Annex 3a

Economic Analysis Report

Enhancing Climate Information and Knowledge Services for Resilience

Cost Benefit Analyses for the Cook Islands, Niue, Palau, Republic of the Marshall Islands and Tuvalu

Report

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Prepared by Enveco for the United Nations Environment Programme (UNEP) and the Green Climate Fund (GCF)

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1 Overview

1.1 Introduction

Small Island Developing States (SIDS) across the Pacific Ocean are threatened by an increasing frequency and intensity of climate-related hazards such as tropical cyclones, coastal storm surges and droughts, which affect livelihoods, infrastructure and ecosystems. Sea level rise exacerbates these damages through stronger coastal storm surges. This GCF programme proposes to enhance climate information and knowledge services in Pacific SIDS. The aim is to make the region more resilient to climate-related impacts and hazards. Better climate related information and knowledge improve security and economic livelihood through appropriate adaptation interventions address climate change threats, requiring tailored climate information and people-centred knowledge services covering oceans and islands across all sectors.

The proposed programme aims to provide climate services for several vulnerable Pacific Island Countries by using a multi-country approach. The Cook Islands, Niue, Palau, Republic of the Marshall Islands (RMI) and Tuvalu are highly vulnerable to natural hazards. The Programme aims to build capacity to provide climate and knowledge services for governments, the private sector and local communities. The United Nations Environment Programme (UNEP) will convene several partners and Executing Entities.[1]

1.2 Economic context

The Cook Islands, Niue, Palau, RMI and Tuvalu face geographic, institutional and systemic challenges affecting the cost and provision of climate information and knowledge services. Barriers to sustained economic growth and government wealth include the distance from the main trading centres and from each other, small-scale economies, the lack of major natural resources, limited manufacturing and an extremely high exposure and vulnerability to natural hazards. Additional administration costs are imposed by the high number of small islands, low-lying atolls and their physical separation. The potential for economic growth is heavily shaped by geography and isolation from other large economies.

Other major constraints facing the successful operations of climate-resilient solutions are the shortage of development capital and manpower skills, a chronic under-investment into research, insufficiently advanced legislation, policy and planning frameworks, and inadequate infrastructure facilities. Investment in public services is lagging behind, expect for the Cook Islands benefiting from tourism income. Economic expertise and data availability for combatting climate related risks, particularly in a cost-benefit analysis context, is patchy, not routinely updated and not generally the focus of local governments, who are busy providing basic services and infrastructure. None of the five countries currently conduct systematic,

[1] UNEP Environmental, Social and Economic Review Note (ESERN).

comprehensive economic impact assessments or cost-benefit analyses of disaster risk measures nor collect economic disaster data (McKenzie *et al.* 2005).

1.3 Countries overview

It is helpful to provide an overview of all five countries to put the socio-economic and geographic make-up into context. Table 1 gives an account of the most relevant indicators for the beneficiary countries on population, GDP and geographical indicators.

Table 1. Key socio-economic country indicators [2]

Key Indicator	Cook Islands	Niue	Palau	Republic of the Marshall Islands	Tuvalu
Population	17,459	1,618	21,729	53,127	11,000
Rural population	24.9%	56%	11.9%	26%	38%
Number of islands[3]	15 islands (12 populated)	1 island	340 islands (10 populated)	29 atolls (20 populated) 5 islands (4 populated)	6 atolls and 3 islands
Surface area (km^2)	237	261	466	181	26
GDP total (US$m)	302	20.4	310	220 (2019)	49
GDP per capita (US$)	16,698	12,945	16,632	3,866	4,421
GDP growth (2018)	7.0%	No data	0.5%	2.5%	4.3%
Average GDP growth since 2015	7.1%	4.1%	2.3%	2.0%	4.8%

Data adapted from the World Bank (2017), UN Data (2018), Asian Development Bank, IMF and Government of the Cook Islands National Accounts (2018)

RMI has by far the highest population and, with 26% of its people living rurally spread over 24 isles, provides a considerable challenge in terms of reaching remote communities for effective climate resilient solutions. Palau, the Cook Islands and Tuvalu, although containing a much smaller population, face similar issues. Niue, a single coral island, is likely to be the easiest to manage in terms of logistics. Lack of adequate infrastructure such as roading, electricity, telecommunications and institutional capacity jeopardises the effective and efficient implementation of climate effective solutions country-wide, a major barrier to be overcome for all five countries.

