Climate change adaptation in the Pacific: making informed choices

Summary for decision-makers

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List of acronyms

BCR	benefit–cost ratio
CBA	cost–benefit analysis
CCA	climate change adaptation
CV&A	community-based vulnerability and adaptation assessment
DDR	disaster risk reduction
DM	disaster management
DRM	disaster risk management
DRR	disaster risk reduction
EIRR	economic internal rates of return
IPCC	Intergovernmental Panel on Climate Change
MEA	Multilateral Environmental Agreement
NAPA	National Adaptation Plan of Action
NGO	non-government organisation
NTP	National Transport Plan
PACCSAP	Pacific Australia Climate Change Science and Adaptation Planning
PASAP	Pacific Adaptation Strategy Assistance Program
PIC	Pacific Island Countries
RMI	Republic of Marshall Islands
SLA	sustainable livelihood assessment
TLB	taro leaf blight
V&A	vulnerability and adaptation assessment

Climate change adaptation in the Pacific: making informed choices

This summary for decision-makers accompanies the overview report, Climate change adaptation in the Pacific: making informed choices, a project supported by the Australian Government under their Pacific Adaptation Strategy Assistance Program (PASAP). The specific objectives of this project are to provide:

- an analytical framework(s) suitable for assessing economic and social costs and benefits of climate change adaptation (CCA) projects in the Pacific
- an overview of key constraints in undertaking economic and social assessment-based informed choices about the CCA projects in the Pacific
- suggestions for overcoming key institutional and other constraints in the use of economic and social assessment in making informed choices about CCA in the Pacific.

This document provides user-friendly and easy-to-access information about key concepts, issues and challenges that decision-makers face in identifying, assessing and selecting adaptation measures while using policy/project cycle-based risk management, supported by robust analysis based on analytical frameworks such as sustainable livelihood analysis, environment impact assessment, and cost–benefit analysis (CBA). It also identifies key constraints in the Pacific for making informed decisions using such analytical frameworks, and makes specific recommendations for strengthening, drawing on risk management, knowledge-based CCA decisions in the Pacific Island Countries (PICs).

Using this document

The numbers in square brackets, for example [3.1], refer to the section in the overview report where that topic is discussed. Similarly, [case study 4.1] refers to the specific case study—in this case the food security case study—where the specific issue is illustrated.

Adaptation to climate change

Climate change is, as defined by the Intergovernmental Panel on Climate Change (IPCC) (2011), a change in the mean and/or the variability of climate property (such as precipitation, temperature and wind force) that persists for an extended period, typically decades or longer. Climate change may be due to natural internal processes or external forces, or to persistent anthropogenic changes in the composition of the atmosphere or in land use. For climate change, disaster risks are changing in terms of scale, scope, frequency and intensity, calling for major shifts in the way society adapts to current disaster risks and future climate risks [2.2; 2.3].Disaster risk is the likelihood of severe alterations in the normal functioning of community or society to weather or climate events interacting with vulnerable social conditions (IPCC, 2011).

Climate change directly or indirectly affects all sectors and communities and requires appropriate measures to reduce and manage residual risks in a changing environment. The economic and social impact of disasters in the Pacific are already significant and risks of disasters and their costs are increasing with climate change [2.2,2.3], so there is a need for disaster risk management (DRM) not only to address current risks, but also risks heightened through climate change.

Disaster risk management is defined as the implementation of strategies to avoid or minimise risks and unacceptable consequences by avoiding exposure to hazards as well as reducing vulnerability and managing residual risks [3.4]. Disaster risk is a result of the interaction between hazard and vulnerability of people, communities, environment and economy, and disaster outcome is a product of the risks and capacity to prepare for, respond and recover from a disaster event. Adaptation 'in the human systems is the process of adjustment to actual or expected climate and its effects to moderate harm or exploits beneficial opportunities' (IPCC, 2011). IPCC SREX report also notes that adaptation actions may range from incremental steps taken to improve things such as existing governance and technologies to reduce exposure and vulnerabilities to transformational changes in fundamental attributes of a society (IPCC, 2011).

Climate change adaptation exhibits key elements of DRM, but with two key differences. DRM deals with known disaster risks. It comprises disaster risk reduction (DRR) and disaster management (DM). which in turn include disaster preparedness and post-disaster response and rehabilitation. Whereas climate risk management is about dealing with future climate risk. DRM strategies are based on historic data and current experiences with a hydro-meteorological event as a guide to the future disaster risks (without climate change). On the other hand, CCA decisions may be based on past disaster experiences. CCA must also take account of changing risks associated with projected changes in the average and variability in climate condition and sea-level rise, and changes in the frequency and intensity of extreme events, such as precipitation, cyclones and storm surges [3.3]. Climate adaptation must also reflect considerations of uncertainty, which is a key feature of climate change.

