Country
PICAP	Pacific Insurance and Climate Adaptation Programme [UNCDF]
PIFS	Pacific Islands Forum Secretariat
PRCS	Palau Red Cross Society
RDAT	Red Cross Disaster Action Team [Palau Red Cross Society]
ROI	Return on Investment
SFERA	Special Fund for Emergency and Rehabilitation Activities [FAO]
SIDS	Small Island Developing States
SMS	Short Messaging Service [text message]
SOGIESC	Sexual Orientation, Gender Identity and/or Expression and Sex Characteristics
SOP	Standard Operating Procedure
SPC	The Pacific Community
SPREP	Secretariat of the Pacific Regional Environment Programme
SPS	Social Pension Scheme [Fiji]
SUFAL	Supporting Flood Forecast-based Action and Learning [Bangladesh]
TC	Tropical Cyclone
UNCDF	United Nations Capital Development Fund
UNDP	United Nations Development Programme
UNDRR	United Nations Office for Disaster Risk Reduction
UNEP	United Nations Environment Programme
UNESCAP	United Nations, Economic and Social Commission for Asia and the Pacific
USD	United States Dollar
VMGD	Vanuatu Meteorological and Geosciences Division
VUV	Vanuatu Vatu
WFP	World Food Programme
WIN-DRR	Women's International Network on Disaster Risk Reduction
WITTT	Women I Tok Tok Tugeta [Vanuatu]
WMO	World Meteorological Organization
WWW	Women's Weather Watch or Women Wetem Weta [Vanuatu]



## Executive Summary

The Pacific island countries (PICs) are among the most exposed and vulnerable countries globally to geophysical and hydro-meteorological hazards. PICs are also susceptible to relatively high economic losses due to climate and disaster events; as such, PICs are constantly preparing for and responding to the effects of climate change and natural hazards.

One of the considerations is investing early to prevent and reduce any adverse impacts of climate change and natural hazards. However, there is limited Pacific evidence to support the policy decisions for ex ante investments. The governments and communities in the Pacific have also been advocating for more evidence that is directly related to their country context to improve transparency and accountability in government decision-making.

Responding to the demand, the Australia Pacific Climate Partnership commissioned the Economics of Acting Early research to generate evidence on the value of early actions in reducing the impact of climate change and disaster events in the Pacific. It is intended to help create incentives for policymakers and other decision-makers to act before a disaster occurs.

The research identified early practices of anticipatory approaches, inclusive climate change adaptation, and disaster risk reduction actions from the Pacific region. The three case studies selected were the early actions by the Palau Red Cross Society, early warning and early action messaging through Women's Weather Watch by ActionAid Vanuatu, and the parametric insurance for social protection by the World Food Programme (WFP) and the United Nations Capital Development Fund (UNCDF) in Fiji. The Vanuatu case study is one of the first studies that measured the economic value of women's participation in climate actions and disaster risk reduction in the Pacific.

Despite different approaches and the degree of program maturity, the key message from these case studies is clear – **there is economic value in acting early**. The case studies demonstrated that early actions, such as early warning information and pre-hazard insurance payout, have greater economic benefits than post-disaster response.

Early warning information is particularly cost-effective if the message does not only provide the hazard information but also practical early actions that households can undertake. The analysis of the Women's Weather Watch or Women Wetem Weta (WWW) estimated that for every \$1 invested, there is a corresponding benefit of \$4.40. This benefit underscores the value of WWW early warning messages in communities with no access to the National Disaster Management Office (NDMO) messages.

The Palau case study was a great example of localised early actions, symbolising an anticipatory approach that is practical and relevant to the context of a Pacific small island country. In particular, it underpinned the importance of having locally-available funds for early actions, as well as proactive behaviours enabling the Palau Red Cross Society (PRCS) early actions to alleviate suffering during Typhoon Surigae.

The Palau case study showed key ingredients necessary for enabling early actions – local capacity in the form of trained Red Cross Disaster Action Teams (RDATs) facilitating early actions; risk data and information as well as early warning systems triggering early actions; and the local fund that enabled the PRCS to mobilise RDAT. All of these are the elements of effective early actions, especially in rapidly evolving disaster situations. The case study further indicated the necessity of considering early actions in the national disaster risk management (DRM) environment, including DRM governance and financing arrangements.

The Vanuatu case study confirmed that after receiving early warning messages, communities take preventative actions to protect their assets and minimise potential losses. They did this, for example, by undertaking early crop harvests and strengthening their houses before a major disaster event, contributing to the benefit-cost ratio of 4.4.

The Vanuatu case study also verified that empowering women in multi-hazard early warning systems, and climate and disaster resilience activities more broadly, could lead to transformative social impacts. These non-economic benefits are grouped into seven benefit streams in this publication, where evidence highlights gender-transformative changes for all women participating in the research.

The Fiji case study showed that there were no reported negative coping strategies in the Vuda district, and consequently a benefit-cost ratio of less than one. While the Fiji case study is only reflective of the Vuda district, it showed that existing social protection systems could help cushion the impact of shocks and help keep recipient households above the survival threshold when disasters occur. The vertical expansion of existing social protection schemes through top-ups before (or after) a disaster, therefore, would be a more cost-effective mechanism than parametric microinsurance to deliver social protection objectives in times of disasters, especially in the context of Vuda where the research took place.

The Fiji case study estimated the potential benefit of early insurance payouts or cash transfers prior to a hazard event, as it showed an increased purchasing power benefit of 37 to 41 per cent for pre-hazard insurance payouts compared to post-hazard payouts.

These case studies reiterated the importance of governments and communities needing a range of disaster risk financing (DRF) approaches, and 'risk layering' to manage the impact of disasters pre-emptively and intentionally include marginalised groups. Compounding shocks put pressure on formal and informal support networks, which means people could fall below the survival

threshold. In such complex situations, access to regular and predictable social protection, parametric microinsurance, and early warning and early action information, all play an important role. Furthermore, the case studies signalled the importance of embedding early action within national DRM systems and governance arrangements, and in national risk financing strategies.

## Summary of policy insights from this research

### Social and behavioural change

- Early warning systems and early action initiatives not only have economic value but also change social norms and behaviours.
- Early warning information increases community confidence to undertake preparedness measures before a major hazard event.
- Early warning information allows communities to take preventative actions to protect their assets and minimise their losses before a major hazard event.

### Practicality of early warning information

- An effective early warning system (at national and community levels) is the foundation of any early action.
- Early warning information is most effective if the message not only provides the hazard information but also practical early actions that households can undertake.

### Gender and inclusivity

- Empowering and including women in early warning information, as well as broader climate and disaster resilience activities, leads to transformative social impacts.
- Early action messages from women to women have seen shifts in gender norms and have supported inclusive early warning and early action. Civil society networks, and women's networks in particular, are critical in broadening the reach of early warning and early action information, especially to marginalised groups.

### Optimising social protection systems

- Social protection systems help cushion the impact of hazard events and can help keep recipients above the survival threshold when disasters occur.
- Vertical expansion (top-ups) through existing social protection systems is an effective and efficient way to protect livelihoods in times of disaster.

### Local and existing framework

- Existing early action protocols, accessible local financing, and local presence, enable efficient early actions that sit within a locally-led development framework.
- Strengthening existing capacities, including the availability and quality of early warning data, information and systems, alongside locally-available human and financial resources, is key to enabling early action.

### Finance risk layering

- Governments and communities need a range of DRF instruments, otherwise known as 'risk layering', to manage the impact of hazard events pre-emptively.
- Early action needs to be embedded within national DRM systems and governance arrangements, and in national risk financing strategies.
- Insurance payouts or cash transfers prior to a hazard event can result in increased purchasing power compared to post-hazard delivery of payouts. As such, parametric microinsurance provides another mechanism for households, which could be used as an early action approach.

### Economic studies

- The economic cost-benefit analysis and social impact assessments provide Pacific governments, development partners, and other non-government organisations, with an evidence base and data to make more informed investment decisions.
- Economic studies provide the opportunity to learn and adapt programs to achieve better outcomes and to minimise the impact of hazardous events on people, livelihoods, and nations as a whole. As such, further studies are encouraged to inform policy, particularly on early action approaches.





## Introduction

The Pacific island countries are among the most exposed and vulnerable countries globally to geophysical and hydro-meteorological hazards. PICs are also susceptible to relatively high economic losses due to disasters, with average annual losses ranging from one to 10 per cent of their gross domestic product (GDP), and humanitarian needs often high (UNESCAP, 2020).

The impact of natural hazards can be reduced through disaster risk reduction, climate adaptation and mitigation, and increased disaster preparedness. Among humanitarian and development policymakers and practitioners, there is also an increasing narrative on the need to shift humanitarian action forward. Dialogue on Anticipatory Action (AA) asks 'why wait' until a natural hazard turns into a disaster, 'why not respond before' the event and minimise hazard impact.

The economics – especially the net benefit – of acting early to climate change and natural hazard events have not been properly studied for the Pacific. Global research shows that the response actions that are made one month earlier will have a gain of 0.8 per cent of income per capita in the long run (Hill, 2023).

There are many other gains from taking early action prior to hazards occurring; for example, avoiding negative coping mechanisms such as taking on unrealistic loans and selling productive household assets.

The value of acting early also prevails in climate actions. The Intergovernmental Panel on Climate Change (IPCC) Sixth Assessment Report posits that the global economic benefit of limiting warming to 2°C is reported to exceed the cost of mitigation (IPCC, 2022). While there is no specific cost-benefit ratio introduced in the Sixth Assessment Report, the value is often presented as the cost of inaction. For example, it is estimated that climate inaction would cost Asia-Pacific economies USD97 trillion by 2070 (Deloitte, 2021).

The global and regional economic figures are useful. However, it is not as relevant to apply these in the context of PICs, where a combined population of 2.56 million people is contributing to 0.01 per cent of the world's economy. As such, PICs have been advocating for more evidence that is directly related to their country contexts to improve transparency and accountability in government decision-making, including evidence-based choices of projects, policies and initiatives.



Hanuabada Still Village over water, Port Moresby, Papua New Guinea. Photograph: RGAPhoto86/Shutterstock.com.





Responding to the demand, the Australia Pacific Climate Partnership commissioned the Economics of Acting Early research to generate evidence on the value of early actions in reducing the impact of climate change and disasters in the Pacific. This research helps create incentives for policymakers and other decision-makers to act before a disaster occurs.

Recognising the vast range of projects, policies and initiatives that can be considered as examples of early actions, the Economics of Acting Early research confined its scope to two specific topic areas, which are: (a) anticipatory approach and early warning systems; and (b) inclusive climate change adaptation (CCA) and disaster risk reduction (DRR).

This publication introduces three case studies from the Pacific, carefully chosen to demonstrate the characteristics and the potential of early CCA and DRR actions, and which demonstrate early actions, women-led early warning messages, and parametric insurance for social protection.

## About this publication

This research is not intended to define the concept of Anticipatory Action or anticipatory approaches (see Box 1). Where possible, therefore, it chooses to use the term, 'early actions' for simplicity and consistency.

By generating Pacific-focused economic evidence for early CCA and DRR actions, this publication noted three distinguished methods or typologies for delivering early actions, especially from the perspective of receiving entities. They are shown in the forms of: (a) localised in-kind support; (b) early warning information; and (c) insurance payouts.

The early action by the Palau Red Cross Society (section 1) is an example of localised in-kind support. Women's Weather Watch or Women Wetem Weta by ActionAid Vanuatu (section 2) showcases the early warning information typology, which also examines the economic value of

women's participation and leadership in CCA and DRR. This study is one of the first studies in the Pacific – and in the world – applying an economic lens to understand women's role in CCA and DRR. The parametric insurance for social protection by the World Food Programme and the United Nations Capital Development Fund in Fiji (section 3) represents the insurance payouts.

The three case studies include relevant global and regional examples of early actions, women-led early warning messages, and parametric insurance schemes for social protection, respectively, before examining the case study examples in detail. Consequently, each of the case studies follows a sequential order of global examples, regional examples, and the specific in-country case study. It is worth noting that the Palau case study only captures secondary information, as primary data collection and associated economic analysis in the country did not take place.

Lastly, this publication emphasises the importance of information governance for anticipatory approaches and multi-hazards early warning systems (section 4), before concluding with the key messages and policy insights.



**'When we were young, we were just told... to bunker down and wait. Nowadays we have the forecasts and finances to act early.'**

*Maireng Sengebau, Palau Red Cross Society Executive Director and WIN-DRR Finalist in 2022. Photograph: UNDRR.*



Women in Vanuatu participating in ActionAid capacity building activities. Photograph: ActionAid Australia.



# 1. Case Study – Local Early Actions

To explore the topic of local early actions in this publication, this section refers to the current context and global and local examples, before leading into a case study developed to examine localised early actions by the Palau Red Cross Society.

Their efforts represented an anticipatory approach that is practical and relevant to the context of a Pacific small island country. Although a formal anticipatory approach was yet to be established, PRCS initiated early actions through the network of trained Red Cross Disaster Action Teams. In particular, PRCS applied an innovative way of managing financial resources, suggesting practical local solutions to manage a major disaster event.

## 1.1 Context

Strengthening financial resilience and preparedness for rapid and slow-onset hazard events requires a strategic approach to disaster risk financing. This approach must consider the potential frequency and severity of different events, risks, and levels of exposure, all of which have cost implications. The effectiveness of risk financing instruments for different risks can be significantly improved when different types of instruments are strategically combined to maximise coverage and reduce gaps in protection. Financial resource needs can be broadly broken down into ex ante financing needs (for which resources are spent in preparedness before an event takes place), and ex post needs (for which resources are spent after an event occurs). While the costs of ex ante and ex post financing needs are borne at different points, both need to be considered before an event occurs.

While many donors continue to react after a crisis, a different approach is needed to reduce the impacts of an imminent hazard and build resilience in advance. Over the last decade, the potential value of delivering funds prior to adverse disaster impacts has spurred innovation in the humanitarian world. The need for funding availability before a hazard event has given rise to a creative form of disaster risk financing.

## 1.2 Anticipatory Approaches and Financing Mechanisms

The humanitarian system generally focuses on activating financing for responses to disasters, and only rarely do Anticipatory Actions get resourced in a timely manner. Recent advances in data availability, and improvements in weather forecasting models and early warning systems, provide the opportunity to act earlier and faster before a shock occurs and/or stresses build up. Anticipating and providing assistance ahead of the peak impacts of shocks can minimise or avert impacts, thereby building resilience (Chaves-Gonzalez et al., 2022).

### Box 1: Anticipatory Action

Anticipatory Action is an activity that takes place prior to an extreme weather event and is based on a forecast trigger, to mitigate the anticipated impact on food security, lives and livelihoods. It is considered to be a synonym of early action, as well as early warning early action, forecast-based financing/ forecast-based actions, and forecast-based early action in the context of preparedness and early response (de Wit, 2019).

Different terms are used depending on the context and organisational mandates. However, regardless of the terms used, they are organised around three building blocks – triggers and warning; pre-agreed actions; and, most importantly, pre-arranged financing (Davila et al., 2022).

In reality, the boundaries are blurred between Anticipatory Action and broader resilience work, or between early response and more 'normal' crisis response (Scott, 2022).

The literature around anticipatory approaches and financing mechanisms enabling local early action demonstrates that these approaches can be fast, effective and dignified. Global studies are building an evidence base that demonstrates that early action can protect hard-won development gains, as well as contribute to accountability and localisation (Chaves-Gonzalez et al., 2022).

While there is no internationally-agreed definition of anticipatory action financing, it is commonly referred to as anticipatory financing (Scott, 2022). Over the last decade, anticipatory financing has gained momentum and, while it was mainly humanitarian actors such as the International Federation of Red Cross and Red Crescent Societies (IFRC) that invested in this area initially, more recently development partners have revised existing global disaster relief and emergency funds to include provisions for anticipatory financing. The United Nations Office for the Coordination of Humanitarian Affairs (OCHA), the World Food Programme, humanitarian organisations under the START Network, and the Food and Agriculture Organization (FAO), have established different finance mechanisms to fund anticipatory approaches.

The FAO has been a long-time advocate of anticipatory interventions, and works closely with governments and partners in the humanitarian and scientific communities to anticipate crises. FAO revised its Special Fund for Emergency and Rehabilitation Activities (SFERA) to include an early action window. In line with FAO's mandate, Anticipatory Actions can range from cash transfers that

help fishers store their gear ahead of a cyclone, to livestock treatments that boost the health of a goat farmer's herd ahead of a drought. Anticipatory Action may build flood defences that protect crops against a severe rainy season or provide agricultural inputs and technical support to increase food production ahead of potential food crises (FAO, 2019).

In 2018, the OCHA worked with donors, implementing organisations, governments, and experts, to promote change toward a more anticipatory approach. The OCHA has recently included an initial commitment of up to USD140 million from its global Central Emergency Response Fund (CERF) to develop 12 pilot Anticipatory Action Frameworks for different shocks, including drought, flooding, cyclones, and communicable disease outbreaks. Between July 2020 and June 2022, an estimated 2.2 million people in Somalia, Ethiopia, and Bangladesh, were reached through OCHA-facilitated Anticipatory Action. The CERF spent just over USD60 million on these pilots, representing more than six per cent of its total spending over the same period. The OCHA has also finalised frameworks in Burkina Faso, Nepal, Niger, the Philippines, and Malawi, covering more than 2.3 million people and providing USD58.5 million of pre-arranged finance for action, should triggers be reached (Chaves-Gonzalez et al., 2022).

### 1.2.1 Early Action Protocols

Forecast-based Financing (FbF) by the IFRC emerged as an anticipatory approach as early as 2007, and has been further developed and tested through pilot projects globally, setting the trigger, selecting early actions, and designing the monitoring framework. FbF follows a no-regrets approach – it can reduce the burden of emergency response and make it more effective, even if the crisis does not turn into an extreme event.

FbF promotes coordination and relationship building among key actors at the intersection of practice, research, and policy. FbF also aims to strengthen national Red Cross Red Crescent Societies' capacity to adopt and deliver anticipatory humanitarian action locally. The output of the FbF process is an Early Action Protocol (IFRC, 2022a).

To support the implementation of the approved Early Action Protocols and to ensure that national societies have access to funds before a disaster strikes, IFRC established Forecast-based Action (FbA) by the Disaster Response Emergency Fund (DREF) in 2018 (IFRC, 2019). It is now called the Anticipatory Pillar of the DREF.

IFRC noted that the FbA by the DREF or the Anticipatory Pillar of the DREF has ignited the scaling up of AA taken by national societies before the impact of an event to mitigate its effects, allowing communities to take action, save lives, and reduce the need for post-disaster response (IFRC, 2020a). The DREF has evolved to be an agile, fast, transparent, and localised way for national societies to access reliable international funding for emergency response at the community level and for all kinds of disasters (IFRC, 2023). The funds have been allocated for AA and response to imminent, small and larger disasters and crises, through a combination of expert judgment when analysis is needed at the time of allocation, and fully automated when skilled scientific forecasts of humanitarian

impact exist. The range of situations addressed by national societies through DREF resourcing is diverse and includes weather-related disasters, earthquakes, volcanic eruptions, social unrest, forced migration, and acts of violence.

One of the milestones for 2023 is the allocation of 15 per cent of the overall DREF funds to AA (IFRC, 2023). In addition to the overall increase, the amount that was allocated for AA or responding to imminent crises has shown a fivefold increase since 2015 (IFRC, 2022b). IFRC aims to continuously increase the DREF AA allocations for weather and non-weather-related events, reaching at least 25 per cent of the total allocations by 2025 (IFRC, 2020a).

In cases where the magnitude of the hazard forecasted will have a greater impact than the early action protocol, the early actions may be scaled up with a grant allocation from DREF. Alternatively, if the hazard will result in a disaster with larger-than-anticipated humanitarian consequences, the national society can request a grant from the DREF for response activities or an Emergency Appeal with a start-up loan from the DREF.

## 1.3 Global Examples of Early Actions

### 1.3.1 Economic feasibility of global financing mechanisms enabling local early actions

In addition to reducing suffering, saving lives, and protecting livelihoods, anticipatory approaches and early actions make sense from a financial standpoint. However, despite the increasing attention internationally, a systemic shift in funding flows is yet to be seen, with AA continuing to receive a small proportion of the overall amount of humanitarian financing. While several global funds have AA windows, these often represent a small percentage of the overall fund. The CERF's AA activity is the largest, with most of the other AA funds operating at less than USD10 million (Scott, 2022).

Since 2017, FAO has been collecting empirical evidence to demonstrate the importance of AA. These studies, which have been conducted from Sudan to the Philippines, show that every USD1 invested can create a return for farming families of more than USD7 in avoided losses and added benefits. However, the benefits of these interventions go beyond the monetary realm. Speaking to individuals, community leaders, and government partners, FAO has also found that these interventions fund preparedness activities that can help curb food insecurity, support resilience efforts, and provide a more dignified way of approaching humanitarian aid (FAO, 2021).

Following a three-year pilot project on early action funds, in which GBP100,000 was made available to three countries (including Ethiopia) prone to predictable slow-onset food and nutrition crises, Save the Children conducted a social cost-benefit analysis in 2018 to determine whether early actions can support households enough to deter them from using negative coping mechanisms that would impact their immediate food security and livelihoods and erode their resilience in the medium- to long-term. The results of the review showed clearly that the early action



funds were a valuable investment, mitigating the effects of negative household coping strategies (i.e. estimated social and economic loss in value) far in excess of the original expenditure of GBP124 per household, when compared to a humanitarian response only. Focusing on the return on investment (ROI) for value, for every GBP1 spent on the early action, the target households received GBP2.58 in social value on average, when compared to households that only received a humanitarian response (Atkinson, 2018).

An impact evaluation led by the University of Oxford and the Centre for Disaster Protection found that cash transfers received in advance of extreme flooding in Bangladesh not only provided immediate relief by protecting food security, but also helped households change their behaviours to mitigate the flood impact. After three months, recipient households had higher food consumption, well-being and earning potential compared to non-beneficiaries. These effects were largest for households that received the cash earlier relative to the flood trajectory (Chaves-Gonzalez et al., 2022).

### 1.3.2 Red Cross Red Crescent examples

Livestock represents the only source of income for more than one-third of Mongolian households. Extreme winters, also known as *dzud*, threaten their pastoralist livelihoods by reducing pasture availability and increasing herd mortality. To help curb suffering and losses before they occur, humanitarian organisations such as the Mongolian Red Cross Society (MRCS) and the FAO established FbF and AA mechanisms, respectively (IFRC, 2021a)<sup>1</sup>.

Based on forecast information and the *dzud* risk map produced by the government, MRCS and FAO triggered their FbF/AA mechanisms in January 2020 to mitigate *dzud* impacts. Both agencies delivered unconditional cash grants and animal care kits to 1,450 of the most vulnerable herders across 12 provinces and 83 *soums*, the administrative divisions of inhabited areas in Mongolia. In addition, MRCS mounted an emergency response in March 2020 to help an additional 1,750 households across 15 provinces and 82 *soums* with funds from the IFRC Disaster Response Emergency Fund (IFRC, 2021a).

An evaluation study by IFRC (2021a), which aimed at understanding the impacts of FbF/AA on herder households in protecting them from the negative impacts of *dzud* in Mongolia, assessed whether and to what extent forecast-based early assistance with cash grants and animal care kits helped the beneficiaries to avoid or reduce negative impacts of *dzud*. Table 1 captures the costs and benefits, as well as the benefit-cost ratio (BCR) of MRCS FbF, FAO AA, and MRCS DREF response. It suggests that for every USD1 invested in MRCS FbF, FAO AA, and MRCS DREF response, the households received a benefit of USD1.05, USD1.26, and USD1.71, respectively. In summary, the benefit outweighs the investment.

The Bangladesh Red Crescent Society (BDRCS) activated its Early Action Protocol for the first time in May 2020 to respond to Cyclone Amphan, reaching 192 shelters in the 10 most vulnerable districts with early actions before the cyclone made landfall. Around 36,500 beneficiaries were reached and provided with dry food, safe drinking water, masks, hand sanitiser, and soap to cope with hygiene security due to the COVID-19 pandemic. Shelters were disinfected before the evacuation. Livestock were also evacuated to shelters (IFRC, 2020b).

The key early actions of the BDRCS Early Action Protocol included the distribution of food and drinking water, provision of basic first aid, installation of light facilities at night at the community shelters, and evacuation transportation of people with their movable assets and livestock to the cyclone shelters. The early actions were intended to reduce the impact of the cyclone by incentivising the population to evacuate to the cyclone shelters. The underlying rationale was that by providing evacuation transportation (for people and livestock) and emergency assistance, the evacuation ratio could be increased, thereby reducing both the loss of lives and the loss of livelihoods. IFRC (2020b) concluded that the implementation of the Early Action Protocol was successful amid COVID-19, as the pre-arranged protocols improved the effectiveness and efficiency of the BDRCS local actions before the cyclone landfall, ending up with the total beneficiary number far exceeding the Early Action Protocol initial target figure of up to 20,000 people.

**Table 1: Summary of costs and benefits, and benefit-cost ratio**

Return on investment (ROI) analysis	MRCS FbF	FAO AA	MRCS DREF Response
<b>Costs (USD/HH)</b>	<b>200.44</b>	<b>280.00</b>	<b>167.18</b>
<b>Benefits</b>			
Animals saved (adult)	110.05	222.11	119.94
Avoided loss of herd value (body conditions)	54.09	125.43	131.66
Animals saved (new-born)	45.23	8.13	34.40
Avoided loss of livestock production value	0.63	-2.26	0.39
<b>Benefits (USD/HH)</b>	<b>210.00</b>	<b>353.41</b>	<b>286.39</b>
<b>Benefit-Cost Ratio (BCR)</b>	<b>1.05</b>	<b>1.26</b>	<b>1.71</b>

(IFRC, 2021a)

<sup>1</sup> In the IFRC document (2021a), FbF and AA are synonymous.



## 1.4 Early Actions in the Pacific

Given the Pacific's high vulnerability to climate change and disaster risk, and the need for a more strategic approach to protect the economy and people from adverse impacts of disasters, the two Pacific island countries of Tonga and Samoa have developed a national disaster risk financing strategy or policy. The collective effort of building financial resilience through the development of the national disaster risk financing strategy is being coordinated by the Disaster Risk Financing Technical Working Group, led by the Pacific Islands Forum Secretariat (PIFS).<sup>2</sup>

For the Pacific national societies, the Australian Red Cross, with the support of the IFRC, the Red Cross Red Crescent Climate Centre (the Climate Centre), and the Secretariat of the Pacific Regional Environment Programme (SPREP), commissioned a scoping study in 2016 for Fiji, Papua New Guinea, and Solomon Islands. Its key findings led to the development of an FbF Roadmap on drought in Solomon Islands, although it was not implemented. Nonetheless, it prompted the former Director of the Solomon Islands National Disaster Management Office and the Pacific Delegation to the 2018 Asian Ministerial Conference on Disaster Risk Reduction to advocate for the institutionalisation of FbF systems in the Pacific, resulting in the inclusion of FbF in the Ulaanbaatar Declaration of 2018, through which the ministers called for the scale-up of effective early warning systems and their translation into early action, including for hard-to-reach and remote populations (UNDRR, 2018).

The Solomon Islands Government further developed a drought early action plan with support from the FAO. Similar drought early action plans were developed for the Federated States of Micronesia and the Republic of the Marshall Islands (FAO, 2017).