GDP per capita figures are wide ranging with some being amidst the lowest in the world. Palau and the Republic of Marshall Islands experience modest growth, whereas the Cook Islands, Niue and Tuvalu have experienced stronger average annual GDP growth since 2015. Population growth is mostly stagnant or declining.

[2] https://data.worldbank.org/indicator/NY.GDP.PCAP.CD, downloaded 18th April 2019.
[3] http://thecommonwealth.org/member-countries, downloaded 28th May 2019.

1.4 Proposed Programme results

The proposed GCF programme will develop strategic frameworks for sustainable climate information services supported by institutional, legal, policy and planning, and private sector engagement.

- Result 1: Strengthened delivery model for climate information services and MHEWS covering oceans and islands
- Result 2: Strengthened observations, monitoring, modelling and preciction of climate and its impacts on ocean areas and islands
- Result 3: Improved community preparedness, response capabilities and resilience to climate risks
- Result 4: Enhanced regional knowledge management and cooperation for climate services

Cost benefits were grouped into a single economic analysis for each of the five countries. Project Management Costs (PMC) and Monitoring and Evaluation (M&E) costs have been included in the analysis and have been divided equally across the five countries. The proposed main results, associated benefit and costs and the detailed economic analysis for each country, have been provided separately to this report in excel spreadsheets.

2 Lives and assets at risk

2.1 Lives lost and at risk

The Pacific is one of the most natural disaster-prone regions in the world. Since 1950 natural disasters have affected approximately 2.5 million people, costing Pacific Island Countries around US$1.6 billion in associated damage costs (SPC 2011). Oceania recorded losses for 51% of total climate-related disasters in 1998-2017 (in Africa this accounts for only 14%), however costs and lives lost for nearly half of all natural disasters events remain unknown (Crunch 2018). DesInventar[4] has attempted to record number of casualties from natural disasters, for some countries from as early as 1831. The data shows that tropical cyclones cause the most deaths as seen in the table below.

Table 2. Deaths from tropical cyclone events

Country	*Period*	Deaths
Cooks Islands	*1831 - 2010*	79
Marshall Islands	*1905 - 2014*	13
Niue	*1915 - 2012*	3
Palau	*1850 - 2012*	16
Tuvalu	*1883 - 2015*	12
Total event		**123**

**Data adapted from DesInventar*

[4] Data derived from http://www.desinventar.net/DesInventar/profiletab.jsp downloaded 12th May 2019.

Different data time periods were covered for each country hence the data is not directly comparable. All five nations have reported 123 historic deaths as a result of tropical cyclones. DesInventar uses official governmental data and causalities are likely to be underestimated, as not all deaths have been reported in the aftermath of a disaster.

2.2 Assets at risk and replacement costs

All five countries have assets, infrastructure and crops at risk from being damaged from natural disasters. It costs money to replace these assets. The term replacement cost refers to the amount that would have to be paid to replace an asset at the present time, according to its current worth.

Table 3 shows that the total replacement costs of assets in all five countries amount to over US$7.6 billion, with buildings at risk contributing the majority of this total at 86.5%, infrastructure at 13.2%, and cash crops at 0.4%. Replacement costs have been adjusted for inflation to 2019[5].