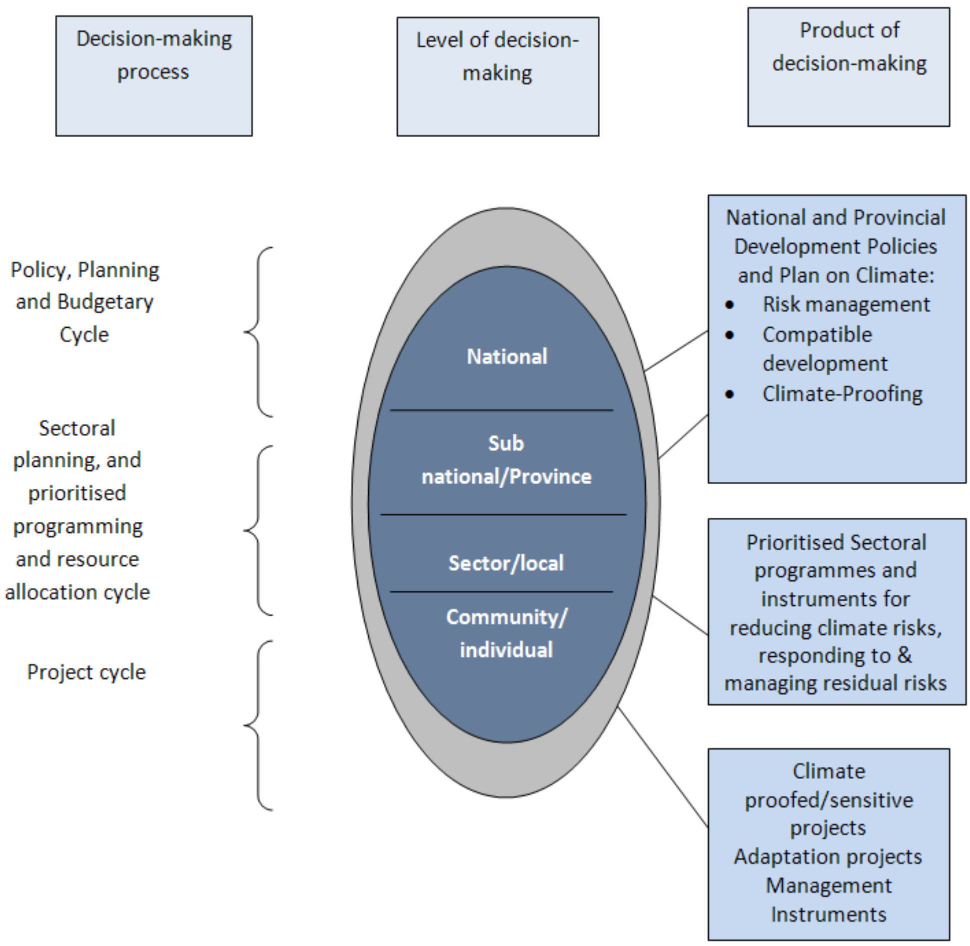
The dynamics of the climate system are not well understood, and there are many uncertainties associated with the available projections of future climate scenarios. For the Pacific, the uncertainty is particularly acute, as the baseline time-series meteorological and sea-level data is limited, sub-regional and national level climate models do not exist, and global climate modelling results are not always consistent. Furthermore, there is uncertainty about the scale, scope and magnitude of climate change impacts across sectors. This is due to limited scientific information available in country, recognising that impacts associated with climate change, variability and extremes are a result of a complex web on interactions involving socioeconomic as well as environmental and meteorological factors [2.1; 3.3].

Adaptation decisions and measures

The adaptation decision-making process would include systematic consideration of climate risk when designing and implementing practical risk reduction and management activities. Adaptation may be implemented in reaction to recent weather and climatic events and current disaster risks or proactively planned for projected climate change, variability and extremes. Adaptation decisions will reflect integrating DRM and CCA principles and would be underpinned by scientific knowledge (technical risk and risk-reduction analysis-based information) and traditional and experiential knowledge [3.2].

Given the cross-cutting and all-pervasive nature of climate change, in practice, all stakeholders in society ultimately face climate change. Adaptation decisions are consequently made across all levels of society. Figure 1 illustrates different levels of government and community decision-making in the Pacific and the effects they normally have. In an ideal world, national level policies translate to sectoral priorities and programs and these in turn determine the portfolio of sectoral activities. Similarly, effects and experiences gained on the ground inform decision-making to higher levels of government to lead to a situation where national decision-making and grass-roots decision-making are harmonised and mutually reinforcing [3.2].

Figure 1 Targeting decision-making processes across different levels of government and communities for mainstreaming of climate change risk considerations in the Pacific



Adaptation measures, decided upon by government, communities and private citizens thus may include policies, plans, strategies, programs and projects. At the national level, it may also include allocation of corresponding financial resources to the sectoral-level authorities responsible for translating national priorities into action on the ground. Given the relationship between economic and social status of communities and their vulnerability to disasters, adaptation measures may be implemented in reaction to recent weather and climate events or proactively planned for projected climate change, variability and extremes, as well as address other national development goals. A range of adaptation measures could be used to address current disaster risks and projected climate change challenges and a portfolio of adaptation measures may be required across levels of government, across sectors and by communities. Such measures may be incremental, where countries take steps to reduce current risks, while may also be addressing projected changes in climate risks. Such measures may also be foundational in that the government creates an enabling environment that allows the society to be flexible and build on as the climate changes. In the medium to longer term, a more transformational approach is selected where countries change their values and development approach such that a different path of development may be followed [3.1].

Climate change adaptation decisions

While there are many dimensions to supporting effective CCA decisions in the Pacific, the report has highlighted two in particular, namely: risk-based policy/project decision-making process and the underpinning knowledge to make informed decisions.