Separately, IFRC and the Climate Centre, with assistance from the Climate and Oceans Support Program in the Pacific (COSPPac) and SPREP, increased efforts around Early Action Rainfall Watch in targeted PICs, which provides disaster managers with a brief summary of recent rainfall patterns, particularly drought and the rainfall outlook for the coming months. However, it was not considered as a fully implemented AA.

In recent years, there has been increasing interest in advancing anticipatory approaches in the Pacific. For example, the United Nations Environment Programme (UNEP), the IFRC, and the Climate Centre, are currently working to strengthen early warning early action (EWEA) in the Pacific. The Climate Centre is appointed as a regional technical partner for the Green Climate Fund (GCF)-funded programme, Enhancing Climate Information and Knowledge Services for Resilience in Five Island Countries of the Pacific Ocean, which covers a wide range of activities, including

climate services, regional and country observational and forecasting capacity, and country-level early warning systems, in the Republic of the Marshall Islands, Tuvalu, Palau, Cook Islands, and Niue. The EWEA pillar particularly focuses on three sub-tasks, which are the early warning early action roadmaps, capacity building, and the development of early action protocols (GCF, 2020).

In March 2023, the inaugural Pacific Week of Anticipatory Action in Fiji brought together over 80 participants, including representatives from national meteorological services, national disaster management offices, and Pacific national societies, representing 15 PICs and regional partners, to discuss how to better prepare for and take action before disaster strikes. The main messages included:

- While aspects of Anticipatory Action exist in the Pacific (early warning systems, preparedness/quick response actions, and funding pools), they are often not streamlined in a system. The approach is not new to the region, but the different elements need refining and pulling together into a coherent system.
- Anticipatory Action in the region has been more commonly known as Early Warning Early Action (EWEA) or Forecast-based Financing. While regional and global forums have moved towards Anticipatory Action as a core term to describe the approach, in the Pacific, the term may need to revert back to its original roots or be reviewed through national-level dialogues for how easy or difficult it would be to switch to AA.
- There is a need for setting up systems and practices and funding activations; therefore, scale-up and financing of Anticipatory Actions need to be explored in-depth. Prior to scale-up, it is critical to better understand the Pacific context and its specific challenges, build evidence on approaches, and collectively explore Pacific-based solutions that can be tested.

At the same meeting, the OCHA announced the first CERF-funded AA pilot in the Pacific. The AA pilot will be led by OCHA Pacific in close collaboration with the broader humanitarian team and will be activated for the 2023–2024 cyclone season in Fiji.

As a separate pilot, the United Nations Office for Disaster Risk Reduction (UNDRR) is applying AA elements in an existing parametric microinsurance scheme in Fiji for the 2023–2024 cyclone season. Several non-government organisations under the Australian Humanitarian Partnership (AHP) are also experimenting with different locally-focused AA pilots in Papua New Guinea, Solomon Islands, Timor-Leste, and Vanuatu.

<sup>2</sup> The Disaster Risk Financing Technical Working Group was established in 2019 in response to a need to better understand the current landscape of existing disaster risk financing mechanisms available to the region and the gaps. The 2021 Pacific Forum Economic Ministers Meeting (FEMM) endorsed the working group as an advisory group to the FEMM on disaster risk financing. It is one of the working groups established under the Pacific Resilience Partnership, which is the umbrella implementation mechanism for the Framework for Resilient Development in the Pacific (FRDP).



## 1.5 Local Early Actions by the Palau Red Cross Society

A tropical disturbance was formed near the Federated States of Micronesia and Palau on 13 April 2021, which was eventually upgraded into Typhoon Surigae on 16 April. Typhoon Surigae passed over the north of Palau, close to Kayangel State. Heavy rainfall and high winds with speeds of up to 136 kilometres per hour caused big swells, power outages, communication service disruptions, water cuts, fallen debris, road blockages, and landslides. All 16 states across the main island and five outer islands of Palau were affected by excessive rain and high winds. The rain and wind blew roofs off houses and damaged critical water and power infrastructure in Anguar, Peleliu, Kayangel, and Koror. The storm produced large waves that were 23 metres high at their peak. It was estimated that 1,500 houses were damaged and 150 destroyed, along with belongings and farming investments. It was estimated that at least USD2 million worth of infrastructure was damaged. The National Emergency Committee (NEC) estimated damage at USD4.8 million across different sectors (health, infrastructure, education, food security, community/residential dwellings, communications, and utilities). Over 300 people evacuated to 20 safe shelters, with no lives lost. Although Surigae was not as strong as previous Typhoons Bopha and Haiyam in 2012 and 2013, it has left the population significantly impacted, due to its high vulnerability and the compounding economic impacts of COVID-19 (IFRC, 2021b).

The PRCS activated its Emergency Operation Centre on 14 April 2021 to ensure coordination with and support to the NEC. While still monitoring the tropical storm and based on the advisories issued by the Palau Weather Service and the National Emergency Management Office (NEMO), the PRCS carried out early actions to address the foreseeable needs of the communities before the storm strengthened into a typhoon on 16 April 2021. This was mainly made possible through the network of Red Cross Disaster Action Teams. RDATs were able to inform the PRCS at an early stage of the needs evolving on the ground and identified households that were most at risk, leading to early evacuations of people assisted by the PRCS RDATs.

The PRCS RDATs supported the evacuation of elders, single-headed households, and community members living in houses that would not withstand the force of the storm, and managed the centres that opened for people to seek shelter. Lanterns, water and snacks were distributed to evacuees to improve their overall experience in the shelter, and RDATs registered the people on arrival into the shelter.

It is important to note that these early actions were made possible with the PRCS leadership's decision to mobilise existing local funds to cover the operational expenses.

**Existing response capacity and locally-available financing were critical enablers for local early actions.**

The PRCS Typhoon Surigae response in 2021 demonstrates what local early actions could look like across the Pacific if financial resources are provided. The PRCS local early actions included:

- **Sufficient telephone credit for RDATs:** The PRCS ensured that all 41 RDATs (24 males and 17 females) engaged in the early actions had sufficient telephone credit to communicate and share information from the ground. This enabled the volunteers to inform the PRCS, as well as the government, of the needs of the communities across the 16 states.
- **Dissemination of the NEC advisories to communities:** Many of the community members were not able to receive the advisories issued by the NEC. Being part of the communities, RDATs relayed the NEC warning and advisory information to their respective communities, making them aware of the typhoon tracks and the potential impact of the imminent typhoon.
- **Early evacuation of people:** A major concern of community members was the loss of their homes, as certain houses would not withstand the force of such a strong storm. Some of the households were also single-headed or with small children. For those community members to feel safer, RDATs assisted in the early evacuation of 337 people.
- **In-kind support to evacuees in shelters:** RDATs helped with the management of the shelters, which usually are community halls, schools and churches in Palau. All evacuees in shelters were registered and provided with lanterns, water and snacks to make their evacuation as comfortable as possible.
- **Management of shelters:** RDATs helped register the evacuees, ensuring there was sufficient, appropriate and safe space in shelters for women and men, families and the elderly, based on their needs.

### *Box 2: PRCS local early action during Tropical Storm Rai*

On 12 December 2021, just eight months after Typhoon Surigae made landfall, the Palau NEMO released an advisory informing the public of an approaching storm. PRCS activated its early action protocols, coordinating the evacuation centre operation of 44 shelters in 12 different states. Following the first advisory warnings, PRCS reached 930 people through the pre-positioning of supplies in these 44 shelters. Pre-positioned shelter items included tarpaulins, lanterns, water bottles, and granola bars, and shelter items were also delivered to outlying states of Peleliu, Anguar, and Kayangel, via small plane and boat. The early actions taken by PRCS, with the financial support of the Australian Embassy, were able to minimise potential losses and reduce the need for post-disaster response.

### 1.5.1 Enablers and barriers for local early actions

PRCS undertook early actions with the overall aim of minimising the impacts of the typhoon and alleviating suffering, for which PRCS initially used their locally-available funds to take early action. Using local financing was an innovative enabler for local early actions in managing large-scale disasters.

Another enabler was the understanding of local context and community needs. The advantage of the PRCS is that its volunteers are representatives of the communities and therefore have a grounded understanding of the local context. Also, PRCS has a network of trained Red Cross Disaster Action Teams. This enabled PRCS, the government and other stakeholders to understand the situation and needs at the early stage of disaster events.

National Red Cross Red Crescent Societies are neither government institutions nor wholly separate non-government organisations. Their relationship with the authorities in their respective country is defined by their role as auxiliaries. To be a formal member of the International Red Cross and Red Crescent Movement, a national society's auxiliary role must be recognised by the national legislation of its country, usually in disaster management plans or legislation, allowing systemic coordination with relevant ministries and partners. In the case of Palau, PRCS is a member of the National Emergency Committee and has good working relationships with the Palau National Emergency Office and other Palau NEC members. This role is particularly important during the times of disasters. In addition, national societies are allowed to act on humanitarian needs without waiting for an emergency declaration.

The Red Cross Red Crescent worldwide network of skills and resources was an enabler in the case of PRCS. The International Red Cross Red Crescent Movement is a global humanitarian network of 80 million people that helps those facing disaster, conflict, and health and social problems, and PRCS is a member. This enables PRCS access to a wide range of human as well as financial resources and capacities, which could be used to strengthen the efforts around anticipatory approaches.

On the contrary, there are also general systemic barriers to scaling up anticipatory finance and more effective early action (Scott, 2022). These include:

- Lack of a global approach to financing for local early action.
- Culture and operations of humanitarian agencies not fully aligned to local early action.
- Silos between sectors, government departments and actors.
- Political disincentives, especially for ex ante decision-making.
- Poor communication of risks and potential approaches to manage them.
- The need for related governance reform, particularly in relation to public financial management.
- Weak forecasting capacities and data gaps.

In addition, the PRCS experience during Typhoon Surigae demonstrated two potential barriers to further promoting early actions as a small Pacific institution. Firstly, it is important to recognise the PRCS is relatively small in size, including the numbers of staff and volunteers. This small size should be considered when developing early action protocols and scaling up. Secondly, while the Anticipatory Pillar of the DREF is available for a national society to access, the PRCS has yet to set up a proper early action mechanism (at the time of this study), which means any pre-arranged funding for early action may not be available when needed. In this case study, PRCS was fortunate to have flexible funding sources from other donors, which were used to cover the initial expenses. However, the aspect of funding flexibility must be looked at for any early action initiatives.

### 1.5.2 Social benefits and change

Despite the systemic and practical barriers, a feasibility study conducted in Palau for the GCF-funded program captured evidence of the EWEA social benefits. For example, about two-thirds of survey respondents indicated that decision-making on early actions, although non-uniform and sporadic, was made collectively in a family, mostly based on the information, awareness and knowledge provided by the disaster committees, Red Cross, government officials, and elders. They also noted that all family members were active in early preparation activities (Climate Centre, 2022a).

In particular, youth groups recognised the importance of early action to reduce the impacts of disasters, including panic and indecision, which cost lives and increase losses to properties and livelihoods. Youths had important roles to play at the household and community levels. Besides supporting typical preparedness activities, youths also played the role of looking after younger siblings while their parents stocked up on food and water and attended to other family needs before the typhoon struck. Others helped evacuate the elders and offered assistance to single mothers and other vulnerable groups before the typhoon.



Tsunami warning sign advising people to go to higher ground in Port Vila, Vanuatu 2023. Photograph: Australia Pacific Climate Partnership.



Some of the youth group members even saw their role as the agents of change in their homes and communities – for example, by playing a critical role in EWEA communications. There were many opportunities identified for youths to engage further in EWEA activities, including joining organisations such as the PRCS, as well as opportunities at NEMO and other organisations that offer training and capacity building in early warning early action in Palau (Climate Centre, 2022a).

## 1.6 Gender Equality, Disability and Social Inclusion in Anticipatory Financing

Many studies of anticipatory financing draw little to no attention to gender equality, disability and social inclusion (GEDSI). However, disasters affect those experiencing the greatest vulnerability disproportionately. Women, people living in poverty, remote rural populations, elderly women and men, people with a disability, persons of diverse sexual orientation, gender identity and/or expression and sex characteristics (SOGIESC), and any combination of these groups, bear the brunt of the impacts of disasters. The inequities they face are the root causes of social vulnerability to disasters, as they affect people's ability to anticipate, prepare for, survive, cope with, and recover from disasters.

Evidence from around the Pacific demonstrates that gender-based discrimination, social exclusion and violence are often reinforced, perpetuated and exacerbated by disasters (UN Women, 2017). Therefore, it is important to integrate GEDSI in early actions to ensure that individuals and groups with differentiated needs participate meaningfully in decision-

making processes. This includes the determination and standardisation of triggers, and identification of actions to ensure their equal access to benefits. While women play key roles in families and communities and often demonstrate resilience in the face of the Pacific's repeated disasters, they continue to be largely excluded from official decision-making processes in many Pacific contexts.

Women may be excluded from receiving early warning messages due to a lack of access to mobile phones (Climate Centre, 2022b). Social gender norms also prevent many women from holding leadership roles at the local level in disaster preparedness activities. For the Palau case study, early actions taken by PRCS helped alleviate the stress and worries of families and households. People who were evacuated early shared with RDATs that they felt much safer and comfortable with the shelters that had enough space for their different needs.

It is vital to consider addressing GEDSI in early actions with 'do no harm' and avoiding unintended consequences, such as increases in women's workloads and violence against women and girls. The need to address inequality and exclusion is particularly crucial in light of the long-term impacts of negative coping strategies, including the consumption of unhealthy low-cost food, withdrawing children from school, or refraining from accessing health services to save money. In addition to increased stress and uncertainty having impacts on gender-based violence, mental health and abuse, results of negative coping mechanisms may also be associated with a higher prevalence of malnutrition, non-communicable diseases, child labour and poverty (AHP, 2021).



UNCDF representative interviewing a farmer who received a payout from her parametric insurance cover, following excessive rainfall in Nadi, Fiji, February 2023. Photograph: UNCDF.



## 2. Case Study – Gender-Focused Early Warning Systems

To explore the topic of gender-focused early warning systems in this publication, this section refers to the current context and global and local examples, before leading into a case study that assessed the value of early warning messages by a women-led program in Vanuatu, *Women's Weather Watch* or *Women Wetem Weta*.

This program is managed by ActionAid Vanuatu, which is working with local women to understand and disseminate the importance of early warning messages. Through their engagement in early warning messages, local women are empowered and better prepared for disaster events.

### 2.1 Context

Vanuatu is highly exposed to natural hazards and risks, including tropical cyclones and storms, earthquakes, volcanic eruptions, landslides, coastal flooding and tsunamis. Climate change projections indicate more intense but less frequent tropical cyclones, more extreme rainfall events, increasing temperatures and sea level rise. Almost 70 per cent of major disasters since 2011 have been severe storms causing significant disaster losses. For example, Tropical Cyclone Pam caused almost USD450 million in losses in 2015, while Tropical Cyclone Harold in 2020 caused estimated losses of USD617 million. Vanuatu's high exposure to severe tropical cyclones, and climate change projections pointing to more intense storms, provides the rationale for investments in early warning systems, to enable disaster risk reduction and preparedness activities to be implemented, aiming to reduce potential losses (Australia Pacific Climate Partnership, 2021).

### 2.2 Early Warning Systems

Early warning systems (EWSs) are implemented to enable at-risk populations to prepare for and reduce the potential impacts of disasters. In locations highly exposed to weather hazards, early warning systems play a critical role in minimising the social and economic impacts of hazards such as tropical cyclones. Multi-hazard early warning systems are identified in multiple Pacific policies and frameworks, including the Framework for Resilient Development in the Pacific (FRDP), as critical approaches to support communities to prepare for disasters and mitigate risks, especially in highly-ranked disaster-prone countries.

In 2018, the Committee on the Elimination of Discrimination Against Women (CEDAW) recognised the importance of gender-focused early warning systems, by stipulating early warning information should be provided using technology that is modern, culturally-appropriate, accessible and inclusive, taking into account the needs of diverse groups of women (United Nations, 2018).

However, it is often the case that women do not have equal access to technology, communication and services, and thus miss out on critical information (WMO, 2022a).

#### 2.2.1 Rationale for gender-focused early warning investments

The use of mobile phones for sending early warning messages has been a key focus of national emergency departments and organisations over the last decade, including in the Pacific. One of the reported reasons for the low death rate of Category 5 Tropical Cyclone Pam in 2015, which hit Vanuatu's southern provinces hard, was the NDMO's use of short messaging service (SMS) early warning messages (Handmer & Iveson, 2017). However, access to mobile phones for rural and remote populations is still limited. Furthermore, in Vanuatu and in many Pacific islands (especially in rural areas), access to mobile phone technology is lower for women compared to men (CARE, 2020; ADB, 2023). Reliance on early warning messages delivered through mobile phones, therefore, continues to exclude some rural and remote populations, and especially women from accessing critical information, given women are more likely not to own telephones, and in some remote locations are not allowed to own telephones at all (CARE, 2020).

As part of the literature review, several benefits of early warning systems were identified. These benefits include an avoided loss of lives that can be estimated using non-market approaches such as the economic value of a human life. For example, the World Bank undertook research about how improved weather and forecasting information and early warning systems can help reduce deaths from disasters. The study estimated that upgraded early warning systems in developing countries can save an average of 20,000 lives per year, which has an economic benefit ranging from USD700 million to USD3.5 billion per year (Anderson et al., 2015). Some studies estimated the benefits of EWS by calculating the benefits of avoiding damage to livelihoods, crops and assets against the costs of EWS. The World Meteorological Organization (WMO) study on the Severe Weather Forecasting and Disaster Risk Reduction Demonstration Project for the South Pacific Islands demonstrated that Pacific island farmers avoided loss of livelihood by harvesting early, relocating livestock, and rescheduling farming activities, through accessing meteorological information. Since agriculture plays a critical role in the Pacific islands' economy, preventing damage to crops helped the countries avoid economic loss from seasonal extreme events such as floods and heavy rainfall. Nine Pacific countries involved in the project saved major cash crops worth around USD360 million through strengthened EWS (Holland, 2014).



Other studies investigated how investing in EWS enables cost-efficient decisions and contributes to economic benefits at the national level. Recognising the risks posed by climate change, the Bhutanese Department of Hydro-Met Services and the Finnish Meteorological Institute conducted an economic analysis study to assess the benefits and costs of improved EWS and climate and weather forecast services for 15 Bhutanese economic sectors at a broad level. They quantified benefits by measuring changes in damage probability and estimating increased productivity through the use of meteorological and hydrological information. Their study estimated a BCR of three, indicating that the EWS investment is an economically viable undertaking (Pilli-Sihvola et al., 2014).

Nevertheless, the gender perspective was found to be largely absent in the reviewed economic impact assessment literature. This is despite the benefit of early warning systems for women – for example, in 1970, before early warning systems and storm tracking by satellite, the Great Bhola Cyclone claimed an estimated 300,000 victims in Bangladesh, with women victims outnumbering men 14 to one. Cyclone Sidr some 37 years later was as powerful, but casualties fell to about 3,500. The ratio of female to male deaths dropped to five to one (World Bank, 2013).

The literature on gender-focused early warning investments was not motivated by the economic outcomes of intervention. Rather the focus was more on the social benefits and resilience outcomes. For example, the Women's Weather Watch model designed by femLINK Pacific recognised and addressed the barriers women face in accessing early warning messages. ActionAid's Agroecology and Resilience Project in Senegal and the Gambia intentionally included local female farmers in extensive training programs to facilitate and encourage them to play an active role in early warning message dissemination and climate-resilient agricultural practices (ActionAid, 2017).

There was no evidence of economic cost-benefit analysis associated with gender-focused early warning investments, particularly for the Pacific.

## 2.3 Global Examples of Gender-Focused Early Warning Systems

There are a growing number of EWS examples that recognise the need for a dedicated focus on women's participation, engagement and uptake of EWS information. For example, Practical Action conducted action research in communities of Nepal and Peru to address the existing gaps between gender and EWS, and highlight local voices to ensure the effectiveness of EWS at community levels (Brown et al., 2019). The study involved participatory activities with men and women of the communities to explore the challenges faced by women in accessing early warning information. The research also identified existing strengths and the capacity of local women to improve the effectiveness of EWS. As part of the research, Practical Action identified gender as a critical factor in EWS and recommended that transformative EWS should be gender-inclusive (Brown et al., 2019).

The Agence Nationale de l'Aviation Civile et de la Météorologie and Red Cross are jointly leading a project in Senegal, focusing on women's access to meteorological and climate information in rainy seasons (WMO, 2022b). The project focused on training women to access climate information and using this to minimise risks, including loss of harvests and livestock, and water stress on crops. Recognising local women's practice of mutual assistance and existing social cohesion, the project systematically involved local women's associations, women's groups, and potential local women's leaders. Women who were trained in the program disseminated the knowledge to other women within communities through local women's groups and social events. This practice ensured the accessibility of climate information to women within communities, who are often overlooked in different awareness raising and early warning initiatives (WMO, 2022b).

There is emerging evidence that inclusive and gender-focused early warning initiatives improve women's participation in disaster preparedness and deliver benefits to women. For example, CARE Bangladesh implemented the Supporting Flood Forecast-based Action and Learning (SUFAL) project in the flood-prone regions of Bangladesh, focusing on forecast-based early actions in vulnerable communities. SUFAL applied different early warning information dissemination methods, such as loudspeaker announcements from boats, hired vehicles and mosques, and mobile voice messages in local languages, to ensure flood forecast information can reach remote communities. This consequentially helped women within communities of the project locations and enabled them to take preparedness measures before floods. While these investments did not have a primary focus on gender, easy and accessible early warning messages benefited women to make informed decisions and increased their preparedness capacity (Anwar, 2022).

From 2011 to 2017, the Nigerian Meteorological Agency in partnership with the WMO conducted the METAGRI Project to inform rural farmers about the usefulness of climate information and weather forecasts. The project took a targeted approach to ensure women's participation in the awareness raising seminars. The contents of seminars were gender-inclusive as well, including agro-climatological information relevant to women's farming activities (WMO, 2022d). This example illustrates the emerging recognition that a focus on gender within weather forecasting is important; however, still falling short of a gender-focused early warning system.

## 2.4 Pacific Examples of Gender-Focused Early Warning Systems

Women are often the first responders to disasters in the Pacific and hold significant knowledge, experience and expertise in disaster preparedness, response and recovery. Local women's groups and networks in Pacific countries represent a significant strength and asset in times of disaster, particularly for communicating and passing on vital early warning information. However, early warning



information from national agencies is often communicated in technical terms, or via channels not accessible to women, and some social norms lead to women not having access to this information.

Non-government organisations (NGOs) led by Pacific women have developed and implemented innovative and gender-transformative models to harness women's strengths in times of disaster. Fijian NGO femLINK Pacific introduced a unique model of strengthening and empowering local women's networks to ensure an inclusive early warning system, following the devastating floods in Fiji in 2004. The femLINK Pacific Women's Weather Watch model was developed to address local women's barriers to accessing early warning information and enabling community-wide preparedness actions. As part of the program, women leaders of the network received training on climate and weather knowledge, and technical skills to coordinate the information dissemination process.

During emergencies, the Fiji Meteorological Service partnered with women leaders to articulate weather alerts in simple language. The network decided on two criteria for emergency messages – firstly, the SMS text messages must be less than 100 words, and secondly, the messages must be written in a way that is understandable to the rural women's network. Women's Weather Watch also introduced innovative communication methods such as two-way community radio, bulk SMS systems, and communication through Viber groups and Facebook, to ensure communities receive timely information during disasters (femLINK Pacific, 2019). The capacity of women to contribute live weather updates via SMS texts to the Women's Weather Watch Hub has been a critical tool in monitoring real-time crisis scenarios and making informed recovery and rehabilitation decisions.

Through the Women's Weather Watch model, emergency information dissemination became simple and accessible to women within the network, which helped local women take preparedness and safety measures before disasters. For example, during Tropical Cyclone Winston in 2016, there were power cuts and disruptions of radio networks in the town of Labasa, Fiji. However, Women's Weather Watch network leaders regularly received cyclone updates through SMS alerts and informed their families and communities. The network also supports women to accelerate recovery in post-disaster phases by creating a platform for women to communicate their experiences and voice their needs.

The success of femLINK Pacific's Women's Weather Watch model is seen through examples of it spreading across the Pacific. Multiple investments are drawing on the Women's Weather Watch model to support inclusive, accessible and sustainable multi-hazard early warning systems, through local, national and regional women's networks and coalitions across the Pacific. The Women's Weather Watch model has also been adopted in Tonga and Vanuatu.

## 2.5 Vanuatu Women's Weather Watch

### 2.5.1 Background

Women's Weather Watch or Women's Wetem Weta is a women-led national early warning platform implemented by ActionAid Vanuatu. WWW drew on the Women's Weather Watch model developed and implemented by femLINK Pacific in Fiji. ActionAid Vanuatu adopted the Women's Weather Watch model to suit the Vanuatu context, which focused more on the mobile phone network, involvement of telecommunication company, Digicel, and door-to-door dissemination of EWS messages.

WWW is a component of the ActionAid Vanuatu Women I Tok Tok Tugeta (WITTT) collective<sup>3</sup>, and aims to improve protection, resilience, disaster preparedness and response capabilities of women in Vanuatu. WWW works with women in all their diversity, including women with disabilities, young women and elderly women, empowering them to play new roles in strengthening the resilience of their communities to the shocks and stresses associated with climate change and disasters.

A critical aim of WWW is overcoming early warning information barriers faced by women at the local level – barriers that heighten risks to women's security and protection. WWW draws on weather and climate information provided by the Vanuatu Meteorological and Geosciences Division (VMGD) and the NDMO, with ActionAid Vanuatu translating the technical warnings into simplified and locally-accessible early warning messages. These messages are channelled through established and trusted networks of women from national and provincial to local levels, allowing women at the community level to be informed about severe weather events. Women involved in WWW are trained and follow established processes to share early warning messages to support their own communities in preparing for and responding to severe weather events, such as tropical cyclones.

ActionAid Vanuatu and WWW work in close partnership with national and provincial governments, sharing their processes, progress and information gathered from their networks. These feedback loops are a critical element of WWW, as they enable local information and needs to reach government sectors, providing them with accurate data to respond appropriately.

Activation of WWW in Vanuatu has occurred numerous times and for various reasons since its inception. It is activated for rapid onset events such as tropical cyclones (recently, Tropical Cyclones Judy and Kevin in March 2023) and ash fall events (such as Yasur Volcano on Tanna Island in 2020), as well as slow-onset and health emergencies during the COVID-19 pandemic.

<sup>3</sup> See here for a short description of WITTT: <https://actionaid.org.au/wp-content/uploads/2020/09/WITTT-Profile.pdf>

## 2.5.2 Reach of the Women Wetem Weta program

WWW activates through the bulk SMS system and the WWW phone tree system, which have different geographic and population reach as described below:

**Rapid-onset events – delivered through the WWW phone tree:** Early warning messages for rapid onset events are disseminated through the WWW phone tree and reach the locations and communities of the five islands within the WWW network. WWW reaches approximately 6,000 households (approximately 30,000 people) within the five islands in four provinces where ActionAid Vanuatu works. The five islands where the WWW network is operational are:

- Efate in Shefa Province
- Erromango in Tafea Province
- Tanna in Tafea Province
- Malo in Sanma Province
- Malekula in Malampa Province.