Table 3. Replacement costs of building, infrastructure and cash crops

	Replacement Costs *(million US$2019)*			
Country	**Buildings**	**Infra-structure**	**Cash Crops**	**Total**
Cook Islands	1,918	175	12	2,105
Niue	258	110	1	369
Palau	1,982	237	4	2,223
RMI	2,078	423	9	2,510
Tuvalu	339	56	1	397
Total	6,574	1,000	28	7,603
Average	*86.5%*	*13.2%*	*0.4%*	

Adapted from PCRAFI data and adjusted to 2019 (www.usinflationcalculator.com)

RMI, Palau and Cook Islands have similar buildings replacement costs at risk, around US$2 billion, whereas Niue and Tuvalu building replacement costs are smaller. RMI have the most developed infrastructure with replacement costs amounting to over US$423 million, although keeping in mind that the original PCRAFI model has not been updated since 2011. There have been significant investments in Tuvalu and Niue in recent years such as a new airport for Tuvalu in 2016 and the New Zealand's High Commission building in Niue in 2019. Palau has a slightly larger population than Niue and Tuvalu and average GDP growth over the past 5 years has been lower. Given no available data on asset growths, annual growth rates in assets have been matched to average GDP growth rates over the period 2015-2019 for each country (table 1).

[5] www.usinflationcalculator.com

2.3 Economic damages and losses as result of natural disasters

2.3.1 Economic damages and losses

Economic analysis distinguishes between the following avoided economic damages and losses.

- *Avoided economic damages* include impacts on infrastructure and physical assets, particularly contents, and crops. Effective climate information and knowledge services have the potential to partially reduce the loss of contents and reduce crop loss through early harvesting etc. Improved hazard information and dissemination, providing better preparedness and longer lead times to evacuate, move content and harvest crops, are key contributors to these avoided damages. Replacement costs are used to derive economic damage values.
- *Avoided economic losses* represent changes in economic flows arising from the disaster, lasting up to several years. Typical avoided economic losses include improved productivity and avoided losses to agriculture, livestock, fisheries, industry, commerce and tourism. They include unexpected expenditures to meet emergency needs.

The table below outlines the avoided economic impacts that have been included in the economic analysis.

Table 4. Direct and indirect economic impacts of natural disasters

Direct		Indirect	
Tangible	**Intangible**	**Tangible**	**Intangible**
Property	Physical and mental health effects	Alternative accommodation costs	Inconvenience caused by disruption of utility services
Crop values	Loss of memorabilia and irreplaceable items	Clean up and emergency services costs	Disruption of communities & livelihoods
Damage to content	Loss of ecosystems including water quality impacts	Increased travel costs	Cultural & social values
Infrastructure and utilities	Loss of subsistence crops	Production and income losses	Increased vulnerability of communities & businesses
Loss of Life		Land management and pollution effects	Potential disease outbreaks

***key**: not quantified assessed quantitatively assessed qualitatively*

Enhanced climate information and knowledge services have the potential to minimise damage to assets and crops. Economic losses and damages will differ according to the type of natural disaster. For example, events that incur the highest levels of economic loss are not necessarily the events that affect the greatest number of people. Although tropical cyclones have the highest level of recorded loss, droughts tend to affect more than double the amount of people than floods (SPC SOPAC 2013). Droughts inherently impact society and livelihoods.

Particularly the five countries are highly vulnerable to water shortages, because economic reliance is made on subsistence crops and many people live in remote villages.

For tropical cyclones, floods, storms, intense rainfall and high wind impacts, the largest gains are reaped by preventing damage to content in buildings, which account for the majority of replacement costs. The biggest avoided losses will stem from moving content to higher ground or safer areas, and potentially securing roofs and property in general. For drought, protecting crops and harvesting early before a projected disaster event can reduce losses.