Policy/project cycle-based adaptation decisions

These climate risk considerations at the national and sectoral policy level would normally follow the policy cycle process, which is similar to the project cycle-based risk management decisions followed at the individual activity/project level. A risk management based-policy/project cycle usually follows key steps that integrate risk considerations: situation context analysis, identification of problems and solutions; appraisal – assessment of the options from relevant perspectives (e.g. technical, economic, environmental); design, implementation and monitoring – implementation of project activities with ongoing checks on progress and feedback; and evaluation – periodic review of the project with feedback for the next project cycle. Institutionally, one would expect a direct relationship between adaptation decisions made at the national level (national priorities), sectoral level (sector policies, objectives and priority programs), and community-based and other projects will put into effect sector policies and strategies. [3.4].

Making informed decisions about CCA would ideally require assessing risks without adaptation initiative and then comparing the benefits and costs of risk reduction expected with the adaptation measure, together with other development considerations. In DRM, the benefits of CCA are essentially the social and economic costs of damages, losses of disaster avoided, and the costs are those associated with the particular adaptation measure.

Risk analysis, that is analysis of risks of potential impacts of climate change without risk management involves:

- determining hazards exposure and vulnerability
- identification of management/adaptation measures and associated costs, based on potential adaptation activities and alternatives and their respective costs
- analysis of risk reduction, that is, estimated benefits of reducing risks [3.4.1, 3.5.1].

Making informed choices at the project level

Economic CBA is an established tool for making choices after identifying impacts and assessing economic costs and benefits of an activity and comparing that to the 'without' activity. Economic efficiency measures, such as net present values, benefit–cost ratio (BCR) and economic internal rates of return (EIRR) are used to compare and select a preferred initiative, particularly when there is pressure to achieve the highest benefits with minimal investment. If the probability of events and impacts can be quantitatively determined, the benefits of adaptation can then be worked out, comparing expected economic present values associated 'with' and 'without' adaptation [3.5.2]. If detailed probabilities for events and impacts are not known, then sensitivity analysis can reveal possible trade-offs that may be necessary, as is used in the infrastructure [4.4] and water security case studies [4.2] and the food security case study [4.1].

There are though, several challenges in using CBA to identify economically efficient adaptation measures, including:

- not all benefits and costs of risk reduction are identifiable, quantifiable and quantified in monetary terms, including due to limited baseline data
- disagreement over an appropriate discount rate to use when addressing long-term benefits and costs, particularly in situations of irreversible decisions
- economic efficiency-based decisions do not typically reflect consideration of who bears the cost of a measure and who enjoys its benefits
- in the face of uncertainties, probabilistic CBA is difficult. Instead, deterministic CBA, together with sensitivity analysis around key uncertain parameters can help provide additional information to make informed decisions.

CBA is best suited for deciding about individual activities. In the case of CAA, instead of a single adaptation activity, a portfolio of interventions is often required within a complex development context. Governments often have to decide between investments to address current development issues, including disaster risks, while also preparing for uncertain longer term climate scenarios. However, there is no single approach or criteria that countries can use in assessing and prioritising adaptation measures.

In many instances, in trying to balance the immediate development needs, disaster risks as well as plans for climate futures, adaptation measures adopted would also make sense from a development perspective, whatever the future climate. Such an approach to CCA is often referred to as 'no regrets' or 'low regrets' strategy.

This produces not only risk-reduction benefits but also other development benefits, such as:

- the protection of coastal mangroves ecosystems
- providing a cost-effective buffer against current and future storm surges
- supporting biodiversity conservation
- enabling improvements in economic livelihoods and human wellbeing, particularly to the poor and vulnerable.

Such ‘low regrets solutions that produce win–win outcomes may though, not always be feasible [3.3].

In situations where investments need to be made that have a long life, explicit considerations of climate projections also become critical, such as in the case of roads, bridges, and other similar infrastructure developments. In the extreme situations, countries, with limited resources, may have to choose to postpone making decisions about future climate risks. This better enables them to address their immediate development needs but also avoid maladaptation [3.3].