The households within the WWW network are largely located in rural areas and engage in a variety of livelihood activities, such as farming, fishing and livestock rearing, which are vulnerable to natural hazards.

During rapid onset events such as tropical cyclones, the NDMO carries the national mandate to send out bulk SMS early warning messages. By request of the NDMO, WWW does not distribute bulk SMS messages during these times to ensure a streamlined flow of information.

**Slow-onset events – delivered through WWW phone tree and bulk SMS text messages:** For slow-onset events, WWW activates two types of early warning messages, reaching a larger geographical and population coverage. WWW distributes bulk SMSs through the Digicel network to all Digicel customers across Vanuatu's six provinces.

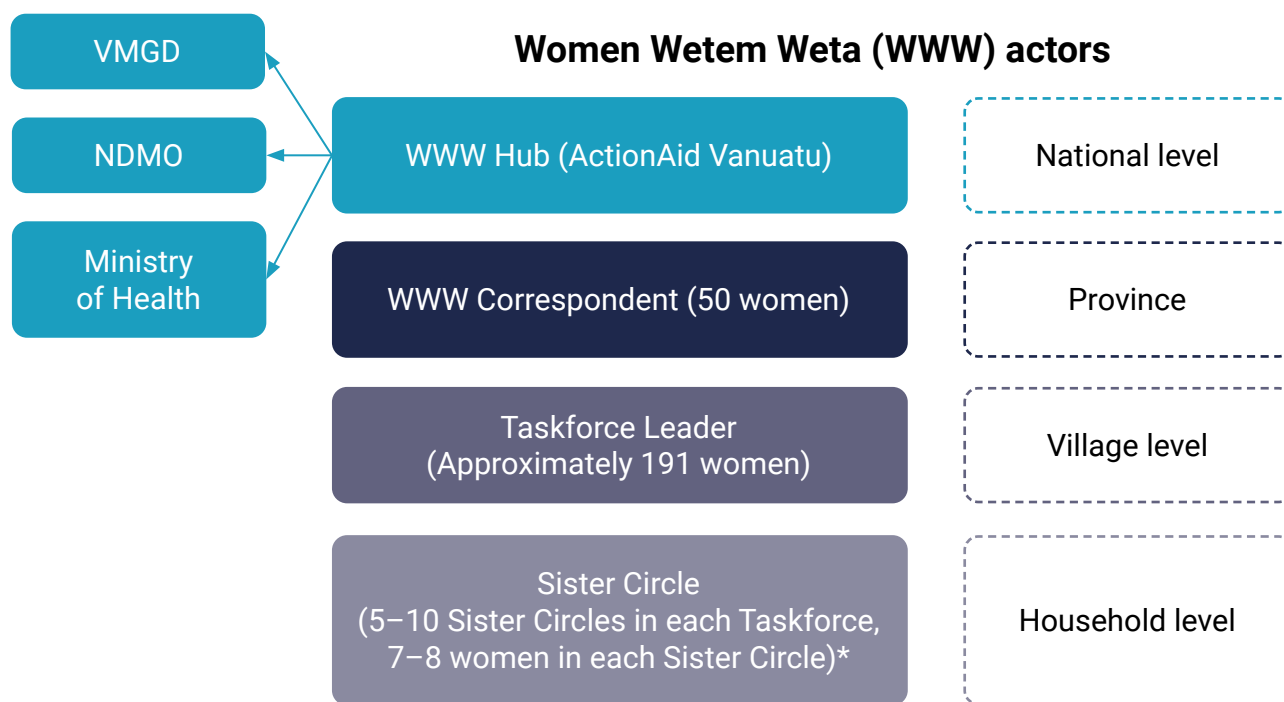
Additionally, WWW sends early warning messages for slow-onset events through the WWW phone tree. These messages ensure that communities without telephone service or without access to a mobile phone (which are often the most vulnerable people, such as women with disabilities), receive readily understandable and accurate early warning information.

The rationale for sending bulk SMS early warning messages for slow-onset events is to provide communities with up-to-date and accessible weather information affecting their livelihoods. For example, if an El Niño is predicted or occurring, messages regarding the need to consider drought-resistant crops or water conservation approaches would be disseminated.

## 2.5.3 Women Wetem Weta actors

Key actors involved in WWW are illustrated in Figure 1. Messages delivered through the WWW phone tree are sent by the WWW Hub at the national level (after validation of message accuracy by national government agencies) and reach the community level through WWW Correspondents, Taskforce Leaders, and Sister Circles. The number of WWW actors at each level varies depending on the geographical area and population size of communities. Women who are part of the WITTT network are trained to play these specific roles – WWW Correspondents, Taskforce Leaders, and members of the Sister Circles.

Figure 1: Women Wetem Weta actors



\*The Sister Circle numbers depend on the size of the community

## 2.5.4 Women Wetem Weta activation

The WWW program works to ensure that the correct and most recent forecasting messages are delivered to women and households within ActionAid Vanuatu-supported communities. As noted above, all the messages through the WWW phone tree and bulk SMSs are sent from the WWW Hub. Prior to sending, the WWW Hub messages are checked for accuracy by VMGD, NDMO, or Ministry of Health (for COVID-19 or health messages).

These checks ensure the simplified messages are accurate and contain the right information.

Figures 2 and 3 demonstrate the flow of WWW information and the critical roles played by WWW actors in ensuring accurate and readily-understood messages reach all members of ActionAid Vanuatu's target communities, which equate to 6,000 households (approximately 30,000 people), across five islands in which ActionAid Vanuatu works.

Figure 2: Rapid-onset event activation

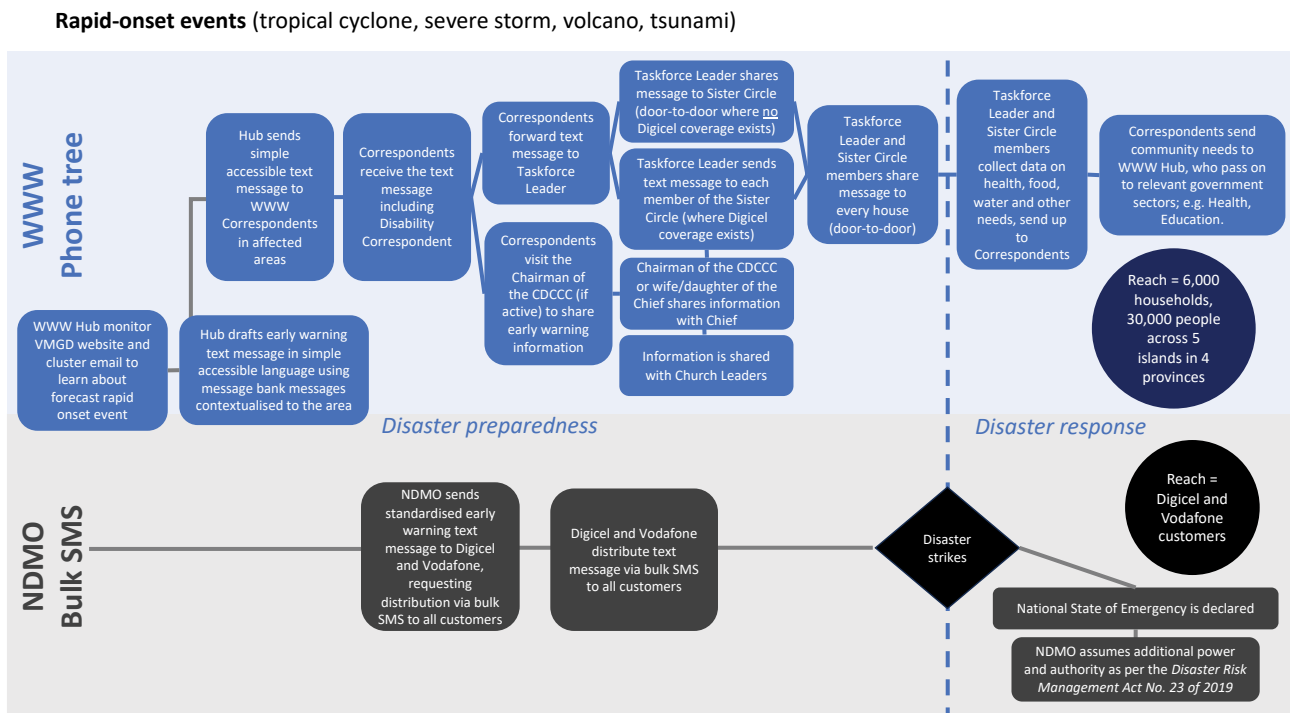
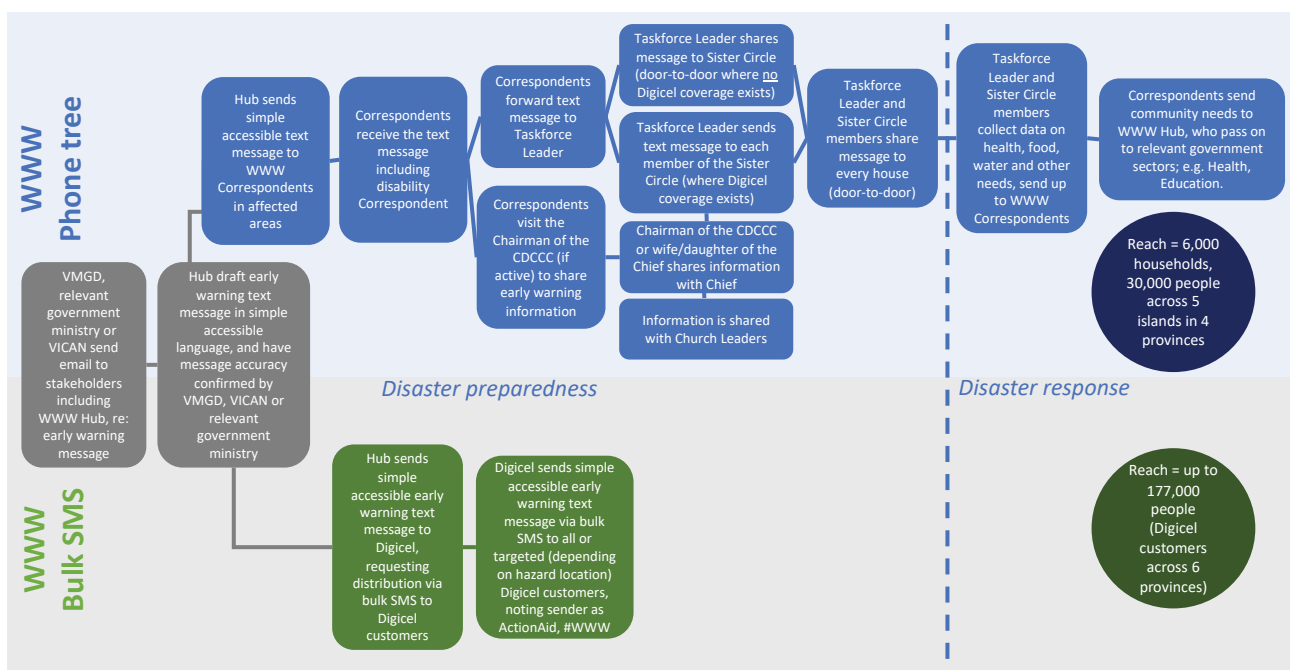


Figure 3: Slow-onset event activation

**Slow-onset events (drought, El Niño, La Niña, pest outbreak, coral bleaching, health warning, COVID-19 messaging)**



The WWW phone tree system is the same for rapid and slow-onset events, drawing on the sophisticated, pre-defined and well-understood network of women and their specific roles in sharing information. The WWW phone tree is triggered by the WWW Hub. The mechanisms of the WWW phone tree invest significant time and effort in sharing, via text and face-to-face communication, the early warning information to women and households at local levels. Importantly, the details of messages are carefully crafted in simple and accessible language to be readily understood by their audiences. The message details also incorporate lessons learned from past events via the feedback loop. Importantly, at the village and household levels, WWW actors visit each house door-to-door, to ensure everyone has received the message.

The difference in WWW activation for rapid and slow-onset events is when the bulk SMS messages are activated. For rapid onset events, the NDMO takes on the role of distributing early warning SMS messages for disaster preparedness and as the key authority in times of a State of Emergency declaration. Bulk SMSs are sent by the NDMO through the Vodafone and Digicel networks. However, as noted earlier, access to mobile phones in Vanuatu is much lower for women compared to men; hence the WWW phone tree is used to reach women who would otherwise miss out on receiving early warning messages.

For slow-onset events and health messaging, WWW sends simplified and accessible bulk SMSs via the Digicel network. These messages use plain, accessible language and are validated prior to sending by a relevant stakeholder (for example, by VMGD for weather-related events, and by the Ministry of Health for health warnings). Validation from sector experts ensures message accuracy, while WWW lessons and feedback from past events ensure clear wording for women and communities to understand.

## 2.6 Vanuatu Women's Weather Watch Study

The Vanuatu case study assessed both economic and non-economic benefits of WWW, with each following the methodology described.

### 2.6.1 Methodology for assessing economic costs and benefits of Women Wetem Weta

A cost-benefit analysis (CBA) framework was applied to assess the economic performance of the WWW program. A CBA identifies and measures the changes (costs and benefits) that are generated from a policy intervention. Importantly, changes are measured with regard to the situation where the policy intervention is not implemented – sometimes referred to as the 'counterfactual scenario'. The intention is that only the changes that are attributable to the intervention are counted, and changes are not included that would have occurred anyway.

The study aimed to capture information and compare the outcomes of communities and households not part of the WWW program with those that are part of the program. Based on consultation with ActionAid Vanuatu, the identified key outcomes of the WWW program were:

- Reduction in damages and losses to agriculture and food.
- Reduction in damages and losses of public water services.
- Reduced incidence of violence, injuries, sickness and death.
- Reduced damages to household infrastructure.

A survey questionnaire was developed to gather information about access to early warning messages, protective actions deployed, and post-event damages resulting from Tropical Cyclones Judy and Kevin that hit Vanuatu in March 2023. The quantitative survey questionnaire was developed by the research team in collaboration with ActionAid Vanuatu, and was broadly based on the Post-Disaster Needs Assessment, as well as past household income and expenditure analysis methodologies for Vanuatu.

The English version of the questionnaire underwent a review by a translation committee of seven ni-Vanuatu ActionAid staff and local enumerators. Subsequently, the entire survey was translated into Bislama to ensure that enumerators could ask the same questions without the need for translations during interviews. A translation committee was involved in the conceptual translation of the English language questionnaire to Bislama, following established guidelines (Douglas & Craig, 2007; McKay et al., 1996).

Initially, two villages participating in the WWW program and two villages without the program were selected as primary case study locations. These villages were Ekiye and Rentapau (WWW villages) and Epule and Eratap (non-WWW villages). Later, the village of Eton, one of the first places to introduce WWW activities, was added to gather more comprehensive information about the outcomes of WWW. All five villages are situated on Efate Island in Vanuatu.

The village selection was designed to allow the assessment of relative outcomes under two counterfactual scenarios. Firstly, the impact of the WWW program could be investigated by comparing outcomes within the same village for households that reported receiving and acting on early warning information from the WWW program against those households that did not receive any early warning information from the WWW program. Secondly, the impact of the WWW program could be assessed by comparing average outcomes in villages with the WWW program versus those villages that did not have the program.

Village representatives were asked to identify and invite people of different socio-demographics, including 'households with people living with disabilities', 'poor female-headed households', 'poor households', 'middle households', and 'better-off households', based on the community's definition.





Primary data was collected across the five villages in September 2023. The data collection was done using a questionnaire that was translated into Bislama. Of 93 surveys collected, three were removed from the analysis due to significant errors and missing data. Thus, a total of 90 surveys were analysed to investigate the potential outcomes associated with the WWW program in Vanuatu.

### 2.6.2 Methodology for assessing non-economic benefits of Women Wetem Weta

Qualitative data was collected through semi-structured interviews and a focus group discussion, with 14 women involved in WWW participating in the research in September 2023. Interviews were conducted with 10 women in Port Vila and Rentapau village. Interview participants were purposively selected based on their knowledge and engagement with ActionAid Vanuatu's WWW. One focus group discussion was conducted with three women with disabilities and one carer at their office (WITTT Sunshine).

Interviews and focus group discussions were conducted in a mix of English and Bislama, with participant responses being translated into English where required. Within this report, the names of interviewees have been changed or removed to protect women from any potential adverse consequences of their comments.

## 2.7 Vanuatu Women's Weather Watch Study Results

### 2.7.1 Initial study findings

Data collected from a survey conducted in five villages on Efate revealed that households actively respond to early warning messages. The economic benefits derived from access to early warning messages, particularly in the context of the recent twin cyclones, did not exhibit discernible differences based on the source of the early warning messages. This was because a significant proportion of the household sample from WWW-equipped villages reported receiving messages from the NDMO as well. This dual sourcing of information made it challenging to attribute specific benefits to the activities of the WWW network. Regardless of whether the messages originated from the NDMO or the WWW network, however, households took action to protect their assets and enhance their safety. Further quantitative results, including the overview of the study sample and assessments of the key outcome streams, are summarised in Appendix 1.

However, when analysing female-headed households, the survey revealed that those who received WWW messages prepared themselves better than female-headed households without WWW messages. Anecdotal evidence, based on a very small sample of female-headed households, suggests that practical WWW early warning and early action information led to higher pre-emptive harvest value than

female-headed households in communities without WWW messaging. Within the same community, there was also an increase in pre-emptive harvest value among female-headed households who received the WWW messages compared to households who only received the NDMO messages.

**Communities on the island of Efate respond to early warning messages by protecting their assets and enhancing their safety.**

### 2.7.2 Community-level scenario impact analysis

A scenario CBA was applied to investigate the economic viability of investing in a women-led initiative to deliver early warning messages to communities without access to NDMO messages for rapid onset events such as a tropical cyclone.<sup>4</sup> The scenario was constructed based on the assumption that a community in outer islands has exclusive access to WWW early warning messages. Insights provided by ActionAid Vanuatu were used to inform the scenario development. Multiple villages on Tanna and Erromango Islands, for example, face challenges in accessing early warning messages. These challenges were typically an outcome of one or a combination of the following reasons: very poor/no mobile phone reception in the community; lack of access to mobile phones; and limited distribution of messages among households by the few who may receive them. Low mobile phone ownership, particularly among women, could also be a contributing factor.

To bridge this gap and prevent communities from missing crucial early warning messages, the WWW network project has equipped village mobilisers with mobile phones. These mobilisers undertake bi-weekly trips to areas with telephone reception, facilitating communication with the WWW Hub about impending rapid or slow-onset events, such as cyclones, droughts, ash falls, health emergencies, and other activities associated with the broader Women I Tok Tok Tugeta initiative. On receiving an early warning message, these mobilisers promptly disseminate the information as they travel back to their houses, leading to widespread message dissemination. Additionally, some women within the network are trained to deliver messages door-to-door, thereby enhancing the community's overall preparedness and response capabilities.

The economic evaluation of impacts, drawing from survey findings, identified two categories for assessment – the value of protective harvesting of crops, and house protection actions. It was assumed that, on average, the potential volume of crops that a household could harvest aligns with the observed averages in Ekiye, Epule, Rentapau, Eton, and Eratap. Subsequently, the average amounts per crop were translated into monetary terms, with prices adjusted to account for potential variations in pricing between the case

<sup>4</sup> Vanuatu's mobile phone penetration by subscriber is estimated at 48% for the year 2022 (GSMA, 2023). It is also likely that most of these subscribers are located in higher-density urban areas, while people in remote communities have very limited mobile phone ownership rates – this can lead to a gap in access to early warning messages, which are typically sent via bulk SMSs.



study village and the South Tanna area. Table 2 presents the estimated volume and value in Australian dollars (AUD) for agricultural produce harvested for protective reasons following cyclone warnings. It is essential to note that this list is not exhaustive, encompassing only the main crops, vegetables, and fruits identified through the survey.

While households from the survey indicated that they took some actions to protect their house, it was assumed that early warning messages led to an estimated 10 per cent reduction in damages, as stated by Fakhruddin and Schick (2019). The value damages were based on three house types in line with the Vanuatu Census and Post-Disaster Needs Assessment (PDNA) reporting; i.e. concrete, cement or brick walls (permanent house), traditional (bush material floors (traditional house), and all others (semi-permanent house). The average replacement value for permanent houses was VUV2,178,552 (or AUD28,292), and the traditional and semi-permanent house replacement values were estimated at VUV363,092 (or AUD4,175). These estimates are based on values used for damage estimates after Tropical Cyclone Harold, as well as the twin Tropical

Cyclones Judy and Kevin, and adjusted to 2023 values using the Vanuatu Consumer Price Index.

Damage patterns by house type were based on survey findings and damage levels used by the Vanuatu Government to describe house damages (VMGD, 2023). An illustration of damage levels (DLs) is provided in Appendix 1. Damage levels range from DL1 (no damage) to DL6 (complete flattening of the house structure). The proportions of the different damage levels by house type are provided in Table 3. These estimates are based on survey data from across the five villages where data was collected.

The estimated avoided replacement value (in AUD) for the South Tanna community with a household population of 321 is provided in Table 4.

Certain potential benefits, such as avoided deaths, injuries, sickness, and the transformative impacts facilitated by the WWW network, were not quantified in monetary terms, due to limited data availability or uncertainties surrounding their magnitudes.

**Table 2: Estimated average agricultural produce protection volume and value per household**

Main crop/vegetable/fruit	Average protection volume (kg) per household	Average value of protection value (AUD)
Cassava	111	56
Taro	277	160
Yam	81	44
Wild yam	183	198
Sweet potatoes	74	193
Ginger	44	71
Beans	7	16
Capsicum	5	7
Cabbage	11	17
Island cabbage	8	15
Cucumber	15	13
Spring onion	14	23
Banana	49	63
Breadfruit	28	53
Coconut	21	11
Lime/Lemon	2	4
Pawpaw	7	21
Pineapple	6	8

**Table 3. Distribution of damage levels by house types**

House type	DL1	DL2	DL3	DL4	DL5	DL6
Permanent	44%	31%	22%	0%	3%	0%
Semi-permanent	29%	50%	4%	14%	0%	4%
Traditional	35%	52%	9%	4%	0%	0%

**Table 4. Estimated total avoided damages by house types and damage levels (values are in AUD)**

House type	DL1	DL2	DL3	DL4	DL5	DL6	Total (AUD)
Permanent	0	17,246	24,144	0	6,898	0	48,288
Semi-permanent	0	4,420	631	3,789	0	1,579	10,419
Traditional	0	5,155	1,718	1,289	0	0	8,162

Table 5 provides a summary of the key assumptions that informed the CBA modelling. To accommodate uncertainties surrounding certain key parameters, a range of input values was employed. For example, the likelihood of damaging winds for Tanna was estimated within a range of once every five years to twice every five years; i.e. 20–40 per cent annually. These adjustments were made to enhance the robustness of the analysis and account for varying levels of uncertainty in the data.

The cost information used in this analysis was provided by ActionAid Vanuatu (see Table 6). Establishment costs encompass expenses related to the acquisition of mobile phone handsets, the initial training of correspondents, and the training of women assuming roles in the provincial WWW network. Ongoing costs involve a portion of salaries allocated to staff for coordinating the WWW Hub and community mobilisers, along with payments for telephone upgrades and mobile packages covering data and texting costs among network participants. It is crucial to note that

**Table 5. Summary of key inputs used to estimate economics benefits for the CBA**

Parameter	Unit	Low	Most likely	High	Source/Comment
<b>General model inputs</b>					
Discount rate	%	3%	7%	10%	Buncle et al. (2013)
Timeframe	No. years		10		Based on past EWS initiative CBAs (see Fakhruddin and Schick, 2019)
Exchange rate 2022	AUD to VUV		77		
Households (South Tanna)	No. households		321		Vanuatu 2020 Census
Annual cyclone likelihood	%	20%	30%	40%	Global Facility for Disaster Reduction and Recovery (GFDRR) (2020)
East Efate village prices to South Tanna village prices	%	50%	65%	80%	Estimate based on consultation with ActionAid
<b>Benefit modelling inputs</b>					
Value of pre-emptive harvesting of crops	AUD		46,793		Calculated
Avoided damage to permanent houses	AUD		48,288		Calculated
Avoided damage to semi-permanent houses	AUD		10,420		Calculated
Avoided damage to traditional houses	AUD		8,162		Calculated

**Table 6. Summary of key inputs used to estimate economic benefits for the CBA (costs)**

Parameter	Unit	Value	Source/Comment
CAPEX: Mobile phone handset per village	AUD	351	Based on ActionAid Vanuatu data
CAPEX: National workshop per village	AUD	7,062	
CAPEX: WWW training of provincial network per village	AUD	10,390	
OPEX: Annual cost per village	AUD	6,420	ActionAid Vanuatu (plus an uncertainty range of +/- 10%)

**Table 7. Headline results of CBA**

Investment criteria	Value (AUD)
Present value of WWW network benefits (A)	256,259
Present value of WWW network costs (B)	57,838
Net present value (A-B)	198,421
Benefit-cost ratio (A/B)	4.4

the vital role played by women in the village-level network, involving the monitoring and dissemination of early warning messages, is conducted on a voluntary basis and is not accounted for as a cost item in this CBA.

The quantitative costs and benefits outlined above were employed to conduct a CBA for a community reliant on the WWW network to access early warning messages for damaging cyclones. Benefits that were not quantified have been explored qualitatively in section 2.7.3.

The key inputs for the CBA included establishment costs, ongoing operating and maintenance costs, the value of pre-harvested agricultural produce, and reduced damages to houses.

Table 7 presents the CBA results, using a seven per cent discount rate and a 10-year appraisal period. The most likely estimated present value of benefits is AUD256,259, with a present value of costs amounting to AUD57,838. Consequently, the CBA results suggest that, in comparison with a counterfactual scenario where a community lacks access to early warning messages, the WWW network proves to be an economically-viable investment. The most likely net present value is AUD198,421, resulting in a BCR of 4.4. This indicates a substantial positive economic return, affirming the economic viability of the WWW network as a valuable investment for a community without access to NDMO early warning messages.

Recognising the inherent uncertainty associated with the values in the estimates and the assumptions underlying the input parameters, a sensitivity analysis was conducted to gauge how this uncertainty might impact on the results of the CBA. To address this, a range was identified for each input, based on factors such as the data source, data quality, confidence intervals, and variations in values from different reports.

Monte Carlo simulations were employed for the sensitivity analysis, executing risk analysis through multiple iterations using different input parameters and their distribution bounds. This approach generated a range and probabilities of outputs of interest, with 20,000 iterations conducted.

**For every \$1 invested, there is a corresponding benefit of \$4.40. This benefit underscores the value of Women Wetem Weta early warning messages in communities with no access to the NDMO messages.**

The results of the sensitivity analysis indicate that while the most likely BCR is 4.4, the 80 per cent confidence interval for this estimate ranges from 3.3 to 5.7. In other words, based on the quantified benefits and the assumptions employed, there is a 10 per cent chance that the BCR is less than 3.3, and a 10 per cent chance that it is higher than 5.7. These findings underscore the robustness of the investment in a village without access to early warning messages, reinforcing its economic viability despite the inherent uncertainties in the analysis. The key drivers of sensitivity analysis results for the BCR are the uncertainty around the probability of a cyclone hitting the community in any given year, the level of avoided damages to houses due to action linked to early warning messages, and the market prices of agricultural produce.