2.3.2 Annual average losses (AAL)

The Pacific Catastrophe Risk Assessment and Financing Initiative (PCRAFI)[6] has developed catastrophe risk models for tropical cyclones across the Pacific, including the five countries. The country risk profiles give an estimation of the average annual losses (AAL) a country will experience from tropical cyclones. The AAL can be defined as the expected loss per annum associated with the occurrence of future disasters assuming a very long observation timeframe[7]. AAL considers the damage caused to exposed assets by small, moderate and extreme natural disaster events. It represents a useful and robust economic metric for comparisons between countries and has been used as the key indicator for avoided losses on the benefit side of the cost benefit analyses.

Based on historical events and a simulation over 400,000 tropical cyclones, PCRAFI is one of the very few efforts to estimate economic losses for several Pacific countries (Noy & Edmonds 2016). Its accuracy is slightly compromised by the use of high-resolution satellite image and surveys in the field. Individual country PCRAFI reports give an understanding of the potential magnitude of economic losses as a result of tropical cyclones (PCRAFI b-f). For example, in the next 50 years, the Cook Islands have a 50% chance (i.e. losses equivalent to a one in a fifty-year event) of experiencing economic losses in excess of US$69.9 million and casualties of 112 (PCRAFI 2011f). Table 5 shows the AAL from tropical cyclones and the potential casualties for each of the five countries. AAL are made of direct and emergency losses.

Table 5. AAL per capita, population and casualties of tropical cyclones

	Average Annual Losses (AAL) and Casualties Tropical Cyclones (million US$2019)				
Country	**Direct Losses**	**Emergency Losses**	**Total TC**	**Casualties**	**Population**
Cook Islands	9.46	2.13	11.59	79	17,459
Niue	3.40	0.43	3.83	13	1,618
Palau	4.44	0.97	5.41	3	21,729
Marshall Islands	5.79	1.35	7.14	16	53,127
Tuvalu	4.36	0.06	4.42	12	11,000
Total	**27.45**	**4.94**	**32.39**	**123**	**104,933**

Adapted from PCRAFI data and adjusted to 2019 for inflation, asset growth***

** www.usinflationcalculator.com*

*** asset growth rates are matched to average GDP growth over the period 2015-2019 per country*

[6] http://pcrafi.spc.int/
[7] https://www.preventionweb.net/countries/fji/data/

AAL for tropical cyclones are by far the highest for Cook Islands, i.e. US$11.59 million, followed closely by RMI, with the other three countries incurring around half of these losses. The risk of casualties are considerable, but not as high a risk as for other Pacific Countries such as Papua New Guinea, Vanuatu and Fiji (Giorgetti 2018).

The PCRAFI model does not reflect the vulnerability of atoll islands to storm surges and tsunami waves generated by more distant storms or earthquakes (Noy and Edmond 2016) and therefore represents an underestimate. When Cyclone Pam hit in 2015, Tuvalu suffered significant storm surge damages. Estimated loss and damage to households amounted to US$4.45 million, which represents around 14.67% of GDP, with overall loss and damages at national level estimated at around 20% of the GDP[8] (Taupo and Noy 2016). Sea-level rise at Funafuti has been three times above the global average between 1950 and 2009 (Taupo, Cuffe and Noy 2016)[9]. Niue and Palau tend to be affected by heavy rainfalls, strong winds and droughts[10], however PCRAFI has not quantified these effects. The impact of Cyclone Heta on Niue in January 2004 was very destructive causing US$33.32 millions of damage (McKenzie *et al.* 2005).

Another source for economic losses for different types for hazards is the PreventionWeb by UNISDR[11], which covers a range of hazards such as wind, storm surge and tsunami.

Table 6. AAL for wind, storm surge and tsunami

	Annual average loss (AAL) by hazard *(million US$)*				
Hazard	**Cook Islands**	**Niue**	**Palau**	**Marshall Islands**	**Tuvalu**
Wind	-	-	12.82	0.27	-
Storm Surge	-	-	1.00	-	-
Tsunami	-	-	0.06	-	-
Total	**-**	**-**	**13.89**	**0.27**	**-**

Adapted from Preventionweb to US$2019

No data was registered for Cook Islands, Niue and Tuvalu, however Palau can experience wind AAL as high as US$13 million, whereas Marshall Islands record much smaller wind damage, less than US$0.3 million.