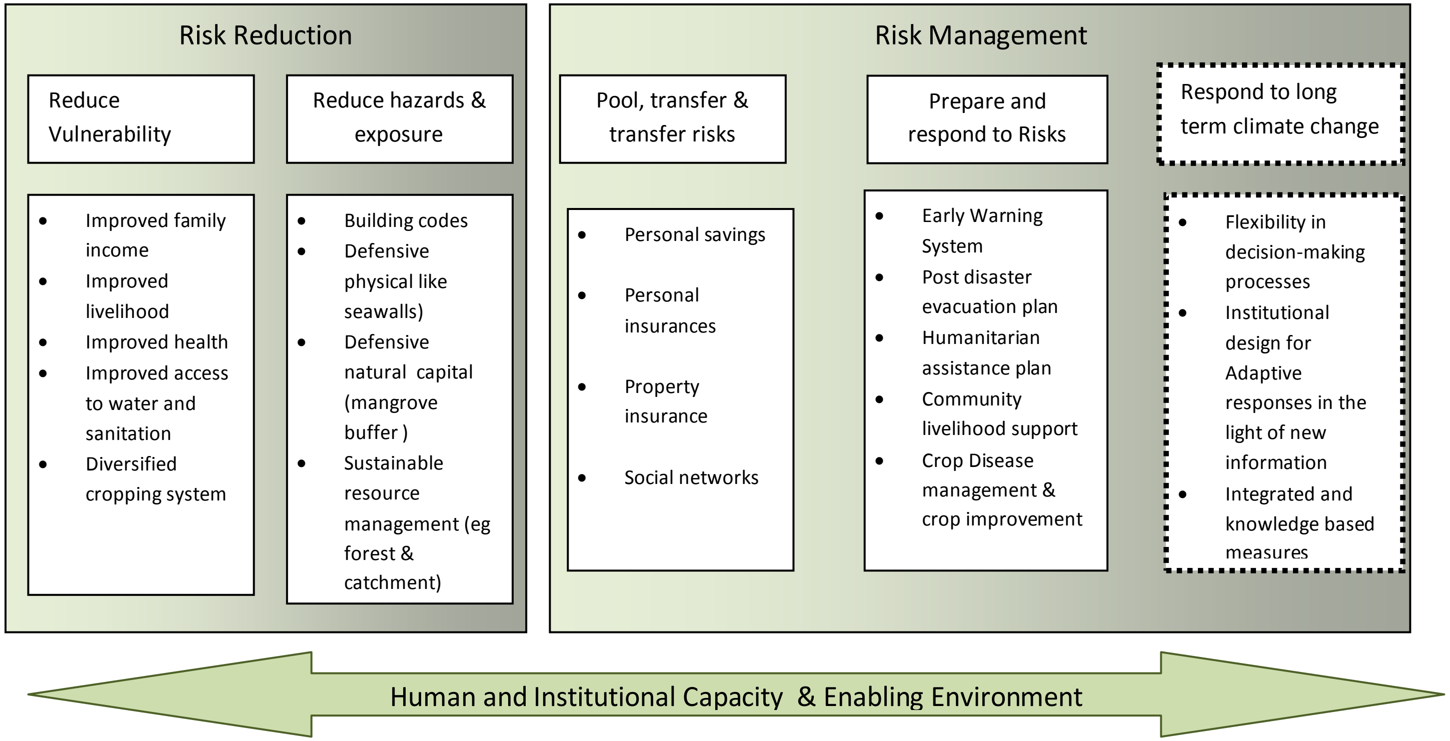
On the other hand, countries may need to choose those development and current disaster risk management options that could also be adjusted over time when new information becomes available. Planned adaptation strategy may also be aimed at building individual and institutional capacity and laying necessary foundations, such as in the form of an early warning system, or crop germplasm banks and institutional technical capacity to plan for, respond to, and cost effectively recover. At the individual and or private sector level, adaptation measures may include specific individual interventions or packages of related actions that they can adopt to reduce and manage their own risks. These include risk transfer and sharing measures (such as disaster insurances, e.g. social insurance), which can help people to have access to financial and other resources in times of disaster [3.3].

Proactive and reactive adaptation measures could therefore include a single measure or a portfolio of activities ranging from ‘pure’ development activities on the one hand (addressing drivers of vulnerability to, on one end of spectrum, targeting risk reduction measures), as well as dealing with residual risks by pooling, transferring and sharing risks and preparing for, confronting and reactively adapting to climate change (Figure 2).

When considering a portfolio of adaptation measures, the geographic scale of the sphere of influence of possible measure options is often large, and benefits may accrue across hard-to-identify groups of people. Therefore, CBA as an assessment tool may not be totally appropriate for making detailed choices [3.5.2, see case study 4.3, case study 4.4].The choice of priority strategies would also be informed by other criteria in the context of national development needs, including for example, technical and economic feasibility and the effectiveness of a measure in the light of uncertainties (US National Research Council) Committee on America's Climate Choices (2011).

Despite such limitations, the CBA framework is still useful in helping to systematically identify, evaluate and consider all impacts and their costs and benefits, rather than it providing an exact economic value of an adaptation measure [relocation case study 4.3]. The CBA process can also help identify critical parameters to measure project impacts, and iteratively learn and adapt using new information.

Figure 2 Climate change adaptation measures: building on disaster risk reduction and disaster risk management measures considering projected climate



Source: Based on McGray, Hammill, et al (2007).

Decision-making criteria

Adaptation choices should be made on the basis of not only quantified economic efficiency measures where possible, but also on the basis of qualitative and quantitative assessments of other social and economic impacts of CCA and with other considerations. Other criteria relating to national development needs, including for example, urgency of addressing immediate development needs; require institutional foundations to support future decisions, technical and economic feasibility and the effectiveness of a measure in the light of uncertainties [3.5.2, case study 4.1].

Criteria to inform adaptation choice would depend on the priorities placed by the government and communities regarding the balance between meeting current development and risk management needs and addressing future climate, and which is likely to vary from context to context, thus selection of decision-making criteria needs to be an explicit step in the climate risk management decision, as is the consideration of the local level of risk perception and risk tolerance threshold. The selection of the relevant decision-making criteria would need to be an explicit step in the climate risk management decision, and informed by development needs, local level of risk perception and risk tolerance threshold [3.5.2, case studies 4.3 and 4.4].

The iterative decision-making process, called adaptive management, is also relevant when uncertainties exist, and there is a need to periodically review and adjust adaptation strategies as new information is gained and lessons are learnt from past initiatives [3.3].

Adaptive management involves regular changes in management policies, strategies and practices that are implemented based on lessons learnt from the outcomes of initiatives and by taking into account changes in other drivers in society. Adaptive management is also about bringing together interdisciplinary science, experience and traditional knowledge into decision-making through ‘learning by doing’ by individual agencies. The adoption of an adaptive management approach would also require cross-sectoral engagement and the use of the decision-making process that allows for change. That is, decision-makers would need to be flexible in their decisions allowing different stakeholders to share their experiences and knowledge, develop a shared understanding of complex problems, accept new information as it becomes available, and make collective decisions [3.3].