### Limitations

While considerable efforts were invested in selecting WWW-exclusive communities – i.e. with no NDMO messages getting through – our findings indicated that households have access to NDMO messages in all communities surveyed in Efate. This made it challenging to attribute the estimated value of benefits to the WWW early warning messages only. Therefore, a scenario-based CBA was undertaken with a community where NDMO messages do not get through.

### 2.7.3 Gender-transformative impact

The experiences of severe weather events for ni-Vanuatu women are acutely influenced by social and cultural gender dynamics in Vanuatu. Women's participation in decision-making in the preparation for, and responses to, disasters – as well as in 'peace times' – are impeded by the patriarchal system of governance from community to national levels. Leadership roles are typically male-dominated, from household and village levels to national level. For example, within the household, men usually make all the decisions. At the village level, the Chiefly system and church roles are dominated by men. At the national level, only five women have ever been elected as Members of Parliament since independence in 1980. Cultural traditions act to uphold practices of gender inequality (Alston et al., 2022) and, across Vanuatu, women are seen as the property of their husbands (Servy, 2020; Tokona, 2021). Stories of men resorting to violence to uphold the gender inequality status quo are not uncommon (Alston et al., 2022). Women's active participation in local-level decision-making is rare in Vanuatu, with women generally excluded from village governance (Vorbach & Ensor, 2022). Mary-Jack Kaviamu, a ni-Vanuatu woman from Tanna, has written about her brave experience of gaining political acceptance, which took decades and required standing up to threats of violence and exclusion from her village (Kaviamu, 2016).



Findings are presented in this section to demonstrate the seven 'benefit streams' that emerged from the qualitative data, which are: (1) new roles in the household; (2) new roles in the community; (3) new income and business opportunities; (4) influencing subnational and national government, resulting in improved government services; (5) improved safety and security for women; (6) improved outcomes for people with disabilities, including children and women; and (7) triggering generational change.

## There are significant gender transformative, intangible benefits with direct attribution to Women Wetem Weta.

### New roles in the household

Interviewees described new roles in the household that came about due to their participation in WWW. New roles related to decision-making, sharing the care of children (with instances of men taking care of children), and collaboratively working with their husbands on WWW activities. Examples indicate shifts in traditional gender norms and roles at the household level.

**Roles in decision-making:** Three interviewees specifically described changes in the way decisions were made at home. Prior to their involvement in WWW and the training they attended, their husbands made the decisions, which is the norm for ni-Vanuatu families and often reflected the ways decisions were made in their families growing up. Women traditionally did not have a say in how decisions were made at the household or village level. Training was provided by ActionAid Vanuatu for WWW members and related to women's rights, leadership, community-based protection, and public speaking. The training raised the awareness of women's right to participate in decisions affecting them and also enabled women to build their confidence to speak up and play a new role in the household.

**Roles in the care of children:** Interviewees also described changes in household roles relating to the care of children and in their support for WWW activities. One interviewee reported that her husband was caring for the children while she led WWW activities away from the village, which represents a shift in gender roles in the village.

*'If ActionAid Vanuatu holds a training for example, in Malekula, and I attend, my husband looks after the kids, and he supports the other women while I am gone. He is supportive. That is not common. Before WWW, we had to listen to the men. Now they [men] are very pleased with our work. We are not changing everything, but small shifts.'*  
WWW Community Mobiliser.

**Roles supporting WWW activities:** Similarly, other interviewees described their husbands being supportive of their roles and activities in WWW. Husbands were described as working alongside their wives on WWW and other ActionAid Vanuatu activities through the WITTT network (e.g. gardening).

### New roles in the communities

All interviewees described various new leadership roles they were playing in the community. Interviewees described how the roles resulted from new knowledge and the confidence they gained from participating in WWW. For example, the training they had participated in had taught them new skills (e.g. public speaking, and the use of technology), provided new knowledge (e.g. about their rights), and built the confidence that enabled them to take on new and diverse leadership and advocacy roles.

The new roles women were playing included becoming members of formal community governance structures, business leaders, community trainers, and data collectors, and taking on advocacy roles. These new roles were significant, given that men usually dominated local leadership positions.

### Members in the Community Disaster and Climate Change Committees:

Two of the interviewees were invited to become members of the Community Disaster and Climate Change Committees (CDCCCs), including one woman with disabilities. One interviewee was invited to be a member of the CDCCC because of her proactiveness in collecting data about household needs (learned through WWW training) after the twin Tropical Cyclones Judy and Kevin in March 2023. When she was invited to become a member of the CDCCC, she accepted on the condition that she was not the only woman on the CDCCC.

As a result of this WWW training on post-disaster relief distribution, the interviewee was able to collect relevant data on household needs. The interviewee noted how her role on the CDCCC shaped the fair and equitable distribution of food relief and supplies after the twin tropical cyclones.

The second interviewee was invited to be the disability representative on the CDCCC. This role enabled her to ensure that disability considerations were integrated into the CDCCC's operations in her village, which is a significant step forward towards more inclusive local community leadership.

**Invitation to the Chiefly Council:** Another interviewee was invited by the village Chief to represent ActionAid Vanuatu and WWW at the Chiefly Council meetings because of her being more vocal and demonstrating leadership qualities in her community. The Chief recognised this interviewee's leadership qualities and saw these as an asset to the community. She noted that while other organisations are represented on the Chiefly Council, the representatives are all men.

*'The Chief noticed I was more confident and vocal – he said it is nice for you to be a part of the meeting. He said, "You have worked so hard, so we have elected you to represent WWW and ActionAid Vanuatu to be in the meeting. Whatever the Council decides, we need you to be in the meeting". I am part of the decision-making process now. I am representing the women in the Chiefly meetings... Because of the job I have been doing with WWW.'*  
WWW Taskforce Leader

**Leadership roles in the church:** Similarly, another interviewee described how she was invited by the Chief and his council to be the Chair for the church. The interviewee noted that it was because of her increased confidence that she was elected for this role.

**Leaders in training:** Two interviewees described how they brought the training from ActionAid Vanuatu to the women in their villages and delivered the training themselves. During the interview process, it was clear that their delivery of the training was a huge milestone for these women, and it represented an important step forward in their confidence and roles as community leaders. One interviewee described how she had changed because of WWWW, and was able to deliver the training with the support of a more senior WWWW mentor from her village.

**Leaders in advocacy for women's rights:** Interviewees described how they had increased their knowledge of women's rights and built up their confidence to advocate for these rights in their community. Interviewees described their confidence to speak at community meetings, which was significant given the dominance of men's voices in these settings. This confidence to speak in front of and with male leaders in the village, including the Chief and at the *nakamal* (traditional meeting place), was raised by several interviewees.

### **New income generation and business opportunities**

Seven interviewees described how they had been able to initiate or grow business and income generation activities because they felt increasingly empowered through their new knowledge and confidence from WWWW, and from the support of other women. These opportunities were factors supporting transformational change for women and provided further evidence of the outcomes that have resulted from women involved in WWWW.

One interviewee described how she offered her family's *nakamal* as a food market venue for other women to sell their fish, vegetables, fruit and other prepared foods. She used her own funds to pay the government's food licence fee (VUV10,000, equivalent to AUD126 per annum), which permits the selling of food (hers and others) at her *nakamal* market. She attended food hygiene training as part of the government's licensing process and passed the lessons on to the other women to ensure food safety at the market. She was seen as a leader among the other women in the village – one who generously supports others.

Other entrepreneurial and business opportunities pursued by WWWW women included: establishing a market house for women and renting it to others in the community for a fee; establishing local village markets; and women supporting each other to grow food to sell at their markets. Interviewees described how these opportunities arose by working together as one, lessons they learned through working with ActionAid Vanuatu and WWWW.

### **Influencing subnational and national governments, resulting in improved services**

Six interviewees, including women with disabilities, described ways they had influenced subnational and/or national governments, in some cases resulting in improved

government services leading to positive outcomes for all women in the village. Interviewees attributed these interactions and their ability to improve services to WWWW, which had informed them about women's rights and built their confidence to speak up on matters pertaining to them, other women, and their communities.

Interviewees with disabilities described how they felt confident to engage with the government, including NDMO, the Ministry of Agriculture, and the provincial government. For example, after the twin tropical cyclones in March 2023, one interviewee, who is the lead of ActionAid Vanuatu's women with disability group and WWWW Community Mobiliser, worked with Shefa Province's Disability and Gender Officer to ensure the cluster response in Port Vila recognised the needs of women with disabilities.

In Eton village, there were insufficient water taps to service the community. Given it was primarily women's role to provide enough water for their households for drinking, cooking and washing, women in Eton were most aware of the issue. One interviewee, a WWWW Correspondent, rallied other women in Eton village, encouraging them to attend the community meeting to raise the issue of insufficient water taps. She stood up and spoke at the community meeting about insufficient water taps. As a result of this interviewee's courage and leadership and the support of the other Eton women, the Chief passed that message on to the government. The government then came and installed more taps. Additionally, the government's water department staff visited Eton and provided training to maintain the taps.

### **Improved safety and security for women**

Issues of women's safety and security were raised by six interviewees, all describing how the training and confidence gained through WWWW had made them more empowered, which had a direct influence on improving their safety and security, and the security and protection of other women in their communities.

One interviewee laid bare the dangerous violence women face, which is amplified in times of disaster.

*'Women often face dangerous forms of violence in times of disaster. Women work so hard after disasters. Men sometimes just sleep and eat... if women ask where the food is, they can get hit, sometimes the husband beats the woman so badly.'*  
WWWW Interviewee

WWWW training included awareness raising of women's rights, and WWWW leaders provided this training for women at the village level. An interviewee described the outcomes of community training and noted that around 70 per cent of women will be okay and their husbands will be generally supportive, so they do not face any backlash. However, she also noted that 30 per cent of husbands will not be supportive and negative repercussions may result.

ActionAid Vanuatu and WWWW take these potential consequences seriously and proactively provide support, including referral pathways for following up on incidents of violence and watchdog services. These protection services



include helping arrange hospital transport, immediate rapid assessments, and other protection services for women in need.

Another interviewee described how she changed a village policy that had a direct influence on forms of sexual violence against women. A previous village policy forbade women from wearing trousers. As a result of her new knowledge about women's rights, and the confidence she gained through WWW training, one interviewee spoke up for the first time at a community meeting about the issue of women's safety.

*'I stood up and I told them [at the village meeting]. I said, you cannot stop us. I learned at [WWW] training about women's rights. If you are walking by, if you are wearing trousers it is hard for men to rape you. You cover up with lava lava [sarong] or you wear a skirt. I said that in front of everyone. And the outcome was, we [women] are allowed to wear trousers now. Most of the time when we swim in the river, we wear pants. But before, we were not allowed to do that.'*

WWW Correspondent

Examples of improved protection in evaluation centre settings were also described. A WWW Correspondent explained WWW leaders locate male and female toilets away from each other for reasons of women's safety. Toilets for women with disability are reliable and accessible, also offering protection and security for women.

The final example of improved safety and security relates to women banding together to sell their food at evening food stalls. Four interviewees described how they now felt safe to sit outside and sell their food at market stalls, because they learned about their right to be safe in their community – and they learned how to support each other to feel safe through WWW training. The women sit together four nights a week from 5 pm to 8 pm selling their food and generating an income.



WWW volunteers have established Eton Market in support of women's safety and resilience. Photograph: Australia Pacific Climate Partnership.

*'The food stalls are operating in the evening time. Now we know our own rights and security. We started with five mamas and it is continuing. Those mamas bring their food to the stalls and we are getting new support from the community.'*

WWW Taskforce Leader

### **Improved outcomes for people with disabilities, including children and women**

Within WWW, ActionAid Vanuatu has a specific disability focus, which has provided women with disability with training and mentoring to enable their leadership, participation and advocacy in multiple sectors and settings. Interviewees described significant and positive outcomes because of their participation in WWW.

A leader of the WWW disability group described how she had been empowered to meaningfully participate in forums and training at local, national, and regional scales. After acquiring her disability in her 20s, she described how she became withdrawn, shy and stayed home. After engaging with ActionAid Vanuatu, she noted:

*'Now I participate a lot in community programs and even nationally. Within the WWW network – we see ourselves in the ToT [training of trainer] training. NDMO come to the training and we can speak for ourselves in that space. Without it [WWW], I would not feel confident to speak out for myself.'*

WWW Disability Community Mobiliser

Her training with WWW and the provision of a smartphone enables her to connect with other WWW Disability Community Mobilisers and pass on information needs quickly. She explained how she has a directory of contacts for women and girls with disability, enabling her to check in with them across the country.

*'We created our chat group where we can talk about what the weather is doing even far from Tanna. With the smartphone and the chat group, we are connected. It is a safe space for women and girls with disabilities.'*

WWW Disability Community Mobiliser

Another interviewee from the disability group described how she now felt confident to speak out for herself. She spoke at National Agriculture Week and is empowered to go to the front of a crowded room and speak in front of a lot of people.

Another member of ActionAid Vanuatu's disability group described how the training she received enabled her to collect data during disasters regarding access for people with disabilities.

A final example of positive outcomes for people with disability came from Rentapau village, where one of the interviewees described a change in herself that had



significant and positive outcomes for her daughter (aged eight years old) with a disability, and their whole community. She explained that before she was with the ActionAid Vanuatu network, her perception of people with disabilities aligned with the common view in Vanuatu; i.e. that their marginalisation and exclusion from participation in society was acceptable. The WWW training about the rights of people with disability changed her view in a profound way, as she noted:

*'Before I was with the [ActionAid Vanuatu] network, I thought disability is something that should not be cared for, or they do not matter and they should isolate themselves. Then I joined the [ActionAid Vanuatu] network, I learned about disability how they have special needs, they deserve to be looked after. I learned that I need to fight for my daughter and other people with disabilities.'*

WWW Interviewee from Rentapau Village

She explained how her changed perspective of people with disabilities – especially her daughter, shifted her own, her family's, and her community's perceptions as well. Her daughter is now celebrated, supported and loved by all in the community.

### Triggering generational change

Four interviewees described how their new leadership and advocacy roles in their communities could be seen as a trigger to generational change regarding the role of women in Vanuatu society. They intentionally worked with younger generations (boys and girls) to instil the value of women and awareness about women's rights.

One interviewee was highly conscious of the influence she was having on her sons and daughter, through her participation and leadership in WWW. She noted that she wanted the strength and abilities of women to be recognised, appreciated and valued.

*'I want my sons to recognise this! My daughter is activating it [women's strengths]. I want her partner to recognise this – how strong she is.'*

WWW Community Mobiliser

Another interviewee also had an intergenerational change on her mind as she participated in WWW activities. This interviewee recognised that social change will not happen overnight; rather it will require the next generation, and the one after that, to recognise and value women as genuine leaders in their communities. She noted:

*'I will support the next generation of leaders in the [ActionAid Vanuatu] network too. My two eldest boys have wives already and they are part of the WWW network. They appreciate what I am doing in the network. They work together and learn a lot from me. If all the boys and their partners in the community are the same as the WWW women, then they are supporting us.'*

WWW Community Mobiliser



Flora Vano leads a planning session for Women Wetem Weta. Photograph: ActionAid Australia.





## 3. Case Study – Parametric Insurance for Social Protection

To explore the topic of parametric insurance for social protection, this section of the publication refers to the current context and global and local examples, before leading into a case study developed to describe how Fiji experimented with a pioneering initiative that involved the implementation of parametric microinsurance as a means to support poor households in coping with cyclone-related risks.

This case study delved into a comprehensive examination of the economic viability of using parametric microinsurance as a social protection scheme, focusing on the Vuda district in the Western Division of Fiji. The research employed Household Economy Analysis (HEA) as a tool to gain a deep understanding of how cyclone events impact the food and cash income of households in the district.

### 3.1 Context

Climate change is a global challenge that presents severe risks to human communities, particularly for marginalised and low-income groups within communities. One of the most significant risks associated with climate change is the occurrence of extreme weather events such as cyclones, which can cause substantial damage and losses to public and private infrastructure, homes, and livelihoods. This, in turn, affects access to essential necessities such as food, water, and education services. Current projections suggest that the consequences of climate change and extreme weather events are likely to worsen (Botzen et al., 2019). The impacts of climate-related disasters are typically higher in developing countries and, within this, the poorest and most disadvantaged groups are the most affected (Chapagain et al., 2022; Hallegatte & Rozenberg, 2017).

Poverty and climate change are closely related. The poorest and most disadvantaged groups tend to rely more on climate-sensitive livelihoods like agriculture (Habtezion, 2013). They also lack the resources needed to effectively deal with climate change impacts – especially where formal and informal social protection systems are weak or have gaps (Winsemius et al., 2018). Reductions in incomes (from climate events) among the very poor can lead to negative coping strategies (e.g. sale of productive assets, reduced consumption of nutritious food, and using the savings that otherwise were intended for education and health), which in turn can deepen the level of poverty that is already being experienced. Moreover, where climate-related shocks are experienced regularly or are in combination with other shocks to livelihoods, such as COVID-19, they constitute poverty traps. Persistent exposure to climate risk can negate development gains made in poverty alleviation and progress towards achieving the Sustainable Development Goals.

Several gender-specific issues can further compound the impacts of climate change. Despite the critical role that women play in food production, they often face barriers to accessing agricultural land, training, credit, and services. The cumulative effects of poverty, combined with social, economic and political barriers, result in women often being disadvantaged in coping with the adverse impacts of the changing climate (UN Women, 2019).

#### 3.1.1 Cyclones in Fiji

Cyclones pose serious threats to communities across the Pacific region, and it is predicted that the impacts of cyclones will intensify over the coming decades (ADB, 2018). In Fiji, the agricultural sector, which is important for both subsistence and formal economic activities, contributing 9.1 per cent of the GDP (Ministry of Agriculture, 2021), is highly susceptible to tropical cyclones that regularly cause widespread damage to crops, trees, livestock and equipment. Historical data shows that on average 28 cyclones per decade developed within or passed through the Fiji Exclusive Economic Zone (Fiji Meteorological Service, 2015).

These cyclones led to significant social, economic and environmental damage in the affected communities and the broader country (Fakhrudin & Schick, 2019; Prabhakar et al., 2018). The Government of Fiji and the World Bank (2017) estimate that cyclones and subsequent floods on average cause annual damages equivalent to 5.8 per cent of the GDP. However, economic damages can be much higher in any given year. For example, the 2016 Tropical Cyclone Winston was estimated to have led to damages of about FJD1.99 billion or 20 per cent of Fiji's GDP (Schimel, 2020). Cyclones cause extensive losses of food supplies and lead to increased prices for main staples such as cassava (Magee et al., 2015). In some cases, agricultural productivity can take between five and 10 years to return to the pre-cyclone level (UNCDF, 2020).

#### 3.1.2 Social protection systems in Fiji

Governments use social protection systems to help the poorest and most disadvantaged groups. Formal social protection refers to a broad set of government transfers of funds or services designed to reduce vulnerability to lifecycle risks, and idiosyncratic and community-wide shocks, and to build resilience. Social protection mechanisms can also improve access to vital services, such as education, health care, and labour market programs. Globally, social protection has assumed an increasingly important role in promoting socio-economic development over the long-term and contributes to preserving development gains (UNESCAP, 2020).

The practice over the last decade in Fiji has been to use the existing formal social protection systems to assist

vulnerable households in meeting their basic needs following severe cyclone events; e.g. Tropical Cyclone Winston in 2016, Tropical Cyclone Harold in April 2020, and Tropical Cyclone Yasa in December 2020 (UNESCAP & MNRE, 2020). Following severe cyclone events, the Government of Fiji temporarily increased the value of existing schemes over a period of time to meet the additional needs of existing beneficiaries. This strategy is sometimes referred to as 'vertical social protection expansion'<sup>5</sup> and is aimed at making existing social protection schemes 'shock-responsive'.

For Tropical Cyclone Winston in 2016, the Poverty Benefit Scheme (PBS), Care and Protection Scheme (CPS), and Social Pension Scheme (SPS), were used for delivering 'top-up' cash within one month of the event. Households under the PBS received cash amounts of FJD600 (lump sum),

while those enrolled for the CPS and SPS received FJD300 (over three months) to assist households in coping with and recovering from the damaging impacts of Tropical Cyclone Winston (Government of Fiji, 2016; Mansur et al., 2017). The total value of cash top-ups through social welfare programs post-Tropical Cyclone Winston was FJD19.9 million.

This practice of social protection top-ups (or vertical social protection expansion) for severe cyclone events in Fiji is in line with a Government of Fiji recommendation following the experience of Tropical Cyclone Evan in 2012 (Government of Fiji, 2013). It is noted, however, that to date this practice has not yet been formalised. The main social protection systems that have been used for vertical expansion are provided in Table 8. Other social protection systems include the Expanded Food Voucher Program for Rural Pregnant Mothers.<sup>6</sup>

**Table 8: Main social protection programs in Fiji**

Program name	Description	Value
Poverty Benefit Scheme (currently Family Assistance Scheme <sup>7</sup> )	The PBS is aimed at protecting the poor and vulnerable through the provision of a cash transfer and food voucher.	FJD35 per adult and FJD17 per child under 17 years old for up to four household members per month; plus, a FJD50 food voucher per family per month.
Care and Protection Scheme (currently Care and Protection Allowance <sup>8</sup> )	This is a cash allowance and food voucher for vulnerable children, such as those from single-parent families and absent spouses.	Benefit amounts range from FJD29 for preschool children to FJD46 for secondary school children, and FJD69 for those with a disability. There is a maximum cut-off value of FJD127 per household; plus, a FJD50 food voucher per family per month.
Social Pension Scheme <sup>9</sup>	The SPS is a non-contributory pension for elderly persons (aged 65 years and above) who have never received superannuation through the Fiji National Provident Fund.	FJD100 per month per person.
Disability Allowance <sup>10</sup>	The disability allowance is aimed at assisting individuals with permanent disabilities.	FJD90 per person for up to two members in the household, so a maximum of FJD180 per month.

(Satriana, 2021; Fiji Government, 2022; Ivaschenko et al., 2019)

<sup>5</sup> 'Vertical expansion' is the temporary increase of the value or duration of a social protection intervention to meet the additional needs of existing beneficiaries. 'Horizontal expansion' is the temporary inclusion of new beneficiaries from disaster-affected communities into a social protection program, by extending geographic coverage, enrolling more eligible households in existing areas, or altering the enrolment criteria (Bowen et al., 2020).

<sup>6</sup> From August 2023, it is now referred to as the Food Allowance Program for Rural Pregnant Mothers (Ministry of Women, Children and Social Protection, 2023).

<sup>7</sup> From August 2023, the new rate for the Family Assistance Scheme changed from FJD35 to FJD40 per month for one-person household; from FJD58 to FJD66 per month for two-person household; from FJD92 to FJD105 per month for three-person household; and from FJD127 to FJD146 per month for four-person household. FJD50 food voucher value will be added to the above amounts respectively (Ministry of Women, Children and Social Protection, 2023).

<sup>8</sup> From August 2023, children not in school receive FJD33 rather than the old rate of FJD29 per month. Children in Primary School receive FJD40 rather than the old rate of FJD35 per month. Children in Secondary School receive FJD52 rather than the old rate of FJD46 per month. Children with disabilities receive FJD79 rather than the old rate of FJD69 per month. Children in residential homes receive FJD138 rather than the old rate of FJD120 per month. The FJD50 food voucher value will be added to the above amounts, respectively (Ministry of Women, Children and Social Protection, 2023).

<sup>9</sup> From August 2023, recipients on the social pension scheme aged above 70 years receive a 25% increase to their allowance, while those between ages 65–69 years receive a 15% increase to their allowance. This means if you are 65 to 69 years, the new social pension scheme allowance is FJD115 per month, while for those who are 70 years and over the allowance is FJD125 per month (Ministry of Women, Children and Social Protection, 2023).

<sup>10</sup> From August 2023, Persons with Disability receive FJD104 per month (used to be FJD90 per month). In addition, the Bus Fare Assistance is now administered on a monthly basis with a monthly value of FJD25 as opposed to FJD75 per quarter (Ministry of Women, Children and Social Protection, 2023).

The informal social protection system, known as the *kerekere* (Calder & Tanhchareun, 2014), translates as 'to request'. Within the *kerekere* system, village members in need ask their relatives or neighbours for goods or services to fulfil basic socio-economic needs, such as food, or to meet certain social obligations, such as funeral ceremonies (Calder & Tanhchareun, 2014). During times of disaster events, the *kerekere* serves as a form of social protection or coping mechanism for the most affected members of the community.

Some have argued that informal social protection may not always be comprehensive and reliable, while it is an essential part of communities. For example, Calder and Tanhchareun (2014) pointed out that community members with the fewest resources are often the least capable of establishing social networks that enhance informal social protection. As such, it is likely that, although informal social protection plays a crucial role in community coping after a hazard event, there may still be some members who have unmet essential needs. Moreover, as climate events become more frequent and intense, the pressures on these informal systems are expected to substantially increase. It is not known, at this point, what the capacity of these systems is to absorb additional pressures and how and when these systems may break down.

## 3.2 Parametric Insurance

There is evidence that poverty, inequality and disaster risk are reinforcing each other. The United Nations estimated, for example, within Fiji in 2016, 118,000 people were living in moderate poverty under FJD3.20 a day. Economic growth is projected to reduce this number to 38,000 people by 2030. However, with disaster risk, 62,000 people are projected to be living in extreme poverty in 2030 (UNESCAP, 2020).

Governments and international development agencies have a role in helping vulnerable and disadvantaged groups manage climate-related risks and thus to ensure that progress made towards poverty alleviation is not eroded by these events. Ideally, government interventions should be targeted at the barriers that are constraining the capacity of these groups to manage the disaster and climate risks they face (and breaking out of the poverty trap more generally).

Insurance and parametric insurance are disaster risk financing instruments that could help break down the barriers. Insurance is a mechanism to transfer risks of substantial damage and loss (from the insured) to a third party (the insurer). This is a valuable risk management strategy for extreme events because the financial damage does not translate into long-term economic losses if a household can meet its needs and thus avoid negative coping strategies.

Parametric insurance, also known as weather index or index-based insurance, is a type of insurance that provides coverage to policyholders against climate and weather-related events. Parametric insurance is increasingly being considered as a way to provide social protection for poor and vulnerable communities around the world (Sengupta & Kousky, 2020). It operates on predetermined and objective thresholds (e.g. windspeed of more than 200 km/hr) to trigger payouts, rather than on actual damages and losses incurred, as is the case with most other insurance types.

The thresholds are typically verified by a third party independent of the insured and the insurer (Kousky et al., 2021; Lin & Kwon, 2020), reducing the problems of moral hazard caused by asymmetric information in traditional indemnity insurance (Skees, 2012).

Parametric insurance policies can – and have been – written at all scales, from insuring an individual to insuring a country. At one end of the scale is parametric microinsurance, which is low-limit and low-cost, often targeted at low-income households or microenterprises (Sengupta & Kousky, 2020). Parametric microinsurance can be sold directly to the consumer via mobile technologies or as an add-on to existing microfinance services (Clyde & Co. LLP, 2018).

When thresholds are triggered, parametric insurance enables prompt payments to policyholders, as it does not require time-consuming damage assessments (Mărgulescu & Mărgulescu, 2013). The ability to deliver prompt payouts after (or even before) a disaster event provides insurance policyholders with cash to action time-sensitive preparedness and response measures, as well as helps avoid deployment of negative coping strategies.