2.3.3 Warning lead times and reduced economic losses

Warning lead times make a significant difference to how many natural disaster damages and losses can be avoided. The longer warning lead times, the higher the avoided damages and losses or benefits (Table 7). There is a significant difference between 'up to 7 days', 48hrs, 24hrs lead times or none at all. It gives people a higher chance to move their contents, animals and machinery to safety and harvest their crops earlier resulting in reduced economic losses.

[8] More than two-thirds of the disaster damage was physical - agriculture accounted for 5.3% of damages and losses, 14% for crops and 4.2% for livestock. Poor households incurred majority of loss and damage at 78.3%.
[9] This is the main empirical country study estimating the hardship and vulnerability in Tuvalu to natural disasters.
[10] The 2016 drought in Palau led to the closure of Jellyfish Lake, a major tourist attraction severely affecting GDP.
[11] https://www.preventionweb.net/english/countries/oceania/ downloaded 28th April 2019.

Table 7. Damage reduction potential with different warning lead times for different items

Items	Lead time	Damage reduction potential	Items	Lead time	Damage reduction potential
Household	24hrs	20%	Fisheries	24hrs	30%
	48hrs	80%		48hrs	40%
	up to 7 days	90%		up to 7 days	70%
Livestock	24hrs	10%	Open sea fishing	24hrs	10%
	48hrs	40%		48hrs	15%
	up to 7 days	45%	School or office	24hrs	5%
Agriculture	24hrs	10%		48hrs	10%
	48hrs	30%		up to 7 days	15%
	up to 7 days	70%			

Adapted from Subbiah et al. 2008

The average damage reduction potential across all items are 14% for 24hrs, 36% for 48hrs and 58% for up to 7 days warning lead times. It is expected that the proposed investments will be able to provide 48hrs warning lead times, which are a key factor in reducing economic losses and saving lives as a result of natural disasters. Therefore, economic damages and losses are expected to be reduced by 36%. This rate is applied to Niue, Palau and Tuvalu, as few investments in climate information and early warning services have taken place in these countries and therefore the full savings are anticipated. For the more advanced economies of Cook Islands and RMI a slightly more modest reduction in damages is expected, as these countries have been subject to historic climate proofing investments.[12] A saving of 20% for Cook Islands and 25% for RMI is thus assumed (Giorgetti 2018; Subbiah *et al.* 2008).

3 Cost benefit analyses

3.1 Approach and methodology

The Cost-Benefit Analysis (CBA) has identified and assessed costs benefits of enhanced climate information and knowledge services options for each of the five countries and has made inherent trade-offs explicit. The CBA approach is based on guidelines for Disaster Risk Management developed in New Zealand (Smith, Brown and Saunders 2016). A detailed data collection sheet was used to address the economic information needs for the CBAs (Appendix One).

[12] Cook Islands has prioritised climate proofing investments in implementation of the National Sustainable Development Plan, the National Infrastructure Investment Plan (NIIP) and the Joint National Action Plan (JNAP) II and through its Renewable Energy Sector Project, amongst others. Climate proofing investments in RMI include the Pacific Resilience Project Phase II for RMI, “Addressing Climate Vulnerability in the Water Sector (ACWA) in the Marshall Islands” project, the ADB Pacific Disaster Resilience Program and the World Bank Pacific Resilience Program, amongst others. Both Cook Islands and RMI have received support from the Pacific Islands Renewable Energy Investment Program.

The feasibility of the investments was determined by calculating the economic internal rate of return (EIRR) and economic net present value (NPV). Discount rates used in some recent studies conducted in the Pacific range between 3–10% (Buncle *et al.* 2016). A 9% discount rate has been applied as recommended by the Asian Development Bank (ADB 2017). The period of analysis covers 10 years over the lifetime of the proposed results. Given the difficulty of estimating the value of a statistical life (VSL) in those countries and ethical considerations, these benefits have not been included in analysis, but are likely to be substantial.