Adaptation decision: technical aspects

From a technical perspective, the CCA decision-making process would involve many factors. These include the following:

- applying a robust knowledge to identify potential hazards, vulnerable areas, local sectors, and people to target
- developing risk-reduction measures and climate-sensitive or climate-compatible development measures (including policies, strategies, programs, on-the-ground activities and appropriate budgets) [3.4].

Essentially, two alternative knowledge-based adaptation planning approaches are generally advocated for responding to climate change: 'science- or impact-first' and 'vulnerability-first' assessments. The 'impact-first' approach involves identifying climate change scenarios using scientific climate models; assessing impacts based on projected climate change scenarios derived from the modelling exercises; identifying, assessing and selecting relevant adaptation measures; recognising underlying uncertainties; implementing the adaptation measure; and then assessing the outcomes and learnings. The starting point of the planning exercise is the climate change modelling and the impact of future extreme climate conditions. The 'impact-first' approach although used in many research projects, including in the Pacific and globally advocated, has usually not been used to inform adaptation decisions even in developed countries.

The 'vulnerability-first' approach starts by examining vulnerability and sensitivity conditions that the communities currently face, identifying local sensitivities and resilience of the natural and human systems to climatic hazards, identifying local priorities to climatic variability and then identifying viable adaptation strategies and actions required to improve their resilience. Projected climate conditions are also considered at this stage.

The vulnerability-first approach presupposes that adaptation to short-term climate variability and extreme events will reduce vulnerability to longer term climate change. Adaptation policies and measures are assessed in a development context with some reference to future climatic conditions and for which the adaptation strategy is equally important as the process by which it is implemented. It also emphasises stakeholder engagement and capacity enhancement as cross-cutting components [3.4.1].

Different types of technical analysis underpinned by good baseline data are required to inform CCA decisions. Risk and risk-reduction analysis will ideally draw on many different disciplines and traditional knowledge, and would involve backward assessment of past disasters to inform the forward-looking responses in the face of projected climate change, or forward-looking assessments based on scientific modelling. A holistic systems approach would need to be adopted to identify the effects of projected climate change across ecological scales, economic activities and communities and to identify appropriate risk-reduction measures necessary to address those risks. Without such an approach, adaptation measure may not fully address the goals of risk reduction and resilience [3.4.1, case study 4.4].

The nature of technical analysis will vary according to the type of hazard of concern and the priority sector(s) being affected, as well as the pathway through which the impacts are realised. Interdisciplinary vulnerability assessment helps in understanding the nature of current and projected hazards, exposure and vulnerability under project climate changes. Ecosystem-based assessments can help identify the pathway through which the impacts are realised, and the nature of impacts on human livelihoods. Vulnerability assessment tools based on rapid rural assessment and sustainable livelihood assessment (SLA) framework are commonly used to identify and assess people's sensitivity to hazards of a specific intensity and scale, understand the local level risks, risk management and resilience at the household and community level. Such vulnerability and adaptation assessment (V&A) would require knowledge drawn from different disciplines as well as local experiential knowledge and used to understand past disasters and their determinants, as well as drivers of change to inform the forward-looking responses in the face of projected climate change, or forward-looking assessments based on scientific modelling [3.4.1, 3.5.1].

For example, to understand projected increase in risks due to climate change on food security concern due to increased taro leaf blight (TLB) disease, several key technical assessments are required: the effect of increased precipitation and increased warmer nights on the establishment and spread of TLB as well as taro crop varieties available in the Asia–Pacific region that exhibit resistance to TLB (Table 3.5) [case study 4.1]. In comparison, a different type of analysis would be required if the focus is on water security in Tuvalu (Table 4.6) [case study 4.2]. Such information, including empirical data, is drawn from published and grey literature as well as from different government sources, and community knowledge as well as specifically designed data collections [case studies 4.1, 4.2, 4.3, 4.4, and tables 4.2, 4.6, 4.9, 4.13]. Such detailed technical and scientific information would be used to inform ex-ante or ex-post CBA of adaptation measure [case studies 4.1, 4.2, 4.4].

Observations from the Pacific

PICs continue to face serious challenges in strengthening their current DRM, while also responding to projected climate change in the context of their national development goals. Some progress has been made in integrating climate change into national and sectoral level policies, plans and strategies into on-the-ground projects. This range of work implemented also includes a number of climate and weather-related DRM initiatives and projects that may not have explicitly been categorised as CCA. Many of these projects were implemented with financial and technical support of development partners on a bilateral or multilateral basis.

National and sectoral policy level climate change adaptation

Many countries have explicitly recognised disaster risk and climate risk management in their national sustainable development strategy plans although, institutionally, the adoption of risk-based planning is not integral to their day-to-day decision-making process [3.3, 5.1]. Many countries have also attempted to mainstream DRM management and climate change mitigation and adaptation measures in National Disaster Risk Management Action Plan and National Adaptation Plan of Action (NAPA) for climate change. Some countries, such as Tonga and Republic of Marshall Islands (RMI), have developed joint national action plans for DRM and CCA. However, a common challenge in many countries is their systematic implementation of such policies and plans [5, 4.2, 4.3 and 4.4].