### 3.2.1 The advantage of parametric insurance for social protection

There is a growing consensus that increased insurance penetration can improve global resilience and that insurance continues to play a unique and vital role in rebuilding after disaster strikes. A Lloyd's report estimated that an increase in insurance penetration of one per cent would reduce the proportion of the total damage resulting from a natural hazard borne by the taxpayer by approximately 22 per cent of the total estimated damage (Clyde & Co. LLP, 2018; Lloyd's, 2012). There is no simple or one-size-fits-all solution to close the protection gap, but appropriately designed insurance solutions can help mitigate the effects of disaster events by enabling marginalised households and communities to get back on their feet quicker and more efficiently. Parametric insurance is one of those.

As parametric insurance payments do not require loss adjusting on the ground, payments can be made quickly to hard-to-reach policyholders in remote locations, often via online payment platforms or through mobile phone networks. Parametric insurance schemes are also extremely useful where there are wide-ranging and hard-to-quantify losses; for example, at the national scale.

Parametric insurance policies are less expensive than regular insurance as they avoid many of the transaction costs associated with providing a large number of very small insurance contracts in the traditional manner (CCRIF, 2019).

Parametric insurance can also play a critical role as a pre-disaster financing tool to address post-disaster needs, particularly with public sector agencies that have the responsibility to rebuild a community after a disaster. Unlike post-disaster financing, insurance payments do not have to be paid back and are guaranteed to support the recovery process. This type of pre-disaster financing can reduce the need for using taxes/levies to pay for recovery after disasters (Sowers & Michel, 2022).



### 3.2.2 Potential issues with the use of parametric insurance for social protection

While parametric insurance offers numerous benefits, it also comes with certain challenges. The first major concern is basis risk. In the context of parametric insurance, basis risk refers to the financial risk arising from a disconnect between experienced losses and insurance payouts (Weingärtner et al., 2017). This can lead to significant costs for insurance policyholders or the insurer, potentially undermining the viability of the insurance scheme. Lin and Kwon (2020) explain that there are two types of basis risk: positive and negative basis risk.

Positive basis risk occurs when the insurer delivers payment to policyholders who have not experienced a loss event or when the payment amount exceeds the actual loss. This discrepancy can affect the scheme's viability from the insurer's perspective. Positive basis risk is depicted by the diamond-shaped area below the payment line in Figure 4. On the other hand, negative basis risk occurs when policyholders receive no payment or when the payout is less than the actual damage incurred. Such situations can erode trust and reputation, leading to policyholders not renewing their policies (Aheeyar et al., 2021; Clarke & Grenham, 2013). The issue of basis risk arises due to the simplification of payments when external triggers, rather than actual losses, determine the release and amount of payout. Negative basis risk is of particular concern where individuals do not have access to full premium subsidies, as this can lead to discontinued enrolment in subsequent years. Investment

in access to location-specific data and development of objective parameters for informing objective triggers of insurance payouts is one way to minimise basis risk and support the development and use of parametric insurance (Chantararat et al., 2012).

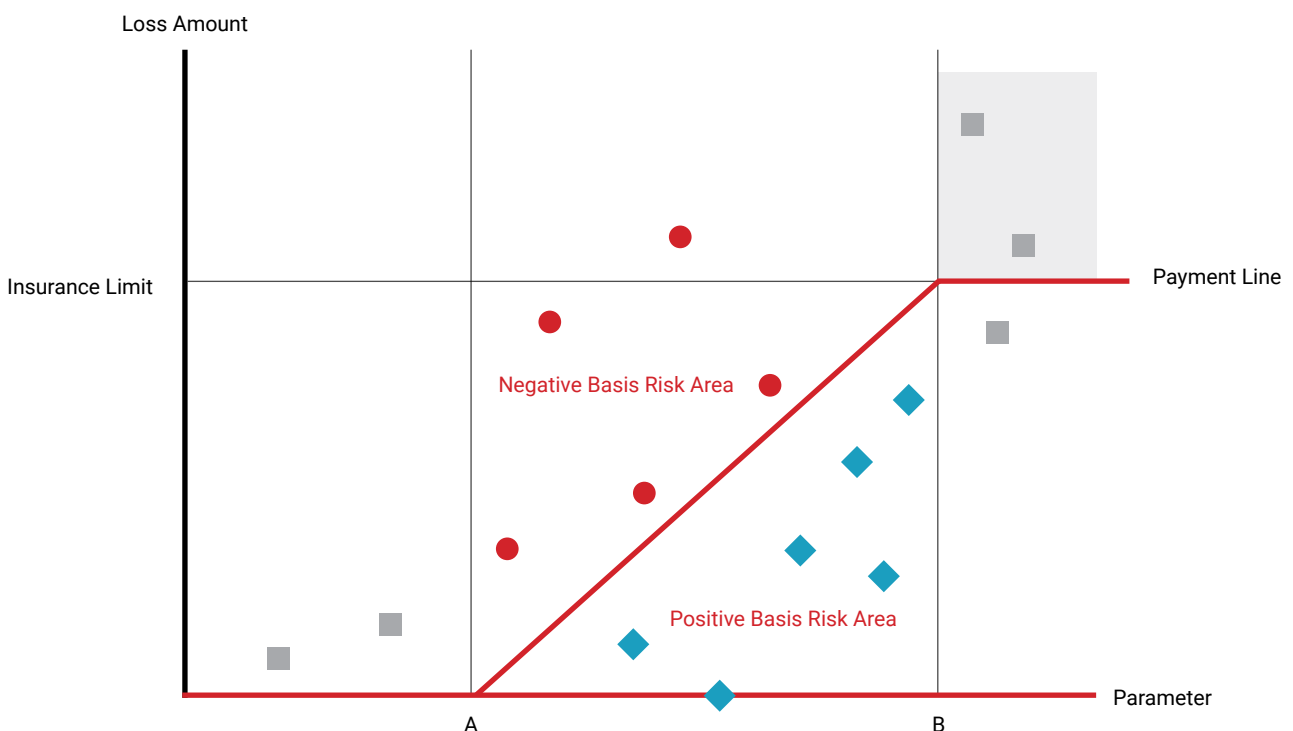
A further challenge for the use of parametric insurance schemes in social protection relates to achieving the appropriate balance between private sector profit and public good objectives of the insurance. Insurance premiums are driven by the level of risk, associated capital costs, ongoing expenses, and expected private profits of the insurer (Clarke & Grenham, 2013). A lack of competitive pressures can inflate expected private profits and hence the economic viability of the scheme.

### 3.2.3 Barriers constraining the use of parametric insurance and the role of the government

Poor households have limited resources to manage damages and losses incurred from disaster events. This includes financial resources to use in the purchase of insurance products. To help address this barrier, governments and international development organisations have played a role in partially or fully subsidising insurance premiums.

As poor households are generally unable to afford insurance premiums, there is a very low demand for parametric insurance by the poor (Clarke & Grenham, 2013). Low demand can also be due to a lack of access to and knowledge or financial literacy about existing parametric

Figure 4: Positive and negative basis risk<sup>11</sup> (adapted from Lin & Kwon, 2020)



<sup>11</sup> The y-axis represents payment value ranging from zero to the insurance limit, while the x-axis represents the value of the payment trigger parameter – payments are triggered from A, and the maximum payout is at B. The black square marks indicate points where there are no losses – so no payments or points where loss amounts are outside the insured maximum payout level.



insurance schemes. Nonetheless, low demand leads to diminished viability of the insurance products for the private sector, especially for the small island developing states (SIDS) with small populations, which in turn can lead to the absence of supply of these products. To help address this situation, in addition to subsidising premiums, government and international development organisations support insurance market development to include people who are marginalised (Aheeyar et al., 2021). Past evidence shows that the role of government agencies has been through the co-development of suitable insurance products, establishing an ecosystem of partners to support implementation and/or piloting the products (Machado & Goodes, 2023; Greatrex et al., 2015), and developing appropriate regulation frameworks (Clarke & Grenham, 2013; Clement et al., 2018).

In addition, private insurance companies sometimes face significant barriers to entry. These barriers relate to the high set-up costs, which may include research, design, building infrastructure for data collection, operational costs, stakeholder onboarding, and risk of low demand (Clarke & Grenham, 2013). It is sometimes appropriate for government to help reduce these costs. This can be done for example through 'parallel alignment' and 'piggybacking' of parametric insurance products in the market with existing social protection programs.

Governments can formalise the allocation of funds from national climate risk insurance to social protection if they opt to pre-determine, either through their fiscal policy framework or through their disaster risk management strategies, the percentage of a payout that could be apportioned to those most affected by the natural hazard and align this with the country's social protection strategies and programs (CCRIF, 2019).

### **Box 3: Insurance for social welfare recipients in Fiji**

In partnership with Fiji Care Insurance Limited, the Fiji Government developed an insurance package designed for social welfare recipients. The partnership between the Fiji Government and Fiji Care Insurance Limited started in the 2018–2019 fiscal year and is being renewed annually, benefiting 86,000 recipients of the Poverty Benefit Scheme, Social Pension Scheme, Disability Allowance Scheme, and Care and Protection Program.<sup>12</sup> They are entitled to funeral assistance, fire insurance assistance, and life cover that is applicable to recipients below the age of 70 years. As of March 2022, a total of FJD20.9 million was paid out from 16,689 claims, and the payouts were based on the assessments of the insurer and their terms and conditions (Government of Fiji, 2022).

## **3.3 Global Examples of Parametric Insurance for Social Protection**

Internationally, parametric insurance has been applied for social protection objectives. The Bangladesh flood protection insurance scheme is an example of parametric insurance with a social protection objective. This scheme was a response to the poverty trap created by persistent floods in Bangladesh, where an international development agency, Oxfam Bangladesh, teamed up with the Swiss Re Group, Pragati Insurance Limited, Manab Mukti Sangstha (NGO), and the Swiss Agency for Development and Cooperation, to deliver social protection through parametric insurance (Swiss Re, 2018). The insurance product was designed to be triggered by pre-defined flood water levels and flooding duration. Swiss Re (2018) noted that by using parametric insurance, the protection could be delivered without the need to assess specific flood losses for all covered households, thus making parametric insurance cheaper and more operationally efficient than conventional insurance.

A key feature of this Bangladesh insurance was that it is designed to provide social protection through a group structure; i.e. the policy is held by a local NGO, Manab Mukti Sangstha, which has access to villages and individual households. The policyholder is provided with compensation at the end of the monsoon season and is tasked with distributing funds to households using pre-defined compensation criteria. The scheme was launched in 2013 with 1,661 policyholders across 10 villages in the Sirajgani district of Bangladesh. The following year, 2014, payouts valued at USD25,000 were triggered and delivered to 700 households (Islam, 2015). The parametric insurance scheme has been credited with helping poor households cope with the hardships brought on by floods. It was reported that the payouts were used to repair their homes and invest in seeds and fertilisers to improve crop yields.

The Climate Risk Adaptation and Insurance in the Caribbean (CRAIC) project under the Caribbean Catastrophe Risk Insurance Facility (CCRIF) is another example, in which parametric microinsurance and social protection are aligned to address the underlying causes of poverty and are able to reduce the increasing risk of climate shocks and the impoverishing effects of disasters. The project developed a parametric microinsurance product called the Livelihood Protection Policy (LPP), which is designed to help protect the livelihoods of vulnerable low-income individuals, such as small farmers, tourism workers, fishers, market vendors, and day labourers, by providing quick cash payouts following extreme weather events (CCRIF, 2019).

The Caribbean Ocean and Aquaculture Sustainability Facility (COAST), which has been introduced by CCRIF and the World Bank to allow Caribbean countries to benefit from access to parametric insurance in the fisheries sector, is another example of parametric insurance supporting the social protection objective. The COAST insurance policies provide coverage for fishers and other players in the fisheries industry to enable them to recover quickly after weather-related events (CCRIF, 2019).

<sup>12</sup> Refer to Table 8 for the new titles of these social protection schemes and their details.

The Caribbean examples demonstrate that incorporating parametric insurance into a social protection scheme could allow governments to provide support more quickly after an event, preventing the aftermath of the event from worsening. This strategy could also help families from falling into a poverty trap and can reduce vulnerability. Further, by linking microinsurance with social protection, governments can also reduce the financial burden of disaster response and prevent themselves from having to reallocate budgets by moving resources away from other development priorities (CCRIF, 2019; MCII, 2020).

### 3.3.1 Economic feasibility examples

While there are several global examples of parametric insurance supporting social protection objectives, the literature review undertaken for this study did not find any studies that examined parametric insurance for social protection with an economic lens. In addition, while there are several parametric insurance products across the developing world, there is a general dearth of data on the economic performance of these products. This could be a result of the humanitarian nature of the objectives that drive the implementation of these products (Kousky et al, 2021; Aheeyar et al., 2021).

Some anecdotal evidence on economic feasibility was provided by Prabhakar et al. (2017). This report indicates that parametric insurance was viable in India, providing an estimated BCR of two. This was a weather index form of parametric insurance that was mandatory for accessing crop loans. The Indian insurance product assessed by Prabhakar et al. (2017) was an unnamed parametric insurance product. Benefits included avoiding negative coping strategies, such as the sale of productive assets, and minimised impact on usual livelihoods for policyholders. Only direct costs and benefits were modelled in the cost-benefit analysis, and these included premiums paid and payouts received by policyholders.

## 3.4 Pacific Examples of Parametric Insurance for Social Protection

The use of parametric microinsurance for social protection against climate and extreme events is new in the Pacific region. The first-of-its-kind climate risk insurance for social protection was launched in 2021, jointly by the World Food Programme and the United Nations Capital Development

Fund, in partnership with the Fiji Ministry of Women, Children and Poverty Alleviation<sup>13</sup>, targeting 274 social welfare beneficiaries, including people with disabilities and older persons, located in high climate risk areas in Fiji (UNCDF, 2023a). The social welfare beneficiaries were increased to 2,000 in the subsequent year (Machado & Goode, 2023). This innovative solution was to help the Fiji Government address development challenges for the most vulnerable, transferring administrative burdens and financial risks to the insurance providers to effectively address extreme weather events.

The Fiji parametric microinsurance cover for social welfare beneficiaries was designed to be triggered by windspeed and distance thresholds, as shown in Table 9. During the pilot phase, the WFP assumed responsibility for covering the premium costs on behalf of the Department of Social Welfare. The annual premium cost per policyholder amounted to FJD32, while the payout amounts varied between FJD30 to FJD400, depending on the windspeed and proximity to the eye of the cyclone. The lowest payout amount is triggered by a Category 1 tropical cyclone with a windspeed range of between 119 km/hr and 153 km/hr for those located within 25 km of the eye of the cyclone, or a total sum of 150 to 199 mm of rainfall over three consecutive days. The largest payout is triggered by a Category 5 tropical cyclone for policyholders located within 25 km of the eye of the cyclone.

## 3.5 Fiji Parametric Insurance for Social Protection Study

### 3.5.1 Methodology for assessing economic costs and benefits

To assess the economic feasibility of parametric microinsurance for the poor and marginalised households in Fiji, this study employed a cost-benefit analysis framework. The CBA framework is an established, robust and systematic tool for assessing the benefits of an intervention against its costs.

For this study, the counterfactual scenario took into consideration the existing formal and informal social protection systems in place, which are expected to continue into the foreseeable future. Importantly, the counterfactual scenario is based on what has happened in the severe cyclone events over the past 10 years and where social

**Table 9: Payout structure for windspeed**

Tropical cyclone category	Max. wind speed range (km/hr)	Amount paid (in FJD) by distance to the eye of the cyclone			
		0–25 km	25–50 km	50–75 km	75–100 km
1	119 to 153	30	0	0	0
2	154 to 177	60	40	0	0
3	178 to 208	160	60	40	0
4	209 to 251	280	120	60	40
5	252 and above	400	280	120	60

(Machado & Goode, 2023)

<sup>13</sup> Now the Ministry of Women, Children and Social Protection.

protection top-ups were provided; i.e. Tropical Cyclone Winston in 2016, and Tropical Cyclone Harold in 2020. This assumption reflects the understanding and expectation from community interviews, which indicated that top-ups are likely to happen, although they are not formally institutionalised or regulated. The counterfactual scenario was developed through: (a) the application of the Household Economy Analysis framework; and (b) a review of previous impact assessment reports for Fiji.

From the counterfactual scenario, cost and benefit categories were identified. Costs included capital and ongoing expenditures for setting up and operating the parametric microinsurance scheme. Benefits included the expected value of insurance payouts to policyholders. The following equation shows how the annual expected value was calculated:

$$\text{Annual expected payout} = \sum_{k=1}^n (P \times L)$$

Where:

$k$  = cyclone category and  $n$  is the number of cyclone categories

$P$  = payout amount as per the parametric microinsurance scheme

$L$  = likelihood of the cyclone event, and thus payout occurring in a given year

In addition to assessing the parametric microinsurance scheme as currently designed (whereby policyholders

receive a payout shortly after the cyclone event occurs), the analysis also assessed a second design option where policyholders are given payouts prior to the actual event. This option is intended to assess the potential purchasing power benefit of acting earlier. Previous studies on the impacts of cyclones have shown that prices, especially of agricultural products including key staples, can more than double following a hazard event, with effects lingering on for several seasons (UNCDF, 2020; Government of Fiji, 2016; Magee et al., 2015).

Scheme costs were sourced from the UNCDF and the WFP. A summary of these scheme costs is provided in Table 10.<sup>14,15</sup>

The CBA was set up for a timeframe of 30 years and a discount rate of seven per cent. Sensitivity analysis discount rates were applied at three per cent and 10 per cent.<sup>16</sup> All costs and benefits were adjusted to 2022 Fijian dollar values using the Fiji Consumer Price Index.

In addition to the discount rate, sensitivity analysis was undertaken on the following key input parameters:

- The annualised cyclone likelihood for Category 1 to 5 for the Vuda district.<sup>17</sup>
- Distributional weights for benefits accruing to very poor households – elasticity of marginal utility of income of 1.2 were modelled to test against the assumed parity weighting in the central analysis and were based on upper bound estimates recommended by Pearce (2003).<sup>18</sup>

**Table 10: Total investment in the microinsurance policy**

Variable	Value	Source/Comment
Product development (UNCDF)	USD50,000	UNCDF (personal communication, April 2023)
Set-up costs (WFP)	USD4,976	WFP (personal communication, April 2023)
Project staff	USD101,860	WFP (personal communication, April 2023)
Assume average exchange rate	USD1 = FJD2.14	Based on average exchange rates between 2020 and 2022 when these expenses were incurred.
The estimated proportion of capital costs to project area	6%	Based on the number of geographical areas covered in the pilot ( <i>Tikina</i> ).

<sup>14</sup> The ongoing premium costs were estimated for a caseload of 2,022 households. This represents 10 per cent of the Vuda district's population and is proportionate to the target national caseload of 91,000 policyholders (Machado & Goode, 2023).

<sup>15</sup> UNCDF assumed the responsibility of conducting a literature review and designing the insurance scheme under the Pacific Insurance and Climate Adaptation Programme (PICAP). Hence, for this cost-benefit analysis, the costs incurred by UNCDF are considered as sunk costs. Sunk costs are economic costs that have already been incurred and cannot be recovered. In the context of a cost-benefit analysis, sunk costs are considered irrelevant to the decision-making process, because they cannot be changed by any decision made in the present or future.

However, it is essential to recognise the crucial role played by UNCDF in facilitating the implementation of parametric microinsurance for social welfare beneficiaries in Fiji. WFP invested in project staff and covered the insurance costs payable to Fiji Care, a private insurer. The project staff costs encompassed collaboration efforts between WFP and other stakeholders. Additionally, a contractor was hired to travel and locate the social welfare recipients selected by the Department of Social Welfare for enrolment into the insurance policy.

<sup>16</sup> The choice of discount rate was informed by typical rates used in the Pacific (see Buncle et al., 2013).

<sup>17</sup> Sensitivities for cyclone hazards were limited to investigating the effects of uncertainties associated with forecasted changes in the frequency of different level cyclones under a 2°C temperature rise climate future (refer to Knutson et al., 2020). The analysis did not model uncertainties associated with the PCRAFI modelling (refer to section 3.5.2) for the current period, due in large part to a lack of robust alternatives (at least what could be located in the time available for the analysis) available for the project site.

<sup>18</sup> This sensitivity investigates marginal utility of income for poor households. The following equation was used as per Pearce (2003):  $W_{\text{poor}} = Y_{\text{poor}}$ . Where  $W_{\text{poor}}$  is the equity weight,  $Y$  is national average income for Fiji, and  $Y_{\text{poor}}$  is poor household average income, and  $\epsilon$  is the elasticity of the marginal utility of income. As per Pearce (2003), it was taken to be 0.5 to 1.2. For this case study, the estimated equity weights for this range of  $\epsilon$  was estimated to be 1.6 to 3.2.

Monte Carlo simulations were used to perform the sensitivity analysis. Monte Carlo simulation performs risk analysis by using different input parameters and their distribution bounds through multiple iterations to generate a range and probabilities of outputs of interest.<sup>19</sup>

### Household economy analysis

The Fiji case study also applied the HEA framework, which is a livelihoods-based framework that can help understand how a household is affected by a shock such as a tropical cyclone. HEA provides for a prediction of impacts on income, access to food, and other basic needs such as health and education. The emphasis on the household level is an attempt to get a clearer understanding of the cyclone impacts on households that are the target of the insurance scheme.

The application of the HEA framework for Vuda covered three villages (Viseisei, Lomolomo, and Lauwaki), and two settlements (Nabare and Vuda), in the rural Vuda district, Western Division, Fiji. The Vuda district was selected as a case study livelihood zone for the HEA because it had the highest number (49 per cent) of beneficiaries for the parametric microinsurance pilot project and is a severe cyclone risk area.

The HEA field data collection, conducted in April 2023, commenced with the recruitment of local data collectors, who had prior enumeration experience with the Fiji Statistics Office, and an elderly agriculture expert with experience in engaging local communities as well as approaching the local leaders according to Fijian traditions and protocols. Approval to visit local communities was sought and granted in writing by the Fiji Ministry of Agriculture and the Ministry of iTaukei Affairs.

As part of the HEA process, villagers were categorised into three main wealth groups – 'poor', 'middle', and 'better-off'. The 'poor' category was further separated to gather information about 'poor female-headed households' (FHH) specifically. The analysis focused on poor households, as these were the targets of the parametric microinsurance social protection scheme.

Appendix 2 provides more information about the HEA and the findings from the HEA field data collection.

### Caveats and limitations

The HEA framework aims to generate and analyse the impacts and responses of a 'typical household' in each wealth group. However, it is important to acknowledge that actual experiences and coping abilities may vary, even among households within the same wealth group and livelihood zone. Therefore, the findings from the HEA should not be interpreted as suggesting that no households resort to negative and costly coping strategies after a cyclone event.

Moreover, it is crucial to recognise that these findings are specific to the Vuda location and context. Variations in cyclone vulnerability and in the means of attaining livelihoods and survival can potentially change the outcome results.

Based on the HEA findings and understanding of the role played by social protection mechanisms, it is hypothesised that parametric insurance for social protection may be economically viable in other communities where negative coping strategies are deployed after a disaster event.

### 3.5.2 Cyclone hazard analysis

Information on the frequency and intensity of cyclone hazards for the Vuda district was estimated using cyclone hazard modelling outputs prepared for Fiji as part of the Pacific Catastrophe Risk Assessment and Financing Initiative (PCRAFI) – a long-term initiative implemented by The Pacific Community (SPC) and the World Bank. These PCRAFI modelling outputs show windspeed ranges for each geographical region of Fiji for cyclones with an expected return period of 1 in 20, 50, 100, 250, 500, and 1,000 years. Using this information, a mathematical (exponential) function<sup>20</sup> was derived to approximate the relationship between return period (frequency) and windspeed (intensity) for the Vuda area. This mathematical function was then used to estimate the annual likelihood (frequency) of cyclones occurring that exceed the windspeed thresholds specified for each of the insurance payout levels.

In the medium-term future, the frequency of cyclone events is expected to change under the effects of climate change. However, the direction and magnitude of this change is uncertain. Knutson et al., (2020) estimate the frequency of lower-intensity cyclone events (i.e. Category 1 to Category 3 levels) could change by between minus 42 per cent and plus two per cent relative to current levels under a 2°C temperature rise future. For higher-intensity cyclone events (i.e. Category 4 to Category 5 levels), this change is even more uncertain and could be anywhere from minus 42 per cent to plus 20 per cent relative to current levels.

An illustration of the cyclone frequency data used for a Category 4 level cyclone is provided in Figure 5. The middle solid line shows the forecasted most likely (ML) cyclone probability for the Vuda district. The upper and middle dashed lines reflect the uncertainty around the most likely estimate from 2023 to 2050. The low (L) trends show an optimistic scenario where the annual likelihood of Category 4 tropical cyclones decreases, while the high (H) or upper trend line shows a pessimistic scenario where the likelihood of Category 4 tropical cyclones increases through to 2050. These trends are based on current, year 2050 cyclone probability estimates, and a straight-line interpolation between the two periods.

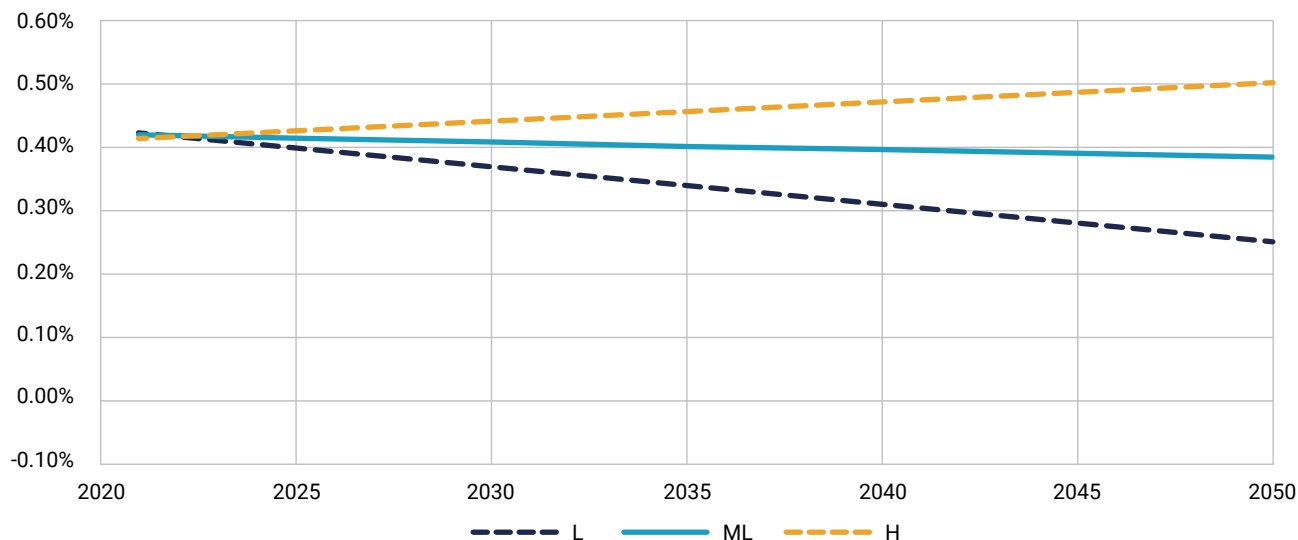
<sup>19</sup> The numerous iterations use a different set of random values from the probability functions. This analysis involved the use of 20,000 iterations.