The following specific assumptions have been made for the economic analyses:

- benefits take the form of avoided damages and losses;
- capital investments in the first year are expected to be 20% effective in reducing damages, based on the expected deliveries in the programme's workplan. Effectiveness is assumed to increase to 40% in year 2, 70% in year 3, 90% in year 4 and 100% by the last year of the programme (year 5) when the Programme is fully implemented;
- the full penetration of interventions are estimated to reduce damages and losses between 20-36% depending on the potential to improve warning lead times;
- productivity gains in the subsistence and commercial agricultural sectors are expected from last mile connectivity activities, but have not been accounted for;
- asset growth rates were derived from average GDP growth rates (2015-2019); and
- estimated benefits are likely to be conservative.

3.2 Results of the CBA

The CBA shows that, assuming a 10-year useful life of proposed interventions at a 9% discount rate, all discounted NPV are positive. The economic EIRR exceeds the discount rates in each instance making all proposed investments economically viable.

Sensitivity analysis has been used to test key parameters: a) a decrease in benefits by 10%; b) an increase in costs of 10%; and a) and b) combined. Although the EIRR decreased with those simulated cost benefit changes, the EIRR remained above the 9% threshold in all cases.

3.2.1 Cook Islands

The total capital and operational costs amount to US$13.53 over 10 years, with an expected co-financing provided by the Government of Cook Islands of US$0.34 million over the first five years.

The Cook Islands CBA estimated the net benefits of the enhanced climate information and knowledge services results. The model shows a positive NPV of US$6.42 million with an EIRR of 30%. Sensitivity analysis has shown that the EIRR remained above the 9% threshold in all cases.

The overall conclusion is that proposed results for the Cook Islands will have substantial benefits, even if costs have been underestimated or benefits overestimated.

3.2.2 Niue

The total capital and operational costs amount to US$8.37 million over 10 years, with an expected co-financing provided by the Government of Niue of US$0.54 million over the first five years.

The Niue CBA estimated the net benefits of the enhanced climate information and knowledge services results. The model shows a positive NPV of US$3.50 million with an EIRR of 27%. Sensitivity analysis has shown that the EIRR remained well above the 9% threshold in all cases.

The overall conclusion is that proposed results for Niue will have substantial benefits, even if costs have been underestimated or benefits overestimated.

3.2.3 Palau

The total capital and operational costs amount to US$10.83 million over 10 years, with an expected co-financing provided by the Government of Palau of US$0.84 million over the first five years.

The Palau CBA estimated the net benefits of the enhanced climate information and knowledge services results. The model shows a positive NPV of US$5.68 million with an EIRR of 31%. Sensitivity analysis has shown that the EIRR remained well above the 9% threshold in all cases.

The overall conclusion is that proposed results for Palau will have substantial benefits, even if costs have been underestimated or benefits overestimated.

3.2.4 Republic of the Marshall Islands

The total capital and operational costs amount to US$10.34 million over 10 years, with an expected co-financing provided by the Government of the Republic of the Marshall Islands of US$0.24 million.

The Republic of the Marshall Islands CBA estimated the net benefits of enhanced climate information and knowledge services results. The model shows a positive NPV of US$4.82 million with an EIRR of 27%. Sensitivity analysis has shown that the EIRR remained well above the 9% threshold in all cases.

The overall conclusion is that proposed results for the Republic of the Marshall Islands will have substantial benefits, even if costs have been underestimated or benefits overestimated.

3.2.5 Tuvalu

The total capital and operational costs amount to US$10.32 million over 10 years, with an expected co-financing provided by the Government of Tuvalu of US$0.43 million.

The Tuvalu CBA estimated the net benefits of the enhanced climate information and knowledge services results. The model shows a positive NPV of US$3.65 million with an EIRR of 25%. Sensitivity analysis has shown that the EIRR remained well above the 9% threshold in all cases.