Elements of 'vulnerability-first' policy and planning approach are observed to have informed development of National Disaster Risk Management Action Plans and NAPAs in the PICs even if this approach was not explicitly identified at the time. National Disaster Risk Management Action Plan and NAPA processes relied on national and sectoral review documents, National First Communication and other Multilateral Environmental Agreements (MEA)-related reports. Such stakeholder-based action plans also reflected the multiple goals of reducing exposure and vulnerability, preparing for and responding to residual risks, and coping with and recovering from disaster events. Limited information together with expert judgements and local knowledge informed the design of the adaptation and risk management measures which also reflected an all-hazards consideration.

However, the two streams of disaster and climate risk management have generally been pursued in parallel in the region. This is despite the two streams of risk management being guided by two regional instruments based on essentially the same risk management framework and guided by similar risk management principles. At the country level, there is arguably little coordination or integration of the two approaches, neither between institutions supporting DRM and CCA, nor during the implementation of policies, plans, programs and activities, let alone in the approaches and tools used in respective decision-making processes [5].

Although most countries have national plans of action for DRM and CCA in place, this has not been translated into the sub-national and sectoral levels. Where they have been undertaken, the relationship between goals, sector objective and activities is not always clear in most countries. Where some linkages can be found, for example in Nauru, a direct line of sight can be seen between national development goal and the sector objectives, but not necessarily between the sector priorities and on-the-ground projects implemented under some regional projects (such as the Pacific Adaptation to Climate Change project). Similarly, the National Transport Plan (NTP) in the Solomon Islands clearly articulates the need for climate proofing of infrastructure as highlighted in their NAPA. But there are no specific strategies aimed at operationalising this. In some cases, pilot project activities are underway to inform the development of the national sector policy and framework, however, the relationship between the overall sector goal, objectives and the actual design of the various projects is difficult to identify [5].

The link between national, sector, program and project-level adaptation measures could be strengthened by adopting a linked set of cascading processes used in climate risk identification and risk management across the decision-making levels, informed by more specific and explicit relational information.

Project level climate change adaptation

Institutionally, risk considerations are often not integral to government decisions. Where projects are implemented to address recent disasters and current disaster risks, these often are stand-alone projects focusing on targeted community/area-based concerns [3.3, case studies 4.1, 4.2, 4.3, 4.4]. They focus on a single hazard and exclude other hazards and drivers of vulnerability considerations (see case studies4.3, 4.4). Government led and community-based projects are also often implemented ad hoc and in a policy vacuum. Such projects often limit scope for sustainability once the project funds are exhausted [3.3].

'Vulnerability-first' planning approach has been the norm, and in some cases a hybrid with 'impacts first' and 'vulnerability first' has been used, together with some use of CBA to inform CCA decisions [3.4.1]. Many externally funded community-based adaptation projects, implemented by community-based organisations and local non-government organisations (NGOs), have adopted some elements of the vulnerability-first assessment approach, starting with community-based vulnerability assessments. These use variations of community-based vulnerability and adaptation assessment (CV&A) tools. However, it is difficult to see in the cases examined to what extent project teams actually followed the 'vulnerability-first' process, as steps followed are often not documented.

Personal observations of recent CCA projects in the region suggest that specific project activities were not selected on the basis of V&A assessments (i.e. risk analysis, or risk management assessment and prioritisation). This is confirmed by the detailed case studies examined here [3.4.1, case studies 4.2, 4.3].

Data limitations, capacity constraints and uncertainty have also been the main constraints in the use of 'impacts-first', and to a lesser extent in the 'vulnerability-first' planning approach at the project level. Where the 'impacts-first' approach has been attempted, researchers are forced to adopt different degrees of quantitative assessments based on assumptions about climate change scenarios, impact scenarios as well as broad generalisations about the nature of adaptation measures and the potential benefits of adaptation assumptions. The 'impact-first' approach is also difficult to use on a regular basis in most countries as climate change modelling expertise is limited but, more importantly, suitable climate change models for the region, let alone countries are not available. Nor is there baseline data to inform such modelling exercises with a degree of confidence. Furthermore, for sectoral-level social and economic impacts, better technical information and country/context-specific data are needed and are generally limited at best and in most cases not available [3.4.1, 3.5.2, case studies 4.1, 4.2, 4.3, 4.4].

Systematic social and economic assessment of projects are not common in the region, and even les so risk management projects, and economic CBA of projects and policies is almost non-existent, except for large-scale externally funded projects such as infrastructure projects. Many DRM and CCA project documents make reference to their economic and social benefits, but empirical information to support such statements is often limited. Even less likely is the undertaking of a detailed ex-ante or ex-post probabilistic CBA. Detailed CBA in the Pacific is often difficult because of factors such as limited empirical baseline data and a high degree of uncertainty concerning future climate scenarios and impacts. In some adaptation projects, CBA could only be done using a deterministic CBA together with a series of sensitivity analysis [3.5.2, case studies 4.1, 4.2, 4.4].

The CBA framework is useful to structure and systematically identify risk-reduction impacts and costs and benefits of adaptation measures, even if detailed CBA may not be critical to making an informed choice [3.4.2, 3.5.2, case study 4.3].

Where detailed CBA of risks and risk reduction measures are warranted, robust scientific information about climate change, their impacts on natural systems and their impact on economic activities and societies is critical. As a start, a holistic systems perspective that provides a context-specific all-hazards understanding of risks would help identify appropriate, hard and soft adaptation measures for consideration and further assessment. Without such a systems-based approach, adaptation measures identified and implemented may not be effective, and in some cases may even be a maladaptation [case study 4.3, 5].