<sup>20</sup>  $y = 0.8437e^{0.027x}$





Figure 5: Estimated annualised likelihood of Category 4 Tropical Cyclones for Vuda (derived from PCRAFI data)



### 3.6 Fiji Parametric Insurance for Social Protection Study Results

HEA results indicate that cyclones impact livelihoods and food for poor households in Vuda in two main ways. The first is a loss of crops (particularly cassava and taro) used for subsistence needs. The second is losses in income pertaining to small-scale trade (e.g. handicrafts, or flowers) and casual self-employment. The magnitude of these impacts is significant for severe cyclones – Category 3 and above. At this severe level, cyclone impacts push food and cash income for the typical poor household below the livelihood protection and survival thresholds.<sup>21</sup>

Figure 6 illustrates this impact and coping response for a Category 4 cyclone event for a typical poor household in the Vuda district. As can be seen, reductions in subsistence crop production (amber) and self-employment (blue) from the pre-cyclone situation to the post-cyclone situation are significant, and it would push food and cash income levels below the livelihood protection threshold (solid black line at 118 per cent), and the survival threshold (dotted red line at 105 per cent), if no external assistance was provided.

With existing social protection schemes (orange) and additional government top-ups (grey) as per recent practice<sup>22</sup>, as well as informal *kerekere* (brown) in the post-cyclone situation, this deficit is corrected. That is, with the coping support from the existing formal and informal social protection systems, the food and cash income of impacted households shifts back up above the livelihood protection and survival threshold levels. However, it is worth noting households are not able to immediately get back to their pre-cyclone income and expenditure levels, as the recovery from pre-cyclone levels could take longer.

Another insight is that there is no evidence of negative or high-cost coping strategies, such as distress migration, sale of productive assets, sex work, detrimental reductions in education and health expenditure, detrimental decreases in food intake, a switch to less nutritional food types, or reduced expenditure on productive inputs (e.g. fertiliser, or livestock medicine). This is in line with what could be expected for a situation where formal and informal social protection arrangements are adequate for basic needs and cover all vulnerable and marginalised sub-groups, noting the following key coping strategies for poor and poor female-headed households in the Vuda district:

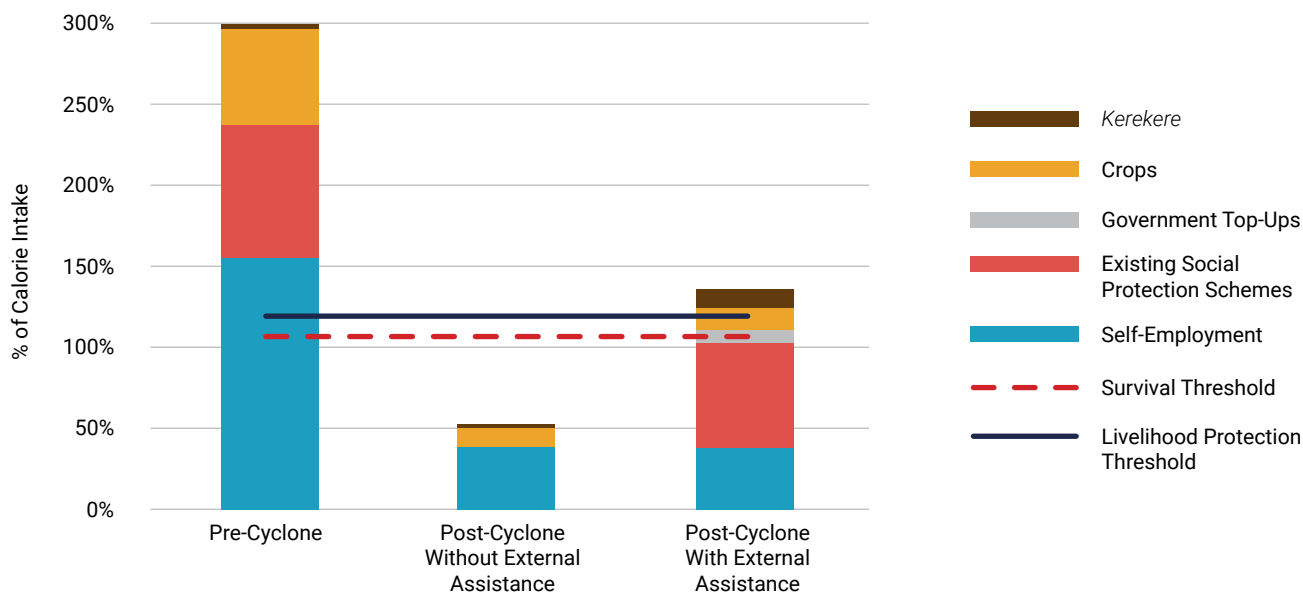
- Access to formal social protection measures.
- Increased exchange of gifts among relatives in the community (i.e. *kerekere*).
- Increased remittances from relatives in town/city or overseas.
- Reduced expenditure on school pocket money and at times delays in purchasing new school uniforms or stationery.
- Increased fishing effort (taking into account that some villages will lose their nets, boats, and fishing gear during a cyclone hazard).
- Adjustments to meal patterns, such as switching from cassava to breadfruit, consuming less expensive food.
- Reduction of contributions to the community or religious events/obligations.

**Existing social protection schemes play a significant role in reducing the need for negative coping strategies in times of disasters.**

<sup>21</sup> Survival threshold is the total food and cash income required to cover the food and non-food items necessary for survival in the short-term. It includes 100 per cent of the minimum food energy need (kilo calories), the costs associated with food preparation and consumption; and where applicable, the cost of water for human consumption. Livelihood threshold is the amount of food and cash income required to protect local livelihoods.

<sup>22</sup> Given that cash top-ups varied based on the number of social welfare beneficiaries in a given family and the type of schemes applicable, an average value of FJD450 from the Tropical Cyclone Winston response was used.

**Figure 6<sup>23</sup>: HEA estimates of Category 4 tropical cyclone impact on total food and cash income for a typical poor household. Without existing social protection schemes, a typical poor household is not able to cover the minimal calories to survive (middle bar graph), which is corrected with the support of the existing social protection schemes, government top-ups, and the kerekere (right bar graph). It demonstrates the indispensable value of existing social protection schemes in Fiji.**



This suggests the robustness of Fiji’s existing formal and informal social protection systems already in place to cover most of the basic needs.

Table 11 shows the headline results of the cost-benefit analysis on the parametric microinsurance pilot for social protection recipients in the Vuda district. The costs of the scheme are significantly greater than the benefits generated – represented by a negative Net Present Value (NPV)<sup>24</sup> result and a BCR<sup>25</sup> result of less than one. This finding indicates the parametric microinsurance social protection scheme, as it is currently designed with its premium and payout structures, in the context of Vuda, does not seem to be cost-effective. Additionally, the existing findings from the HEA showed that formal and informal social protection systems already in place cover most of the basic needs. As

a result, there is no expectation of a change in the economic viability of the scheme in the Vuda district, even if design changes are made so that policyholders receive payouts prior to the cyclone event.

Interestingly, however, the results support the idea of early actions, by estimating the potential 37 to 41 per cent increased benefit of early insurance payouts or cash transfers (such as social protection top-ups) prior to a hazard event, compared to post-hazard payouts. The increase in the value of benefits is an outcome of better purchasing power due to the potential ability to purchase items before high price increases, which typically occur after a catastrophic cyclone in Fiji. For example, post-Tropical Cyclone Winston, the price of cassava doubled to FJD10 per heap (Government of Fiji, 2016).

**Table 11: Headline results of CBA**

Investment criteria	Parametric Microinsurance Scheme as currently designed	Parametric Microinsurance Scheme with earlier payout
Present value of parametric microinsurance benefits (A)	228,138	315,731
Present value of parametric microinsurance costs (B)	809,337	809,337
Net present value (A-B)	-581,199	-493,606
Benefit-cost ratio (A/B)	0.28	0.39

<sup>23</sup> Figure 6 illustrates how people typically live, and how they have been affected and coped in the past. This information is then used to identify whether there is a gap in survival and livelihood thresholds that can be addressed by other instruments such as the parametric insurance.

<sup>24</sup> Net present value is the difference in the value of benefits and the value of costs over the assessment period, when all values are assessed in present value terms. For a project to be viable, the NPV should be greater than zero.

<sup>25</sup> The benefit-cost ratio represents the ratio of benefits to costs. The BCR should be greater than one for a project to be economically viable.

**Table 12: Summary of sensitivity results**

Investment criteria*	P10	ML	P90
Benefit-cost ratio for parametric microinsurance scheme as currently designed	0.27	0.28	0.29
Benefit-cost ratio for parametric microinsurance scheme with earlier payout	0.37	0.39	0.41

\*P10 = 10th percentile and P90 = 90th percentile

The results of the sensitivity analysis indicate the headline finding is robust to changes in input parameter values (within the uncertainty bounds specified). The 90 per cent confidence interval for the BCR is within a narrow range of 0.27 to 0.29. Refer to Table 12, which indicates that there is a 10 per cent (10th percentile) chance that the BCR is less than 0.27, and a 10 per cent (90th percentile) chance that it is higher than 0.29 for the parametric microinsurance scheme as designed.

It is noted here that the sensitivity analysis did not investigate uncertainties pertaining to the accuracy of the PCRAFI cyclone hazard modelling. This is because robust cyclone modelling alternatives, which appropriately specify windspeeds and their associated annual exceedance probability for the Vuda district, could not be located – or at least were not available at the time of this analysis. The CBA results can readily be re-tested using alternative cyclone hazard modelling numbers if such modelling does indeed exist and is available.

Further sensitivity analysis was undertaken to explore the impacts of equity weights, assuming that the utility of one dollar is higher for a poor household compared to a better-off one. The results of this sensitivity analysis (elasticity of the marginal utility of income ( $\epsilon$ ) of 1.2) show that the BCR increases significantly under this test – to 0.90 for the current design and to 1.24 for the earlier payments design – but does not affect conclusions about the intervention under the current design.



Ni-Vanuatu women leading clean-up efforts after Cyclone Pam in 2015. Photograph: ActionAid Vanuatu.

The CBA findings are representative of the context of the Vuda district. However, given the robustness of the existing social protection schemes, as illustrated in the HEA results from Vuda, further investment in the existing social protection schemes (and its vertical expansion in times of disasters) may be more cost-effective to deliver on social protection objectives compared with the parametric microinsurance scheme as it is currently structured.

Nevertheless, parametric microinsurance could still be one of the risk financing options to improve financial protection and build climate and disaster resilience beyond the livelihood and survival thresholds. This would be particularly relevant where there is the presence of high-cost coping strategies that can be reduced/eliminated by the insurance payouts and any related purchasing power benefits associated with acting earlier. It is also likely that the parametric microinsurance for social protection is economically viable in other communities where negative coping strategies are deployed after a disaster event.

**The benefit for the policyholders receiving payouts before the cyclone event is increased by 37 to 41 per cent, due to additional purchasing power.**

This study did not investigate the validity of assistance at different points of time; but it recognises that full recovery could take a long time and that the benefit of cash transfer assistance, like parametric microinsurance, would be realised several months after the disaster. Mansur et al. (2017) suggested, for example, that three months after the cyclone took place, beneficiaries under the Poverty Benefit Scheme were more likely to have recovered from the shocks they faced, relative to comparable households that did not receive the additional assistance during the Tropical Cyclone Winston recovery.

In terms of improving efficiency, it is assumed that ongoing operational costs might be less than what was identified for this study – for example, project staff costs initially borne by WFP to validate the social welfare recipient list would not be necessary once the social protection database is reliable and sound. This needs to be tested and re-evaluated as part of the ongoing monitoring of the scheme, along with other investment costs, including premium subsidy and costs for the insurance providers, associated with running the instrument sustainably.



## 4. Information Economics for Anticipatory Approaches

This section provides some insights into the value of data and information, and accompanying concepts on effective information governance and management.

### 4.1 Context

The costs, benefits, and return on investment of managing information are rarely considered or known. Specifying the value and costs of information and its management is not common, and it requires some effort. However, the discussions and publications about the value of data, and data monetisation efforts are evolving (Coyle et al., 2020; Deloitte, 2020; Mitchell et al., 2021; OECD, 2022; Coyle & Manley, 2022).

Information management is used here as a general term, including data, records and knowledge unless specifically stated. Information management is not used as a synonym for information technology, which is often generalised and therefore leads to gaps. The examples focus on early actions that are transferable to disaster risk reduction, disaster risk management, and other topics.

The success of early action, disaster risk reduction, and sustainable development in the Pacific and globally depends on reliable quality information. Examples of early action information needs, in line with AA building blocks, include those in the following list (Centre for Humanitarian Data, 2022; Dall & Huyck, 2022).

- Risk assessments comprising hazards, exposure, and vulnerability.
- Current hazard data with monitoring, forecasts or models, and historical data including the impacts of past events to develop and update triggers that set off planned actions.
- Qualitative stakeholder engagement data to define anticipated actions and finance.
- Monitoring and evaluation, including the triggers and impact.

### 4.2 Information for Multi-Hazard Early Warning Systems

Essential early action information is provided through the daily operations of effective early warning systems. The checklist for multi-hazard early warning systems (MHEWS) documents various information requirements, as consolidated in Table 13 (WMO, 2018).

The MHEWS checklist demonstrates the variety and volume of information activities and processes. General information activities and processes can be mapped as value chains, as illustrated in Figure 7 (Coyle & Manley, 2022). This includes the collection or creation of information, organising and analysing information for publication and dissemination, as well as the use and re-use of information. To manage diverse information activities effectively and create benefits, financial and human resources are required to cover ongoing and changing requirements and respective skills.



Interviewing community members as part of the data collection exercise in Lauwaki village, Viti Levu, Fiji, April 2023. Photograph: Australia Pacific Climate Partnership.

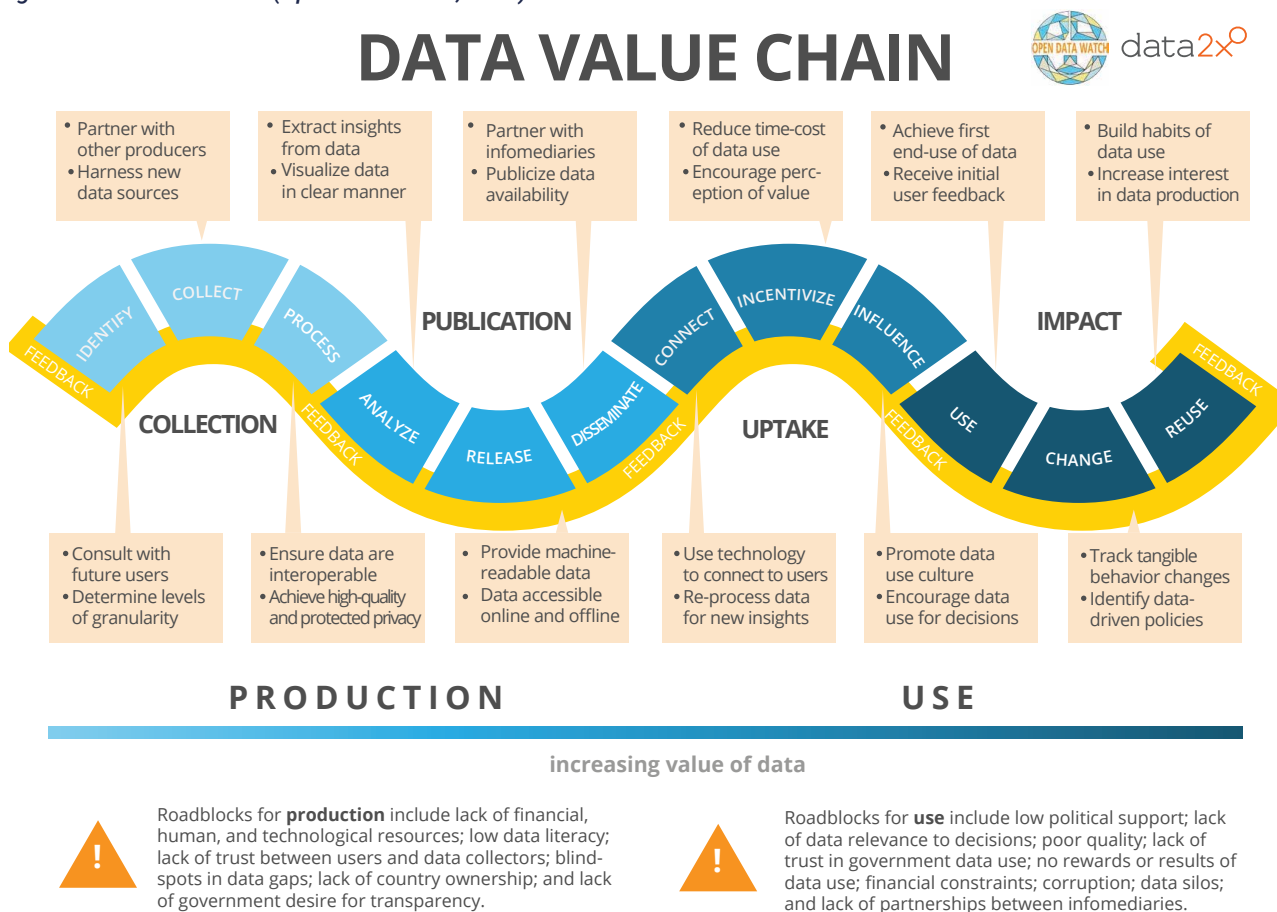


**Table 13: Consolidated information requirements – MHEWS checklist (WMO, 2018)**

Elements of MHEWS	Information Requirements
Disaster Risk Knowledge	<ul style="list-style-type: none"> <li>• Identification of key hazards and related threats – Key hazard characteristics and potential cascading events are documented, analysed, and mapped, including historical data and future risk assessments.</li> <li>• Exposure, vulnerabilities, capacities, and risk assessments – Exposure, impacts, and diverse vulnerabilities of people, services, and essential infrastructure are assessed and mapped, including Indigenous knowledge in rural, urban and coastal areas with risk management and resilience measures.</li> <li>• Roles and responsibilities of stakeholders identified – Relevant government departments, scientific/technical experts, and communities, are involved in local risk assessments based on legislation, other governance, and processes with quality control in place, which clarify mandates, responsibilities, and roles.</li> <li>• Risk information consolidated – All risk and event/disaster information is stored in a central repository with Geographic Information System (GIS) functionality and standardised processes to ensure regularly updated disaggregated risk and vulnerability information based on appropriate funding.</li> <li>• Risk information properly incorporated into early warning systems – Regularly updated geo-referenced risk information covers hazards, safe areas, and evacuation zones with attention to vulnerable groups, and asset protection.</li> </ul>
Detection, Monitoring, Analysis and Forecasting of Hazards and Possible Consequences	<ul style="list-style-type: none"> <li>• Monitoring systems in place – Monitoring data and metadata is managed, and workflows cover planning, collection, documentation, curation, and other processes to ensure quality control, interoperability, archiving, research, and other use cases.</li> <li>• Forecasting and warning services in place – Data is analysed, processed, and innovated, including modelling, prediction, clear and consistent warnings, timely dissemination, and archiving based on standards and protocols with quality control, and monitoring and evaluation.</li> <li>• Institutional mechanisms in place – Processes, documents, and information exchanges are standardised with clear and agreed roles, responsibilities, and mandates to ensure consistent warnings and communications across different hazards and respective agencies.</li> </ul>
Warning Dissemination and Communication	<ul style="list-style-type: none"> <li>• Organisational and decision-making processes in place and operational – Governance documents such as legislation, policies, strategies, and standard operating procedures (SOPs) cover roles, responsibilities, coordination, and functions of warning dissemination and respective actors, while networks support the dissemination, and feedback mechanisms are established.</li> <li>• Communication systems and equipment in place and operational – Trusted and tailored communication and dissemination systems with multiple channels exist, which cover the last mile and support specific needs of people and vulnerable groups, including monitoring and evaluation.</li> <li>• Impact-based early warnings communicated effectively to prompt action by target groups – Clear and trusted guidance for warning reactions from known authorities consider different vulnerabilities and mitigate impacts.</li> </ul>
Preparedness and Response Capabilities	<ul style="list-style-type: none"> <li>• Disaster preparedness measures, including response plans developed and operational – Participatory preparedness measures developed (risk assessments, plans including contingency planning, SOPs, and protocols) are accessible, practised, exercised, and assessed, while they cover people with different needs and vulnerabilities, including last mile operators such as fire fighters and police, and early action with appropriate funding and support.</li> <li>• Public awareness and education campaigns conducted – Public awareness and education cover relevant hazards from known and trusted sources with knowledge on signals and disease symptoms to support community surveillance with diverse needs, including vulnerable groups and efficient response.</li> <li>• Public awareness and response tested and evaluated – Emergency and disaster events are regularly analysed, evaluated, and updated with lessons integrated in plans and activities.</li> </ul>



Figure 7: Data Value Chain (Open Data Watch, 2018)



### 4.2.1 Challenges and barriers

In the Pacific and globally, the volumes, demands, and complexities of disaster risk information and its management are rapidly increasing. At the same time, the expectations and needs to use early action information effectively for reducing disaster impacts are continuously growing. Selected examples of Pacific early action information challenges include (UNDRR, 2023; Jenkinson et al., 2023):

- Roles and responsibilities for risk information and its management are not clear.
- Meteorology and hydrology offices are missing capacities and skills for services such as early warning systems and services.
- Some information is not available, and gaps include high-resolution data, maps, and impact data.
- Information is scattered across a range of agencies and sources or systems, and centralised information access is missing.
- Diverse information formats or types include raw data, documents or reports, images, maps and geospatial data including remote sensing or earth observations, traditional knowledge, and more.

- Some information is not accessible or not shared, especially local information.
- Some information lacks quality, which includes missing reliability or trust, and missing updates or reviews.
- Collaboration and coordination among various partners are insufficient.
- Many agencies are involved in early action information, including national and subnational government departments, civil society organisations and NGOs, regional and global development partners, the private sector, and others.
- Information does not flow effectively with limited communication and missing feedback between producers and users of information.
- Traditional knowledge is not well integrated.
- Ongoing monitoring and maintenance of data systems needs strengthening.

The above-mentioned challenges are often linked to organisational barriers and underlying root causes. Pacific examples of documented barriers include the missing attention to information management benefits, and the lack of visible leadership to change information cultures and practices (Brown et al., 2015; Mackay et al., 2019).

Many information projects focus on some technology set-up with short-term funding. In fact, information management is often confused with information technology. This leads to repeated failures and creates a plethora of outdated information platforms, while ongoing costs for hardware maintenance and security continue with limited information value in return.

Information governance and an effective enabling environment for early action information are often missing. This includes skilled capacities for ongoing updates and services, visible leadership support with sustainable finance, standards and compliance, and efficient processes with quality control, as illustrated in Box 4. Significant behaviour changes and different information cultures are required to overcome known barriers and persistent challenges. This includes appropriate investments and effective information governance approaches to enable quality risk information for early action, with synergies, co-benefits, and cost-efficiencies for other risk information applications.

#### Box 4: Information Governance (IG)

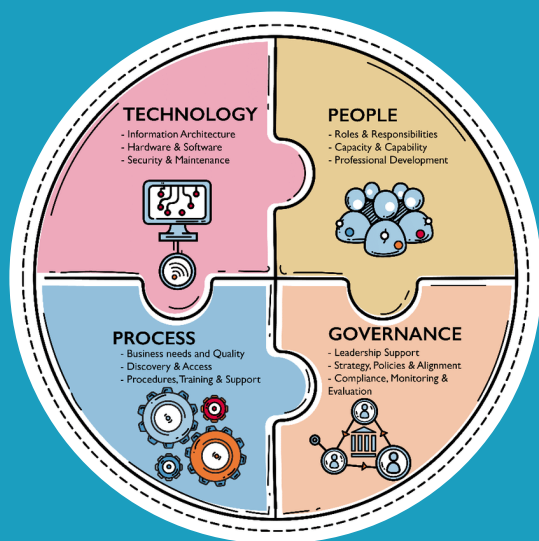
Information governance is defined as a system or organisational structure to manage, operationalise and control information as an asset.

IG provides an organisational framework to institutionalise and operationalise information and data with appropriate resources and accountability.

IG comprises the enabling organisational environment with people, governance, process, and technology. All four aspects are vital to establishing good practice, while visible leadership and time are required to institutionalise positive change.

Contemporary information governance is an opportunity to address complex information challenges.

(GIZ, 2020; adapted from National Archives of Australia, 2019)



## 4.3 Infonomics

The economics of information – also called ‘infonomics’ (Laney, 2017) – targets the value of information as an asset (Gartner, 2023). This includes the identification and calculation of benefits, cost-efficiencies, and time savings or productivity for information and services in relation to investments. Examples include reduced time for searching information, reduced duplication of information, and improved quality information with better knowledge for early actions.

While this might sound mundane, some statistics and efficiencies can be significant when demonstrating the sum of costs, productivity, impact, return on investment, and other benefits. Some critical sources highlight the need for robust research to demonstrate the ROI and other benefits (White, 2021; Robertson, 2008). This section describes selected examples with methodologies to calculate the costs or time savings, value creation or benefits, and ROI for risk and information management aspects.

The following examples promote different business cases for: (a) finding better information – considering the effectiveness of quality information; and (b) finding information better – considering the efficiency of accessing information (Milton, 2020; Weingärtner, Pforr & Wilkinson, 2020).

### 4.3.1 Hydro-meteorological data value chain

Different studies consolidate values and benefit ratios of hydrological and meteorological information or early warning systems and climate services across different sectors (Savage, 2015; Clements, 2013). The Hydromet Value Chain, shown in Figure 8, illustrates multiple outcomes and benefits, together with several beneficiaries (Grimes et al., 2022). It also shows selected functions, processes, output services, key benefits, and beneficiary types. For example, monitoring and observation data is used for modelling and analytics, which supports decision-making leading to an improved understanding of environmental issues (environmental intelligence) risk mitigation, effective policies, and economic efficiencies.

The multiplying effects of various outcomes for various beneficiaries, often on a daily or regular basis, create strong returns on information investments. This includes the effects of quality-controlled information or the lack thereof. Hydro-meteorological information investments need to cover increased budgets for the sustainable operations of multi-hazard early warning systems, human resources for information management and services, and infrastructure for localised observations (Grimes et al., 2022; UNDRR & WMO, 2022). All components are relevant to transforming organisational barriers and information gaps into forecast enablers and development drivers (Climate Centre, 2020).