The overall conclusion is that proposed results for Tuvalu will have substantial benefits, even if costs have been underestimated or benefits overestimated.

3.3 Summary of the CBA

All five countries show positive NPV and healthy EIRR with a 9% discount rate, even if benefits fall by 10% and total costs increase by 10%. Total and country co-financing ranges between US$0.24 million and US$0.69 million. Total capital and operational costs for the first five years for Results 1 – 4 amounts to US$46.70 million. PMC costs per country amount to US$0.48 million and Monitoring and Evaluation costs to $0.07 million per country. It is recommended that GCF supports the funding of the proposed investments in interventions in all five countries given the positive EIRRs.

Table 8. Summary of CBA results and economic costs for all five countries

Economic Indicators	Cook Islands	Niue	Palau	RMI	Tuvalu	Total Scenarios
	($m)	($m)	($m)	($m)	($m)	($m)
NPV @ 9% d.r.	$6.42	$3.50	$5.68	$4.82	$3.65	$24.07
EIRR	30%	27%	31%	27%	25%	-
Total costs results 1-3	*11.09*	*7.17*	*9.54*	*8.89*	*8.46*	*45.14*
Total regional costs result 4	*0.31*	*0.31*	*0.31*	*0.31*	*0.31*	*1.56*
PMC costs	*0.48*	*0.48*	*0.48*	*0.48*	*0.48*	*2.38*
M&E	*0.07*	*0.07*	*0.07*	*0.07*	*0.07*	*0.35*
TOTAL COSTS year 1-5	11.94	8.03	10.39	9.75	9.32	49.43
TOTAL COSTS year 1-10	13.53	8.37	10.83	10.35	10.32	53.40

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Appendix One

Cost Benefit Analysis Data Collection Sheet

Please read the following notes before proceeding to fill out the worksheets 'expected costs' and 'expected benefits'

Porposed interventions

For each option to be assessed in the CBA, please outline the details of the intervention, including what each option would achieve in terms of benefits (outcome) i.e. lives saved, crop damage reduced etc. Please also indicate expected associated capital and operational costs.

The most important first step for the CBA, is to finalise proposed intervention in each country.

What is needed for the CBA:

- A clear definition/description of the intervention – this typically includes a main component and several sub-components. Be as comprehensive as possible.
- The proposed intervention needs to be compared against the 'do nothing' or 'status quo' scenario - to get a good idea about what is already in place in each country and what the proposed (new or improved)intervention is going to achieve.
- What (multi-)hazard will be covered?
- What geographical areas and what population base will be coverd?
- A direct link to benefits/outcomes achieved on the ground, i.e. lives saved, crops saved, productivity increased through crop changes etc.

where BENEFIT = monetary or non-monetary gain received because of an action taken or a decision made

COST = Monetary or non-monetary loss due to an action taken or decision made

Once that is completed, I can then undertake the data collection and think about who to meet.

The most important is to finalise the interventions ASAP and ensuing outcomes/changes. This is a first cut at understanding what is being proposed in each country , what it may cost and what benefits will be reaped.

Summary: These are the first 3 essential steps of the CBA where you need to contribute

First 3 CBA STEPS	
Step 1: Establish the baseline	The baseline for the study is the current situation and provides a point of reference for changes in the climate service to be evaluated. In CBA, the baseline represents the best assessment of the world in the absence of the intervention.
Step 2: Identify changes in the climate service provided	These changes can involve the introduction of new climate services or products, expanded geographic coverage of existing services, improvements in services etc.
Step3: Identify full range of benefits and costs	This step focuses on reviewing the baseline and climate service changes to identify benefits to user communities and costs incurred under each proposed intervention

Proposed Interventions and Expected costs

Current Output	Proposed Interventions					Expected Costs			Data Sources	
Intervention	Intervention		Hazard covered [1]	Expected frequency of occurrence	Expected lifetime [2]	Type of cost [3]	Expected capital costs	Expected annual operational costs [5]	Data source of costs [6]	Key agency holding data [7]
Main component	*Main Component*	*Sub-components*		*e.g. cyclone once every 5 years*	*Years*		*US$* [4]	*US$* [4]	*literature or agency*	*name & contact details*

[1] Please indicate if it is a single or multi-hazard intervention.