Economic efficiency measures of climate adaptation projects may not always be sufficient to prioritise and choose between adaptation measures, and particularly when a decision is required to inform a portfolio of adaptation measures. The choice of adaptation measures in the context of national development will also be guided by the explicit acknowledgement of the multifaceted nature of climate risks and the interaction between development and disaster outcomes. Multiple criteria that would guide the selection may include not only the usual economic efficiency criteria, but also others that recognise current development needs, current disaster risk as well as increasing risks under climate change and associated uncertainties, particularly when resources are limited [3.5.2, case studies 4.1, 4.4].

Where multiple objectives, and or data and capacity constraints are found, decision-makers could progressively move from qualitative to semi-qualitative to quantitative assessment (if adaptation and management responses warranted the detailed assessment). As a minimum, experiences in the Pacific suggest that broad-brush, largely qualitative, risk assessment is likely to be more suitable at the national planning level, where key policy decisions need to be made in the context of national development [5]. A more detailed level of assessment would generally be required at the sector level, when identifying specific sectors to target as well as when developing detailed sectoral level strategies and programs for action. A detailed quantitative CBA of adaptation options is generally useful where choice between adaptation options will be improved by detailed quantitative assessment of risks and uncertainties, particularly where the adaptation has a long shelf life. The level of empirical data used in such assessments would depend on the availability of such information [3.5.2, 3.6.2, 3.2, 5, and case studies 4.3, 4.4].

The selection of adaptation projects, as well as the quality of project designs has often been challenged by capacity constraints to assess projects and/or in the use of robust technical assessments. In-country capacity in technical assessment-based decision-making processes is often limited, even in terms of adequately assessing assessment reports prepared by external consultants.

Key recommendations

To strengthen knowledge-based adaptation decisions, several areas need particular attention across all the PICs. Country-specific priority and entry points for such strengthening may though depend on current status of baseline data, past research, and institutional capacity to make informed decisions. Other factors may also be important such as the urgency in addressing current development and disaster risk management needs, and addressing the challenges of climate change and the relevance of strengthening a foundational enabling environment.

To strengthen a cascading and explicitly linked set of adaptive decision-making processes across all levels of national policy, from planning levels to community/project levels that recognise current development and DRM needs and changing risks under projected climate condition and the associated uncertainty.

At each level of adaptation, there is a seven-step risk management cycle-based process, established on a stakeholder-based hybrid ‘impact-first’ and ‘vulnerability-first’ technical planning approach. This is a systems view of drivers of vulnerability and exposure, and incorporates context-specific integrated analysis of climate risks and climate adaptation measures.

Determining specific adaptation criteria to guide the choice of adaptation measures is an integral step in this process, together with the recognition that decision-makers may use iterative process, moving from qualitative to semi-qualitative to quantitative assessment as warranted.

Strengthening of technical and institutional capacity to make knowledge-based decisions is required at all levels across the region, recognising uncertainties associated with climate change, risks and risk reduction potentials. Such capacity development programs need to address a wide spectrum of institutional and technical capacity needs, including:

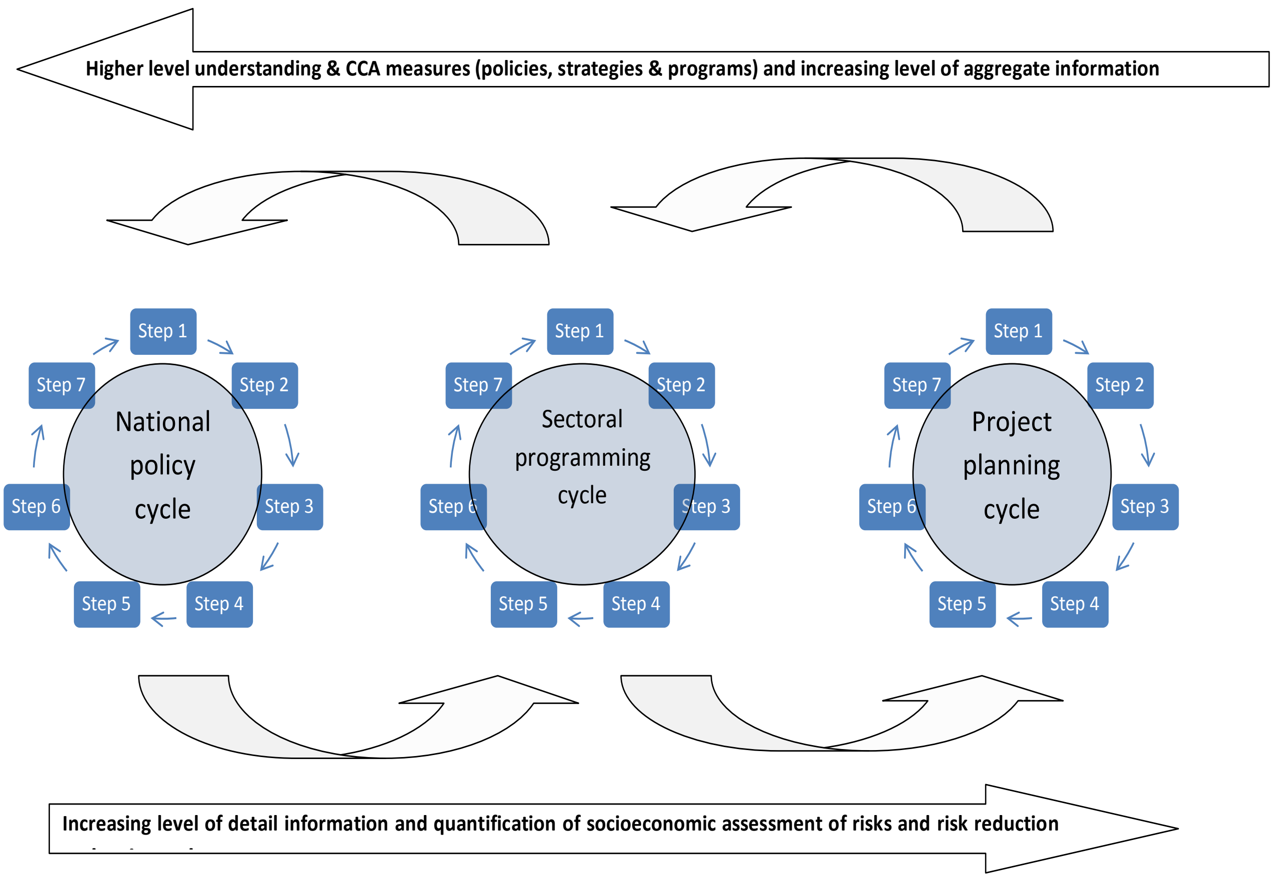
- harmonisation of DRR and CCA plans and policies in the short term and integration of the DRR and CCA decision-making process in the medium to longer term
- integration of climate risks in policy and project cycle-based decisions-making process
- systems understanding of the ramifications of climate change and the interactions with drivers of vulnerability and exposure and spectrum of hard and soft adaptation options available to address those climate risks
- decision-making capacity to choose adaptation measures, including a portfolio of adaptation measures in the context of national development, considering multiple criteria such as economic efficiency, other social and economic benefits and costs, and other development criteria
- economic CBA of risks and risk reduction and adaptation measures
- a sustainable livelihood analytical framework and associated vulnerability assessment tools.