### 4.3.2 Information, documents and records management

Barca (2017) found that using existing social assistance or social protection information systems for early action can provide synergies and benefits. Past events, such as the 2016 Tropical Cyclone Winston in Fiji, and the 2018 Tropical Cyclone Gita in Tonga, demonstrated the use and

Figure 8: Hydromet value chain (Grimes et al., 2022)

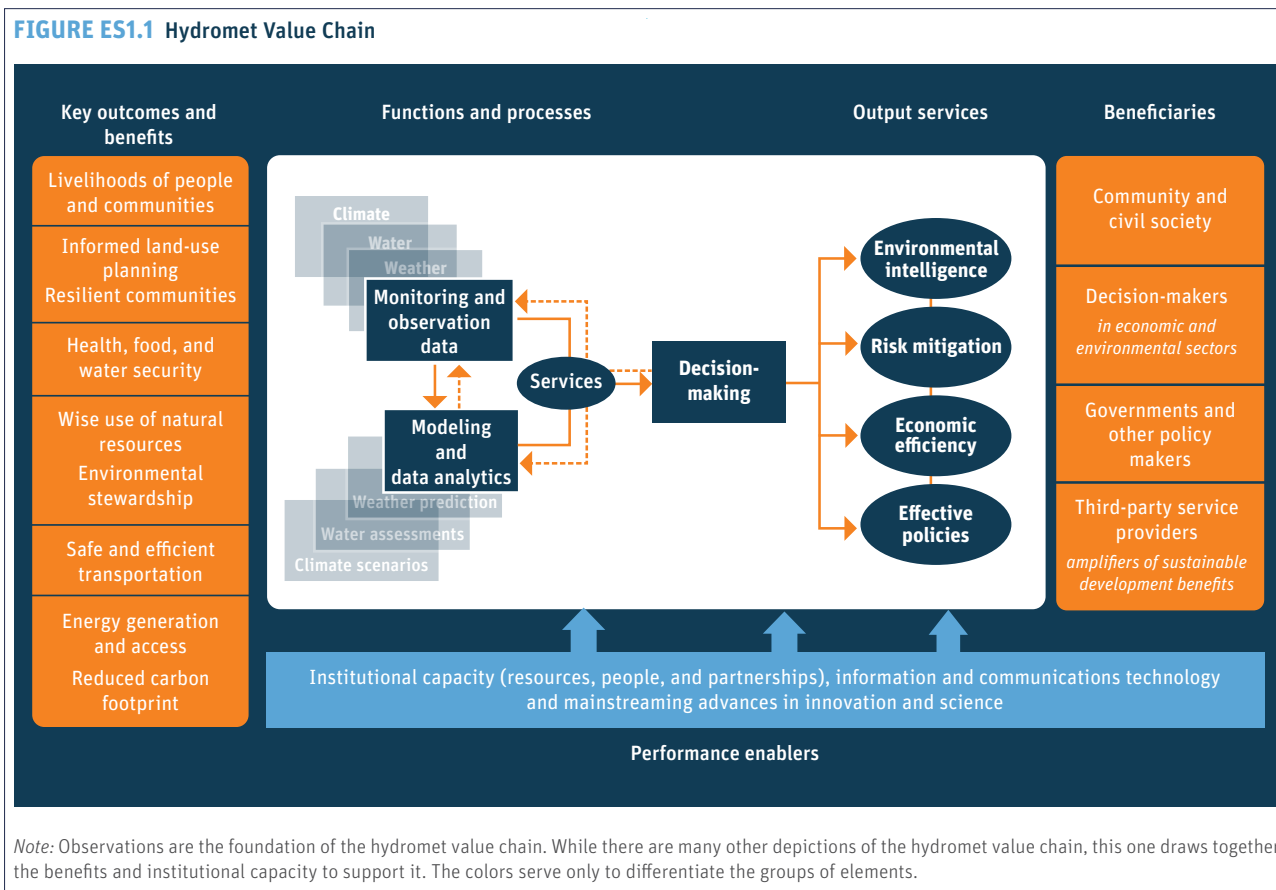
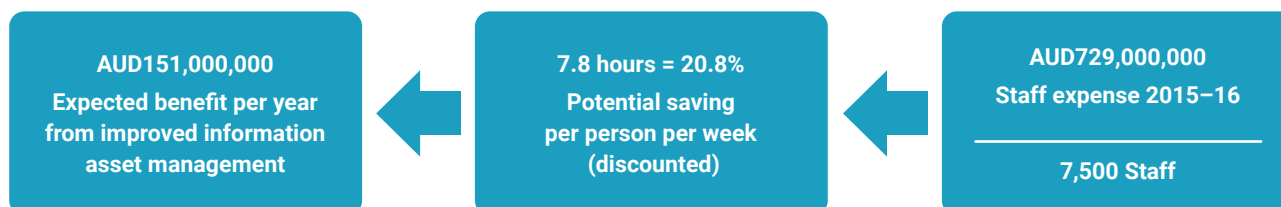


Figure 9: Information management and productivity (adapted from Price, 2023)



efficiencies of existing systems. Examples of synergies include reusing the existing data, processes, infrastructure, capacities, and services. Examples of benefits include improved planning, increased preparedness, saved time for operations and response, reduced duplication, vertical expansion of existing social protection systems and services, and enhanced monitoring and evaluation with learning. While costs can be saved, investments are likely needed to adapt systems and services. Examples of potential changes include:

- The redesign of processes to include early action or other disaster-related interventions.
- Adjustments to the type and number of beneficiaries.
- Developing links and interoperability so that parts of the existing system and services can be used for or linked with early action initiatives.
- Links or interoperability with existing humanitarian systems.

Specific political and policy decisions are required to ensure that social assistance or social protection information management and respective systems are robust and fit for purpose. Specific concerns include potential errors of inclusion or exclusion for timely initiatives such as anticipatory approaches and early actions, which need to be evaluated for trade-offs. Selected criteria include the coverage and approach, decision-making, and approvals. Key requirements include quality data and information with sharing services, and capacities, which are ideally driven by policy requirements and dedicated financial and human resources.

Accessing and sharing public sector data can generate social and economic benefits with a value between 0.1 per cent and 1.5 per cent of GDP (OECD, 2019). Information management benefits were also evident in a study about the State Government of New South Wales, as demonstrated in Figure 9 (Price, 2023).



#### Box 5: Information management inefficiencies

Information is the most valuable asset, providing the basis for early action decisions. However, the management of it is often improper and insecure, posing challenges to individuals, organisations, and even countries. The figures below signify the importance of proper information management, although not limited to early actions exclusively.

- 93% cannot find a document due to poor file naming or weak tagging.
- 82% find document naming for general retrieval challenging.
- 73% do not have document naming guidelines in place.
- 54% of critical business information remains outside content management systems.
- 52% of organisations use four or more content systems.
- \$20 costs for filing a document, \$125 for misfiling a document, \$220 for re-creating a document, \$350 for a lost document.
- 17 different versions exist of the average document in storage systems.
- 14% is business critical information, 32% is redundant, obsolete, or trivial, and 54% is dark data.

(Adapted from M-Files, 2020)

Much of the early action information is government data and records that capture relevant current or historical evidence. Examples include hydro-meteorological information, impact information, vulnerability information, social protection beneficiary databases, and other risk information from different government agencies. Collaboration, coordination, interoperability, and integration, can mobilise synergies and efficiencies for information management and response times (Barca & Beazley, 2019).

While information volumes and complexities are continuously growing, the capacities and tools for managing digital information and digital transformation are not evolving at a similar scale. The lack of structured digital document or records management and filing systems creates significant challenges in finding and using information. The weak enabling environment of government information, documents, and records often leads to gaps, duplication, delays, and operational risks. Substantial change is required to strengthen government information systems and implement whole-of-government approaches to mobilise efficiencies, value, and benefits.

### 4.3.3 Findable, accessible, interoperable, reusable (FAIR) data

The cost of not having FAIR research data in Europe is at least EUR10.2 billion per year, or three per cent of all research expenditure (European Commission, 2019a). Key cost criteria include the time spent and cost of storage. However, not all aspects can be quantified, and the real cost is likely much higher. For example, better knowledge and missed innovation in the open data economy might contribute a further EUR16 billion to the assumed costs (European Commission, 2019a).

The European Commission in collaboration with stakeholders promotes the use of FAIR data. FAIR data represents good practice, and it strengthens information access and sharing. In fact, it can even reduce or eliminate the need for information-sharing agreements. The policy recommendations include priority investments, maximising ROI for FAIR data, culture change, skills development, shared cloud-based data infrastructure, and other measures (European Commission, 2019b; European Commission 2019c).

Some metadata creation can be automated and quality control is recommended. Examples of the FAIR data principles include (GO FAIR, 2022):

- **Findable data** includes rich metadata or resource description and persistent identifiers to optimise the discovery by people and machines, including search engines.
- **Accessible data** includes open and free data, or the clarification of whether and how authentication is required.
- **Interoperable data** includes common file formats and shared controlled vocabularies or taxonomies, ideally shared across sectors.
- **Reusable data** includes clear statements or licences on how the data can be shared and used or not.

Ideally, an agreed multi-agency and whole-of-government approach to FAIR data should be considered and established to realise the joint value and co-benefits by and for partners and stakeholders.

### 4.3.4 Data ecosystems

A recent study showed that for every dollar invested in data, an average economic return of USD32 can be considered (United Nations & Global Partnership for Sustainable Development Data, 2022). The study analysed initiatives and case studies with varying returns from USD7 to USD73 per dollar spent, while using examples from different sectors and income levels. The benefits of data ecosystems include economic, social, environmental, and institutional aspects.



## 4.4 Need for Investing in Information Governance

Investments in early action-related information, and the re-use of quality risk information for early action, can have multi-faceted synergies, efficiencies, co-benefits, and returns. This also applies to purposes beyond early action such as disaster risk reduction, climate change adaptation, land use planning, and much more.

Selected examples illustrated the costs and savings or ROI – or lack thereof – for managing data, information, records, libraries, digital repositories, knowledge, and other aspects. This includes examples of data value chains that represent different processes or workflows for managing and using data. It also includes examples of organising or storing and finding information with duplication and volumes, as well as knowledge or business intelligence for better results.

Information investments are needed to mobilise value, benefits, and savings. They need to cover and strengthen the enabling environment of operations (Climate Centre, 2020). The enabling environment comprises people, governance, and processes as well as technology, as illustrated in Box 4. All four components require sustainable long-term funding to ensure quality information and services for early action effectiveness and reduced disaster impacts.

To strengthen quality information for early action, DRR, and sustainable development, the following recommendations are suggested:

- Provide appropriate long-term financial resources to enable quality information and services for early action.
- Cover the ongoing costs for people, governance, and processes, in addition to technology, to strengthen the enabling environment.
- Promote and establish whole-of-government information systems to maximise synergies, efficiencies, and collaboration.
- Invest in contemporary information skills and talents, together with education and ongoing professional development to expand human resources.
- Establish and maintain FAIR data and quality information to support and improve early action.



Analysing data at ActionAid Vanuatu office in Port Vila, September 2023. Photograph: Australia Pacific Climate Partnership.



## Conclusions

The purpose of the Economics of Acting Early study was to generate more evidence on the value of early action in the Pacific to inform policymaking on disaster risk management in Pacific island countries.

Two of the case studies, Palau and Vanuatu, examined different ways in which organisations and communities have responded to early warning information through localised early action support and through women-led dissemination of early action information messages. The Fiji case study assessed the economic viability of parametric microinsurance payouts for existing social assistance recipients. While it was not developed as an early action mechanism, there are opportunities to explore this as a form of early action mechanism.

### The case studies provide evidence that there is economic value in acting early.

The overall evidence gathered from the literature and data analysis is that **there is economic value in acting early**. The case studies demonstrated that early actions, such as early warning information and pre-hazard insurance payouts, have greater economic benefits than post-disaster response.

**Early warning information is particularly cost-effective if the message provides not only hazard information but also practical early actions that households can undertake.** The analysis of the Women Wetem Weta approach in Vanuatu showed that communities took action to protect the water supply, undertook early harvests, and strengthened their houses. It was found that for every \$1 invested in Women Wetem Weta early warning messages, there is a corresponding benefit of \$4.40 in communities with no access to the NDMO messages.

It also demonstrated that female-headed households that received WWW messages prepared themselves better than female-headed households without WWW messages. Anecdotal evidence, based on a very small sample of female-headed households, suggests that practical WWW early warning and early action information led to higher pre-emptive harvest value than for female-headed households in communities without WWW messages. Even within the same community, there was an increase in pre-emptive harvest value among female-headed households that received the WWW message compared to the female-headed households that only received NDMO messages.

**Microinsurance payouts or cash transfers (such as social protection top-ups) prior to a hazard event can result in increased purchasing power** compared to post-hazard delivery of payouts. Due to rising commodity prices after hazard events, especially for key staples like cassava, the Fiji case study showed a 37 to 41 per cent increased purchasing power benefit from pre-hazard insurance payouts compared to post-hazard payouts.

**Early warning systems and early action initiatives not only have economic value but also change social norms and behaviours.** Qualitative research that accompanied the quantitative results highlighted non-economic benefits. Early warning messaging increased organisational and community confidence in undertaking preventative preparedness measures.

**Early action messages from women to women have seen shifts in gender norms and have supported inclusive early warning and early action.** As a result of the WWW initiative, participating women have taken on greater leadership roles in their households and their communities. It has led to new income and business opportunities, improved safety and security for women, and achieved better outcomes for people with disabilities. Through their active roles in WWW, women were able to influence subnational and national governments, which resulted in improved government services in the community. Some women are now part of local council decision-making processes.



**'When local women are empowered, they are given more respect by leaders. If the Chiefs show respect, then the whole community shows respect.'**

*Flora Vano, ActionAid Vanuatu Country Manager and WIN-DRR finalist in 2023. Photograph: UNDRR.*

While gathering economic evidence from the Pacific, the research identified a range of success factors for effective and efficient early action approaches.

- **Civil society networks, and women's networks in particular, are critical in broadening the reach of early warning and early action information, especially to marginalised groups.** Women are often the first responders, frequently taking responsibility for evacuating the injured, the young, and the elderly. However, the Vanuatu case study highlighted that while the reach of NDMO hazard warning messages is wide, they do not reach everyone, in particular women who are less likely to own a mobile phone than men. The WWW approach helped reach people who are often not reached through conventional methods.

- Existing early action protocols, accessible financing, and local presence, all enable efficient early actions that sit within a locally-led development framework.** The PRCS had national processes and capacity in place for early responses to hazard warnings, and had access to a small amount of existing funding, which enabled its early action response. Its presence in the community was another success factor in enabling early action. While Pacific countries' access to anticipatory funding from international donors is improving, for rapid-onset crises it will be challenging for these funds to be released in time for early actions, unless pre-positioned locally with partner governments or national organisations. It highlights the need for nationally-accessible funding sources and investment in locally-led early action systems (including reporting, monitoring, evaluation and learning, and financial systems).
- Existing social protection systems help cushion the impact of shocks and can help keep recipient households above the survival threshold when disasters occur.** The Fiji case study showed that regular and predictable payments from social protection schemes significantly mitigated the impact of hazard events, allowing social assistance recipients and their households to stay above the survival threshold, without having to adopt negative coping strategies.
- Vertical expansion (top-ups) through existing social protection schemes is another effective and efficient way to protect livelihoods in times of disaster.** The Fiji case study demonstrated that formal social protection top-ups helped people maintain their livelihoods. Ongoing investment in strengthening existing social protection mechanisms, and efficient management of the existing social protection systems, will provide the government with the opportunity to build on quick top-up payments ahead of a forecasted hazard event. In addition, it is plausible that sound social protection systems will also expedite horizontal expansion (temporary inclusion of new beneficiaries), where necessary.
- Finally, parametric microinsurance provides another mechanism for households that could be used for early action response.** The cost of the parametric microinsurance scheme for social welfare recipients was higher than the benefit in avoiding negative coping strategies, because the regular social protection payments meant people did not need to adopt negative coping strategies. However, such insurance schemes would be relevant where there is the presence of high-cost coping strategies that can be reduced or eliminated by the insurance payouts and any related purchasing power benefits associated with acting earlier. These insurance schemes will likely achieve better value for money where negative coping strategies are deployed after a shock event. The learning that has come from trialling these different approaches is important, as the Pacific is exploring different options and should be applauded.

**As demonstrated above, governments and communities need to have a range of DRF approaches and 'risk layering' to manage the impact of disasters pre-emptively, and intentionally include marginalised groups.** Compounding shocks put pressure on formal and informal support networks, which means people could fall below the survival threshold. In such complex situations, access to regular and predictable social protection, parametric microinsurance, and early warning and early action information, all play an important role. The inclusion of women-led initiatives and voices helps promote inclusive early warning early action and can lead to transformative changes.

**This also means embedding early action within national DRM systems and governance arrangements, and in national risk financing strategies.** The benefit of early action is linked to the speed of early action implementation. This requires early action protocols to be part of institutional frameworks at all levels. It requires partnership and collaboration between national government agencies, as well as non-government partners and civil society, whose strong understanding of local context can inform early action policy and practice. The Palau Red Cross Society, for example, coordinated its early action approach with other members of the National Emergency Committee. Coordination can achieve better value for money and reach, and provide opportunities for shared learning and implementation. This also highlights the importance of having NGOs as part of the national DRM governance systems.

**However, the foundation of any early action is an effective early warning system (at national and community levels).** As the policy findings have shown, early hazard information can lead to effective early actions to reduce the impact of hazard events. The 'infonomics' analysis showed that accessing and sharing public sector data can not only save lives, but also generate social and economic benefits between 0.1 and 1.5 per cent of GDP. Ongoing investment in early warning systems and information communication systems is important to ensure information will be as accurate as possible and reach people.

**Further evidence is needed to inform policy on early action approaches.** As Pacific governments and the international community increasingly focus on acting early to hazard events, it is important to evaluate and undertake additional studies into early action approaches to provide more evidence on what worked well and worked less well in certain contexts, including the costs and benefits. Anticipatory Action pilots that are currently planned by development partners provide such opportunities and should **build on existing government and community mechanisms, capacities, initiatives, and expertise.**

Undertaking cost-benefit analysis exercises comes with the risk of negative outcomes, but **economic studies provide the opportunity to learn and adapt** programming to achieve better outcomes and to reach the shared goal of minimising the impact of hazardous events on people, their livelihoods, and nations as a whole.





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# Appendix 1: Details of the Vanuatu Economic Study

## A1.1 Quantitative Results

### A1.1.1 Study sample and the findings on access to early warning messages

A summary of the socio-demographic attributes of 90 households across each of the five villages on the island of Efate is provided in Table 14. The age of the respondents ranged from 22 to 72 years, with an average age of 45 years across the five villages. Most respondents were married, but some individuals were divorced, never married, or widowed. The majority (58 per cent) of the interviewed respondents reported that they had attended primary schools, while 28 per cent stated they had completed junior secondary school, 11 per cent had finished senior secondary school, and only three per cent had completed tertiary education.

The survey findings indicate that in the Women Wetem Weta villages (Eton, Ekiye, and Rentapau), the majority of households reported receiving early messages from the NDMO. In Eton, all 11 households interviewed reported receiving both NDMO and WWW early warning messages. In Ekiye, of the 22 households interviewed, less than half (45 per cent) reported receiving WWW early warning messages, while all respondents received NDMO messages. In Rentapau, 47 per cent of households indicated that they received WWW warnings before the twin tropical cyclones, while 89 per cent reported receiving messages from the NDMO.

In the non-WWW villages, 96 per cent of households surveyed in Epule reported receiving NDMO messages, and 77 per cent in Eratap also received NDMO messages, with the remaining 33 per cent receiving warnings from family and friends in the village.

The timeframe between the receipt of early warning messages and the arrival of the cyclone is of paramount importance. The timing of the message significantly impacts the type and extent of response. For example, some respondents mentioned that on receiving the warning they focused on taking protective measures for their homes and water sources, rather than venturing to their distant fields to

trim branches or engage in early harvesting of crops. This prioritisation stems from the inherent risks associated with travelling to remote fields during an approaching cyclone. In Ekiye, at least 90 per cent of households reported receiving the WWW and NDMO messages two days or more prior to the cyclone hitting the village. In Rentapau, more than 50 per cent of households reported that messages, both WWW and NDMO, were received a day before the cyclone hit the village. A majority of early warning messages in Eton were received within a day or two before the cyclone.

The access and timing of early warning messages provide evidence that, across all five case study villages, households generally had access to NDMO early warning messages. None of the WWW villages showed a notable gap in accessing the NDMO early warning messages. In fact, in Eton, all households interviewed reported having received the NDMO messages.

This meant attribution challenges to support a CBA based on the comparison between villages with and without WWW on the Efate Island.

### A1.1.2 Assessment of early warning benefits

As introduced in section 2.6.1, the Vanuatu case study was initially designed to capture information and compare the prospective outcomes of communities and households covered by the WWW program with those that are not part of the program. Based on consultation with ActionAid Vanuatu, the prospective outcomes of the WWW program were identified in four key areas:

- Reduction in damages and losses to agriculture and food.
- Reduction in damages and losses of public water services.
- Reduced incidence of violence, injuries, sickness and death.
- Reduced damages to household infrastructure.

The findings in these four areas are summarised in the next section.

**Table 14: Summary of demographic data of respondents by village (n=90)**

Village	n	Male	Female	Married	Age			Education			
					Min.	Average	Max.	No. schools	Primary	Secondary	Tertiary
Eton	11	1	10	10	24	46	70	0	7	4	0
Ekiye	22	4	18	12	22	45	72	1	11	8	2
Rentapau	19	5	14	15	25	43	64	3	10	5	1
Epule	25	6	19	20	26	47	72	1	15	9	0
Eratap	13	0	13	7	29	43	59	0	9	4	0

### Avoided damages and losses to agriculture and food

The survey results reveal that households do engage in protective harvesting when they receive early warning messages. On average, the avoided damages due to protective harvesting of crops amount to VUV4,161 (equivalent to AUD54) per household. The top five pre-harvest food items prioritised by households after receiving early warning messages are wild yam, sweet potato, taro, ginger, and bananas. These are followed by cassava, breadfruit, and yam.

In the WWW villages, the majority of households receive early warning messages from both NDMO and the WWW network. Consequently, attributing the value of protective harvesting specifically to the WWW network proved to be challenging, due to this dual source of information. Furthermore, it was also observed that in the villages reliant solely on the NDMO warning messages, households undertook similar protective harvesting actions, and there was no discernible evidence of variations in the extent of benefits to agricultural production.

Beyond pre-harvest protective measures, households also implemented additional precautions, including trimming leaves and pruning branches to mitigate wind resistance and minimise wind-related damages.

### Assessment of damages to houses

The survey findings indicate that 83 out of 90 households proactively engaged in house protection measures on receiving early warning messages. These protective measures encompass a range of strategies, including securing roofs with ropes, stones, and sandbags, and reinforcing windows with iron sheets. Moreover, seven respondents highlighted the cyclone-resistant features of their houses, constructed with sturdy materials such as bricks and iron sheets, complete with window shutters.

As a result, these households reported not needing to undertake specific preparatory measures before the cyclone made landfall in their communities.

A summary detailing the proportion of households reporting damages to their houses is presented in Table 15. Interestingly, there were no discernible differences in the extent of damages among households based on the source of early warning messages.

### Assessment of safety impacts

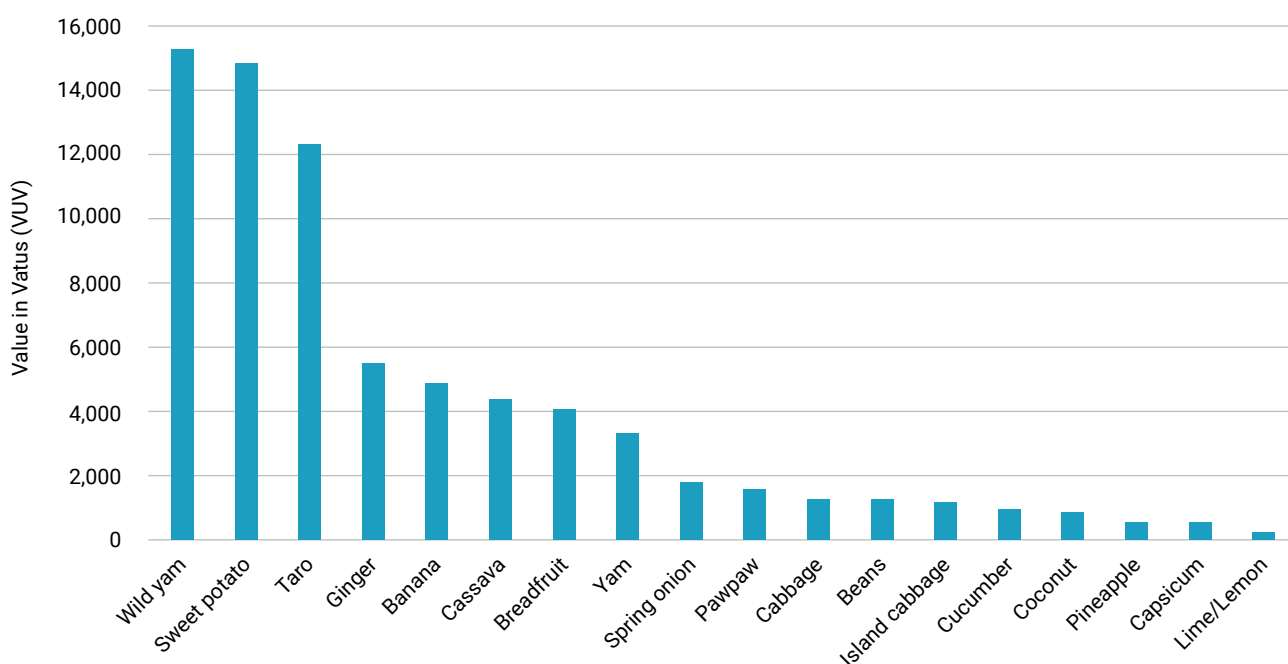
Across the five case study villages, there were no reported deaths. A limited number of people (four in total) were reported to have incurred some injuries and several people became sick after the cyclones, as shown in Table 16. However, there was no evidence of limiting the incidence of injuries or sickness in WWW villages compared to non-WWW villages.

### Assessment of impacts on public water services

The majority of households across all five villages reported actively taking protective measures to safeguard their water sources where possible. Specifically, households mentioned the common practices of removing the rainwater tank spout and covering their water tanks before the intensification of winds, to prevent debris contamination. In certain villages, households shared that they disconnected the water mains pipe, ensuring it remained unclogged amid heavy rains and flooding typically associated with tropical cyclones.

A summarised overview of households engaging in protective actions for their water sources is presented in Table 17. Notably, some households, reliant on water from their neighbours, reported refraining from specific protective measures. Nevertheless, a subset of these households indicated taking precautionary steps such as filling containers with water.