[2] Please indicate how long you expect it to be operative, e.g. new software for enhanced forecasting system will last for 15 years, with an initial capital cost of $1m, an upgrade every 3 years (additional capital costs will incur) and annual costs of $10k.

[3] Examples of types of costs (taken from WMHO 2015 'Valuing weather and climate'):

Service production costs
- Infrastructure investment
– Observations and data management
– Modelling and forecasting
– Information retrieval & processing cost (e.g. satellites)
– Research and development
– Service delivery

PLEASE LIST EVERY POTENTIAL COST. Even if they cannot be quantified, they will be assessed qualitatively.

[4] All values to be expressed in US$2017 (if you have costs from a different year, please indicate so)
[5] Include labour, maintenance costs. The occurrence of these costs is directly linked to the lifetime.
[6] Please indicate where your cost estimates originate from, e.g. name of report, expert opinion (name expert), quote etc.
[7] If you cannot provide any costs, please indicate who potentially holds this data, e.g. Ministry of Agriculture, SPC etc. and provide a contact person

Proposed Interventions and Expected Benefits

Current Output	Proposed Interventions		Hazard covered	Expected Benefits (Avoided Hazard Damage) [1]				Data Sources	
Intervention	Intervention		Hazard covered	Who will benefit? [2]	Type of Benefit [3]	Expected Benefit	Expected reduction in avoided damages [4]	Data source of benefits	Key agency holding data
Main component	*Main Component*	*Sub-components*	*Single or multi-hazard*	*Population & geographical area*	*brief description e.g. expected no. of lives saved*	*Quantitative & qualitative or US$*	*%*	*literature or agency*	*name & contact*
0	0	0	0						
0	0	0	0						
0	0	0	0						
0	0	0	0						

[1] Identify the benefit (avoided hazard damage) expected i.e. lives saved, damage reduced to contents, agricultural productivity improved (name of crop, harvest tonnes per ha and potential avoided damage % e.g. porposed intervention will reduce sugar cane crop losses by 50% on average in an event of a flood). PLEASE LIST EVERY POTENTIAL BENEFIT. Even if they cannot be quantified, they will be assessed qualitatively.

® *Please note that we cannot quantify all of these benefits, it is important to identify them and quantify them when possible, then a US$ value can be assigned*

[2] Indicate the number of people who are expected to benefit (whole population, people living in the capital or highlands etc.)

[3] Examples of triple bottom line (social, environmental & economic) benefits:

Economic

- Residual damages avoided by moving and evacuating property contents (do you have $values of property assets at national level readily available?)
– Avoidance of crop losses from floods or drought (e.g. provide data on main crops harvest (tonnes/pa), sale price (US$/t))
– Increased farm production and sales – Minimization of search and rescue costs – Minimization of hazard-relief costs

Social

– Avoidance of loss of life – Home improvement decisions – Avoided climate-related illnesses (e.g. injuries, hypothermia, psychological effects and risks to life)

Environmental

– Management of local environmental quality – Water savings – Reduced runoff from fertilizer application, resulting in improved water quality

[4] Please indicate the potential to reduce hazard-related damages, e.g. an improved forecasting system can reduce lives by x etc. Often based on expert opinions.

[5] Please indicate where your benefit estimates originate from, e.g. name of report, expert opinion (name expert), quote etc.

[6] If you cannot provide any benefits please indicate who potentially holds this information, e.g. NMHS, Ministry of Agriculture, and provide a contact person