Knowledge-based adaptation decisions need robust data, information and knowledge drawn from across several disciplines that help in the understanding of climate science and climate change, vulnerability, social and economic impacts, and risk reduction and management measures suitable to the local ecological, social, economic and political environment.

Geo-referenced baseline information and other foundational enabling environments need urgent strengthening across all PICs. Robust information about economic, environment and social systems and their vulnerability and exposure to climate extremes is critical for context-specific integrated assessment of risk and risk reduction-based decisions. Foundational enabling environments that also need urgent attention include inter-agency institutional arrangements to sharing of data maintained across agencies, as well as to facilitate coordination of initiatives across scales and between DRM and CAA activities.

A linked regional–national climate service could be useful in providing rigorous scientific underpinnings to key in-country decisions. Such a climate service would cover climate science research, vulnerability analysis, decision support, and communication, It would provide timely delivery of relevant information and assessments, could be used for ongoing evaluation of climate change and climate decisions, and have an easily accessible information portal that facilitates coordination of data among agencies and dialogue between information users and providers. Such a service would also include 'hands-on' strengthening of a national level decision-making process and other enabling environments, that promote knowledge-based decision-making and actions, as well as technical capacity to make informed decisions.

Figure 3 Cascading and explicitly linked CCA decision-making process, involving national policy and planning across to community/project level risk management decisions, and nature of information and knowledge needs



Legend: Step 1: understand social, environmental and economic context of hazards & vulnerability; Step 2: establish development goals & decision-making criteria; Step 3: identify and assess current risks; Step 4: identify CCA measures; Step 5: Assess CCA options and choose preferred option; Step 6: Project design& implement; Step 7: Monitor, lessons learnt & modify action

Table 1 A seven-stage 'vulnerability-first'-based decision-making process for the Pacific

Stage 1	Understand the social, economic and environmental context of communities, broad drivers of change, including climate and other risks—situation analysis	Baseline data to identify parameters for adaptation monitoring Baseline data to assess success/progress of adaptation measure
Stage 2	Establish development goals and specific decision-making criteria, including economic, social and other considerations	Clarity in how the adaptation measure directly contributes to national priorities for economic, social and environmental goals
Stage 3	Assess current risks in the context of climate change (and other drivers)—assessment of hazards and vulnerability	Qualitative and or quantitative assessment of risk to enable estimation of the benefits of the adaptation measure

Stage 4	Identify different risk-reduction and climate adaptation measures, taking into account the urgency of their implementation, depending on the dynamics of the natural environment, economic and social sectors and the dynamic of the climate change impacts	Identify alternative adaptation measures that address current risks and projected risks, considering the dynamics of the underlying economic systems and the dynamics of climate change impacts
Stage 5	Evaluate alternative adaptation options using cost–benefit analytical framework (process), recognising context-specific relevance and/or usefulness of qualitative, semi-qualitative and/or quantitative information	Stepwise assessment of each adaptation option against the pre-identified criteria (from step 2)
		Identification of baseline needs, data gaps, before undertaking detailed CBA where appropriate
		Selection of a preferred adaptation option
Stage 6	Conduct a detailed design and implementation plan, including identification of indicators of the effectiveness of the measure, time horizon; and implement	A feasible and cost-effective design
Stage 7	Monitor and evaluate the adaptation measure, and adjust throughout implementation in light of changes in socioeconomic, technological conditions as well as new scientific information	Learning by doing
		Adjustments over time as new information becomes available
		Adaptive management

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