Figure 10: Estimated average value of pre-harvested crops, vegetables and fruits (for all five villages and households that engaged in protective action)



**Table 15: Households that reported damage to houses**

Village	Percentage of WWW recipients who incurred damages	Percentage of NDMO recipients who incurred damages
Rentapau	33%	35%
Ekipe	100%	64%
Eton	67%	73%
Epule	–	100%
Eratap	–	63%

**Table 16: Summary of reported individuals who were injured and those who became sick during the twin tropical cyclones**

Village	Injured	Sick
Eton	1	5
Ekipe	2	28
Rentapau	0	14
Epule	0	17
Eratap	1	12

**Table 17: Proportion of households that engaged in protective action after receiving early warning messages**



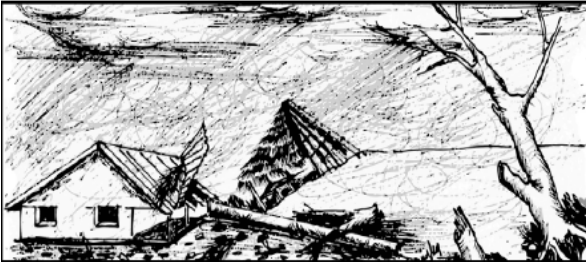
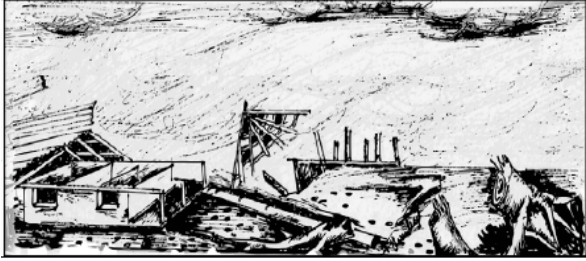
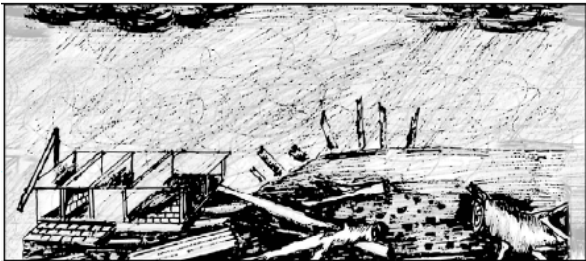

Village	Sample size	Protective action by recipients of early warning messages	
		WWW	NDMO
Ekipe	22	70%	86%
Eton	11	78%	82%
Rentapau	19	67%	82%
Epule	25	–	83%
Eratap	13	–	80%



In Vanuatu, a woman shows the heavy level of damage to homes after Cyclone Pam in 2015. Photograph: ActionAid Vanuatu.



## A1.2 Illustration of House Damage Levels

Damage level	Illustration of damage	Description of damage
1		No damage.
2		<p>Minor damage to concrete house.</p> <p>Some major damage to traditional and semi-permanent house.</p>
3		<p>Major damage to concrete house.</p> <p>Unrepairable damage to traditional and semi-permanent house.</p>
4		<p>Significant damage to concrete house.</p> <p>Complete flattening of traditional and semi-permanent house.</p>
5		<p>Significant damage to concrete house.</p> <p>Complete flattening of traditional and semi-permanent house.</p>
6		Complete flattening of concrete, traditional and semi-permanent house.

(VMGD, 2023; also available from <https://ndmo.gov.vu/fr/community/cyclone-awareness/149-cyclone-categories>)



## Appendix 2: Household Economy Analysis in Fiji

### A2.1 Conceptual Framework

Household Economy Analysis is based on the principle that, to understand how an event affects the survivorship and/or livelihood of a given community, it is essential to have a detailed understanding of how people normally live in a typical year; i.e. their food, incomes and expenditure.

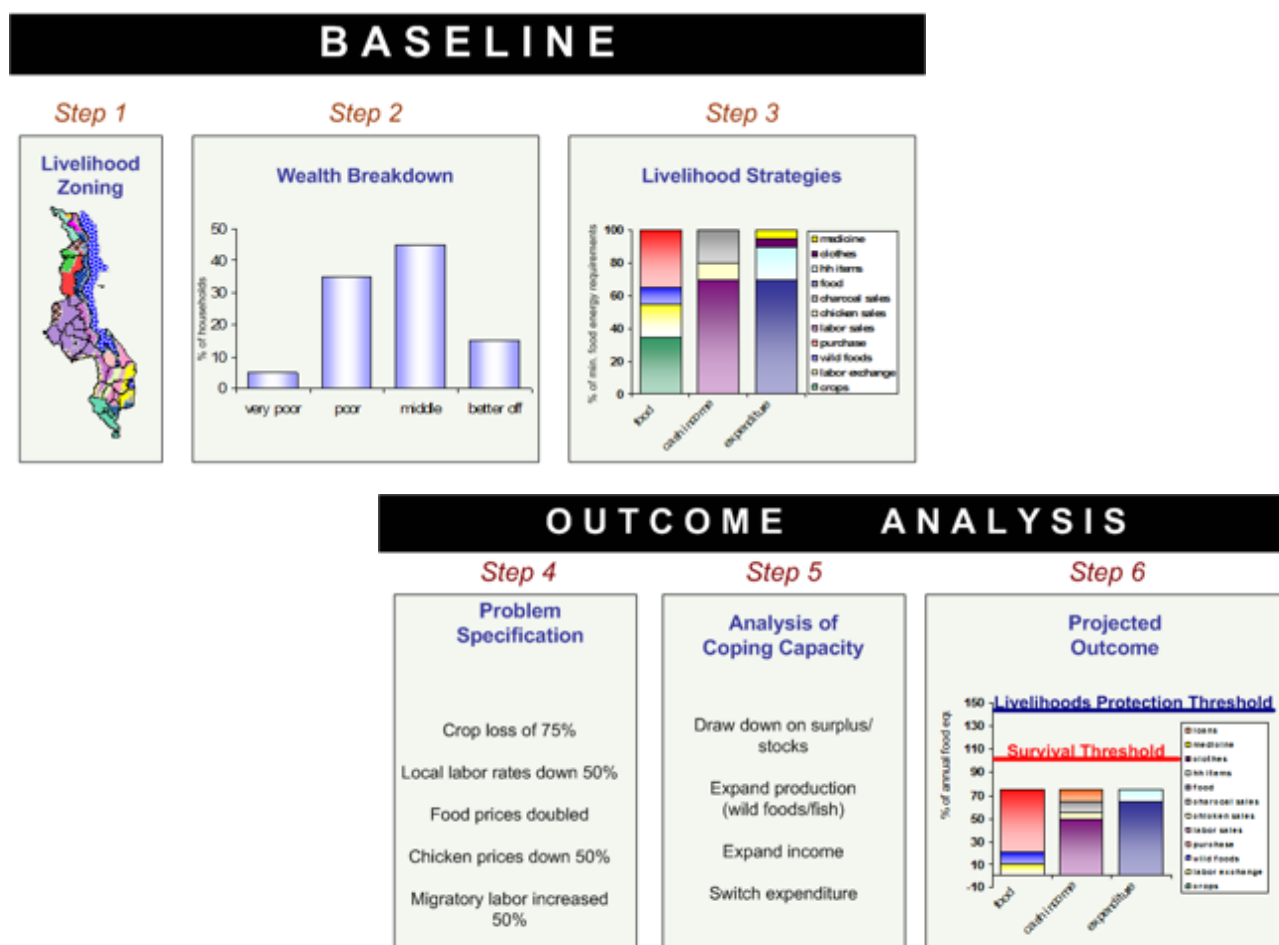
As a first step, HEA seeks to build an understanding of where people source their food and incomes to meet their needs. A survey of key informants and a sample of villagers representing different wealth groups is used to gather information on sources of food, income, asset ownership, and available coping strategies in the event of a shock to the system. The HEA process is guided by six steps: (a) livelihood zoning; (b) wealth breakdowns; (c) livelihood strategies; (d) problem specification; (e) analysis of coping capacity; and (f) projected outcome as shown in Figure 11.

Steps 1 to 3 of the HEA are the baseline, as these involve capturing information on the livelihoods of a given geographic area, grouping people into wealth categories based on the local definition of wealth, and understanding

how people in the zone make ends meet. The last three steps are referred to as the outcome analysis, because this is where an analysis specifies a problem of a shock to the community, such as a cyclone, which can lead to a loss of crops, loss of jobs, and/or increased food prices, among others. Once the problem has been specified, the baseline is used to assess the coping strategies and outcome from that shock in terms of reduced food and cash income to households in the different wealth groups. The outcome analysis results are then assessed against two key thresholds, which are used to identify the appropriate response for shock/hazard.

- Survival threshold is the total food and cash income required to cover the food and non-food items necessary for survival in the short-term. It includes 100 per cent of the minimum food energy need (kilo calories), the costs associated with food preparation and consumption, and where applicable the cost of water for human consumption.
- Livelihood threshold is the amount of food and cash income required to protect local livelihoods.

Figure 11: HEA Conceptual Framework (Oxfam, 2019)



## A2.2 Fieldwork Preparation

The HEA process commenced with the recruitment of local data collectors and an elderly agriculture expert with experience in engaging local communities as well as approaching the local leaders according to Fijian protocols. Approval to visit local communities was sought and granted in writing by the Fiji Ministry of Agriculture and the Ministry of iTaukei Affairs.

Four local data collectors were engaged for the fieldwork. These data collectors all had prior experience in data collection for the Fiji Statistics Office (i.e. census and household income and expenditure surveys), and thus they were familiar with engaging with people in rural Fiji. Two of the four data collectors were females. Data collectors were trained over three days on how to conduct a rapid HEA data collection before going to the field.

## A2.3 Baseline Analysis

This rapid HEA study selected the southern and coastal region of Vuda district as the livelihood zone. This zone is made up of three main villages (Viseisei, Lomolomo, and Lauwaki) and two settlements (Nabare and Vuda). All three villages and two settlements were visited for data collection. Villages are the main traditional residence and are typically inhabited by iTaukei people (Indigenous Fijians), whereas settlements generally include both iTaukei people, Indo-Fijians, and people from other backgrounds. Viseisei is the main village, acknowledged as the point of the first landing of the iTaukei people in Fiji (N'yert et al., 2014). It is located about 20 km north of Nadi city and 12 km south of Lautoka city (by road).

People in this livelihood zone are located in the same geographic region and have common access to food, cash income, and markets. Villagers in the zone rely on agricultural cropping and fishing to meet their food and income needs. The location of the livelihood zone between Nadi city and Lautoka city means relatively easy access to key agricultural markets. Additionally, the local people engage in small-scale trade through stalls located on the roadside. This includes sales of cassava, taro, fish, mud crabs, local fruits, and small crafts, among others. Proximity to Nadi also means that there is relatively significant commercial and industrial activity nearby, including Vuda Marina, Vuda Power Station, and University of Fiji, among others.

The main crops grown are cassava, taro, eggplant, bea and legumes. Typical permanent crops include breadfruit, vudi/plantain and banana, among others (FAO, 2021). Cropping is typically done in small land areas ranging from 0.25 to two acres per household. Additional planting of cassava and dalo is also found along waterways/drains in communal land and village boundaries. The main staple crops (i.e. cassava and taro) are planted and harvested all year round, with planting to harvest taking on average nine to 12 months for cassava. Vegetables such as cowpeas and cabbage bhajia are grown between April and November.

Price information collected from the fieldwork was validated with prices reported by the Agricultural Statistics Online Data Library.<sup>26</sup> Only prices from the Nadi and Lautoka markets

were extracted and used for cross-checking with data sourced from the households' interviews. It is worth noting that, in addition to supermarkets and agricultural markets, locals also buy food items from local and/or cooperative stores and from roadside vendors. Price information for the baseline period is shown in Table 18.

Fiji has a price control policy. Basic food items are included in the price control policy (Huh et al., 2016). Fiji retail prices for items in the price control policy are typically adjusted as a response to international market developments, and there is a lag in implementation. As a result, the price controls have the ability to mitigate against sharp price increases in retail prices for basic food (IMF, 2021).

Compared to agricultural cropping, animal husbandry is a relatively minor source of food or income for locals, and only a few households were reported to own cattle, pigs and chickens. Historically, the area was one of the key sugarcane growing regions in the Vuda district, with cane train lines connected to a sugar mill in Lautoka. Currently, cassava cropping dominates agricultural activity, followed by the use of backyard gardens to grow other crops. Ownership of fruit trees such as breadfruit, jackfruit and banana trees is also common among households.

The wet season typically runs from November to April, and this is the time when people are at increased risk of cyclones and floods.

### Reference year

As part of the rapid HEA, July 2021 to June 2022 was selected as the reference year. The reference year is a specific time period used for the baseline assessment. During the key informant interviews, participants were asked to rank the last five years in terms of production and livelihood of the households. The last five years include a period when the communities were affected by the COVID-19 pandemic; however, towards the end of 2021, movement restrictions were eased, allowing local people to engage in their normal activities.

### Wealth breakdown

Village interviews were used to inform the wealth breakdown. Participants were asked to provide information on different attributes and activities that can be used to define and differentiate different wealth groups in their local villages. The poor female-headed households and the poor households generally contain five members and typically cultivate half an acre of land, including their backyards and village boundaries, along drainage systems and riparian areas. The main source of livelihood for the poor was government social welfare, domestic labour work, horticulture in their yards, and casual labour to local businesses and the more wealthy in their village.

### Source of food income

While the focus of this study is the poor and the poor female-headed households, the baseline results are presented for all wealth groups for comparison purposes. The food economy analysis indicates that Vuda households across all wealth groups typically derive their food from own crop production,

<sup>26</sup> See <https://analytics.wfp.org/t/Public/views/FijiAgricultureStatisticsOnlineDataLibrary/HomePage>

**Table 18: Baseline price data (FJD)**

Item	Unit	Size	Price (FJD)	Typical place of purchase
Cassava	Heap (kilogram)	4	5.00	Market
Eggs	Tray	12	7.95	Local store/supermarket
Taro	Bundle (kilogram)	7.5	22.50	Market
Rice	Kilogram	5	11.45	Local store/supermarket
Beans	Bundle (gram)	500	4.00	Market
Sugar	Kilogram	2	5.06	Local store/supermarket
Oil	Litre	5	29.76	Local store/supermarket
Milk (liquid)	Litre	1	2.80	Local store/supermarket
Milk (powder)	Gram	450	5.80	Local store/supermarket
Fish (tuna)	Gram	142	2.20	Local store/supermarket
Fish (fresh)	Bundle	1	22.50	Market
Dhal	Kilogram	1	3.00	Local store/supermarket
Eggplant	Heap	1	2.00	Market
Cattle livestock	Number	1	600–1,500	Farm
Pumpkin	Piece	1	3.00	Market
Tea leaves	Gram	150	3.00	Local store/supermarket
Salt	Kilogram	1	2.00	Local store/supermarket
Soap (powder)	Gram	500	3.00	Local store/supermarket
Soap (bar)	Number	1	5.00	Local store/supermarket
Cooking fuel	Litre	1	7.30	Local store/supermarket
Water for humans	Litre	1	1.70	Local store/supermarket
Lighting	Month	1	30	Electricity authority
School fees (building fees)	Term	1	50	Household
Books and stationery	Year	1	50	Local bookshop
School shoes	Pair	1	80	Local shoe shop
Uniform	Piece	1	30	Local clothes shop
Pocket money	Day	1	0.20–5.00	Household

followed by purchases of staple and non-staple food from shops, local agriculture markets and roadside vendors, and fishing. In the reference year, all wealth groups consumed enough food to meet the recommended dietary intake; i.e. 2,100 kilocalories per person per day, as per the World Health Organization (WFP, 2020; Sarker et al., 2022). The rich typically owned livestock and consumed some of the meat from the slaughtered livestock. Often such livestock products would be surplus meat from cattle slaughtered for family or community ceremonies.

Households also indicated that they received food rations from the government to help combat hardships associated with the COVID-19 pandemic. The exchange of food gifts as per the *kerekere* tradition was common. Some households also received remittances from family members in the urban areas or overseas.

Figure 12 shows the proportions of food sources for different wealth groups. Results indicate that the poor and poor female households' food sources are heavily dominated by their own crop production and purchases of food. In addition to the use of their own crop production and purchases as a food source, the middle and better-off households typically rely on livestock products, and they also catch and consume more fish than the poor.

#### **Source of cash income**

Findings indicate that annual cash income ranged from FJD9,000 for poor female-headed households to FJD20,600 for the better-off in the community. Figure 13 shows that cash income increases by wealth, and this is a result of the different resource ownership and access available to wealth groups. The income for the better-off households is about 20 per cent higher than the median income of FJD17,232 for the rural Western Division in Fiji (Fiji Bureau of Statistics,



Figure 12: Sources of food income by wealth groups

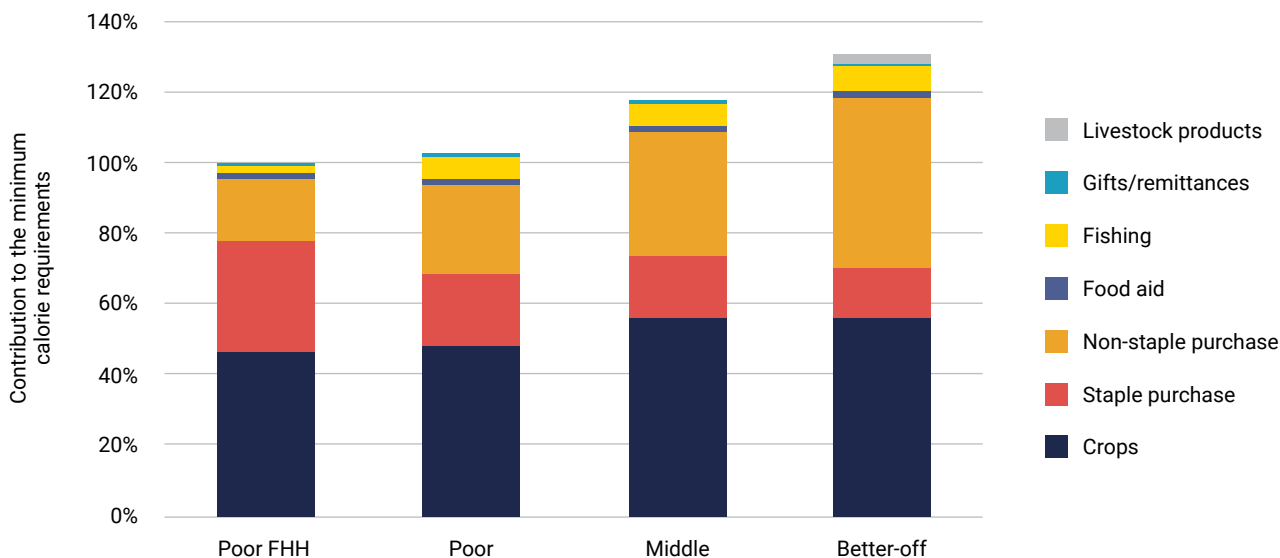
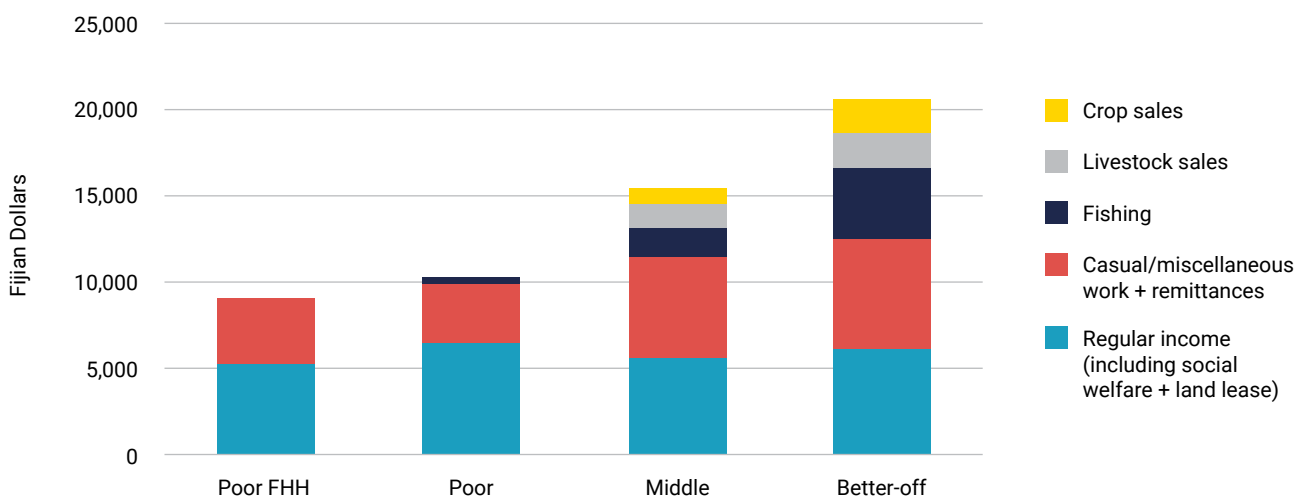


Figure 13: Sources of cash income by wealth groups



2021). The reported income for each wealth group is estimated at the mid-point income earned between June 2021 and July 2022, the reference year for this study.

The main sources of income are casual labour, self-employment including money earned from the sale of crafts, land lease money, and any social welfare funds. The middle and better-off have resources to engage in fishing and agriculture, resulting in having excess volumes of crops, fish and livestock/meat, which they then sell for additional income.

Of all declared expenditure items, most of the income earned in the reference year was spent on food (staple and non-staple) and social services. For the case study, the purchased main staple food items are cassava and rice. Non-staple food items included beans, cooking oil, meat, milk, vegetables, and fresh fish, among others. Household items include purchases used in the preparation of food, such as salt, cooking fuel, soaps, tea and utensils, among others. Social services include expenditure on education

and health-associated expenses. The 'other' expenditure item covers savings, food and non-food items that were not specifically identified by interview participants.

The poor and poor female-headed households spent relatively more of their income on food compared to the middle and better-off. This shows any shock that affects them is relatively more likely to threaten their survival and, as such, they are better candidates for parametric microinsurance. The poor wealth group spent more money on staple food (i.e. cassava and rice) compared to the middle and better-off. This is likely an outcome of the poor having less access to land and other farm resources. The middle and better-off households in this rural area have better access to land, which allows them to plant enough crops to meet their staple food consumption. Inversely, the middle and better-off have relatively high propensity to spend on non-staple food, clothes, household items, social services and water purchases to meet their larger consumption behaviours compared to the poor.

## Appendix 3: Existing Economic Studies in the Pacific

There have been some efforts to understand the Economics of Acting Early in the Pacific. The Asian Development Bank (ADB) published *The Economics of Climate Change in the Pacific* (ADB, 2013), identifying and quantifying the costs of adverse effects of climate change, particularly on agriculture, fisheries, tourism, coral reefs, and human health. The World Bank also estimated the costs of adaptation to climate change and disaster risks in its publication, *Pacific Possible Background Paper on Climate Change and Disaster Management* (World Bank, 2016). In addition, a working paper by the International Monetary Fund (IMF), *The Economic Impact of Natural Disasters in Pacific Island Countries: Adaptation and Preparedness*, showed that severe disasters have a significant and negative impact on economic growth and lead to a deterioration of fiscal and trade balance, and recommended policymakers to incorporate the disaster impact into the macroeconomic projections and debt sustainability analysis (Lee et al., 2018).

A snapshot literature review in Table 19 found some other research papers and economic studies available for the Pacific, a few of which had even suggested cost-benefit ratios. For example, a study on the Navua flood warning

system in 2009 concluded that every dollar spent on the warning system would save a minimum of FJD3.60 to FJD7 in return (Holland, 2009). The cost-benefit analysis of early warning services for cyclone hazards in Samoa suggested that for every USD1 invested, there is a return of USD6 as a benefit (Fakhrudin & Schick, 2019). These noble studies, however, did not add up to the critical mass that influenced decision-making in the Pacific.

An unpublished internal study by the Australia Pacific Climate Partnership with Geoscience Australia and the United Nations Development Programme (UNDP) Governance for Resilient Development (Gov4Res) program on understanding the benefit of retrofitting residential households for Tonga's capital city, Nuku'alofa, using a scenario of Tropical Cyclone Gita, calculated that retrofitting – acting early before an event – would result in 70 per cent reduction in losses in some places, suggesting less than a third of costs required for recovering from the same cyclone impact.

**Table 19: List of existing economic studies on climate and disaster resilience in the Pacific**

Pacific economic studies	Location
Ambroz, A. (2009). <i>Economic costs of January 2009 Ba Floods</i> . SOPAC Technical Report 425.	Fiji
Cook, S. (2011, April). <i>Vanuatu investment in disaster risk management. Economic report (PR21)</i> . SPC Applied Geoscience and Technology Division (SOPAC). <a href="https://www.yumpu.com/en/document/view/23078377/vanuatu-investment-in-disaster-risk-management-sopac">https://www.yumpu.com/en/document/view/23078377/vanuatu-investment-in-disaster-risk-management-sopac</a>	Vanuatu
Cook, S. (2011, October). <i>Fiji investment in disaster risk management. Economic report (PR33)</i> . SPC Applied Geoscience and Technology Division (SOPAC). <a href="https://pacific-data.sprep.org/resource/pr33-0">https://pacific-data.sprep.org/resource/pr33-0</a>	Fiji
Gerber, F., Holland, P., & Lal, P. (2011). <i>The DCCEE-IUCN Project: Assessing the social and economic value of climate change adaptation in the Pacific region. Case study: Water quality, quantity and sanitation improvements as an adaptation to climate change, Tuvalu – A preliminary assessment</i> . International Union for Conservation of Nature (IUCN) Fiji.	Tuvalu
Greer Consulting Services. (2007). <i>Kiribati technical report: Economic analysis of aggregate mining on Tarawa</i> . EU EDF 8 – SOPAC Project Report 71 March.	Kiribati
Holland, P. (2009). <i>Economic costs of January 2009 Nadi floods</i> . SOPAC Technical Report 426.	Fiji
Holland, P. (2008). <i>Fiji technical report: An economic analysis of flood warning in Fiji</i> . EU EDF 8 – SOPAC Project Report 122 <i>Reducing Vulnerability of Pacific ACP States</i> .	Fiji
Lal, P.N., Rita, R., & Khatri, N. (2009). <i>Economic costs of the 2009 floods in the Fiji sugar belt and policy implications</i> . IUCN Switzerland. <a href="https://portals.iucn.org/library/sites/library/files/documents/2009-037.pdf">https://portals.iucn.org/library/sites/library/files/documents/2009-037.pdf</a>	Fiji
Lal, P.N., Singh, R., & Holland, P. (2009). <i>Relationship between natural disasters and poverty: A Fiji case study</i> . SOPAC Miscellaneous Report 678.	Fiji
Rios Wilks, A. (2013). <i>Preliminary cost benefit analysis: Storm surge hazard mitigation in the Tuamotu Islands: Deterministic quantification and inclusion of the hazard in future development planning</i> . SPC SOPAC Division Published Report 171. <a href="http://www.sopac.org/sopac/preen/CBA%20full.PDF">http://www.sopac.org/sopac/preen/CBA%20full.PDF</a>	French Polynesia

Pacific Economic Studies	Location
United Nations Economic and Social Commission for Asia and the Pacific (UNESCAP). (2020). <i>The disaster riskscape across the Pacific Small Island Developing States: Key takeaways for stakeholders</i> . <a href="https://www.unescap.org/sites/default/d8files/IDD-APDR-Subreport-Pacific-SIDS.pdf">https://www.unescap.org/sites/default/d8files/IDD-APDR-Subreport-Pacific-SIDS.pdf</a>	Regional
Woodruff, A. (2008). <i>Samoa technical report. Economic analysis of flood risk reduction measures for the Lower Vaisigano Catchment Area</i> . SOPAC Project Report Nr. 69g.	Samoa
Woodruff, A., & Holland, P. (2008). <i>Economic tools for flood risk reduction: Bridging the gap between science and policy in Pacific island countries</i> . SOPAC Miscellaneous Report 696. 2nd Australasian Natural Hazards Management Conference, Wellington, New Zealand, 29–30 July 2008. <a href="https://pacific-data.sprep.org/resource/mr0696-0">https://pacific-data.sprep.org/resource/mr0696-0</a>	Regional
World Bank. (2006). <i>Not if, but when: Adapting to natural hazards in the Pacific Islands Region</i> . Policy Note.	Regional





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Aid**



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