ECONOMIC PRINCIPLES FOR PRACTICAL COASTAL ADAPTATION

The current approach to assessing the costs and benefits of coastal adaptation is not sustainable, does not meet the challenges posed by the inherent uncertainty of climate change and will therefore not effectively address climate change risks. This Ricardo think piece proposes an approach that can provide decisions makers with the information and confidence they require to make sound investments of the right scale at the right time.

Economics of coastal adaptation

Climate change is leading to sea-level rise, coastal erosion and the increased frequency and intensity of storms, which all pose significant risk to the social, economic and environmental values present along Australia's extensive coastline. Climate change adaptation encompasses actions to respond and adjust to these risks and avoid damages and losses to things that people value, including houses, businesses, infrastructure, services and beaches. The scale of the values at risk is significant. For example, in 2009 the Australian Government estimated that the value of existing residential buildings at risk of inundation from a 1.1 metre sea-level rise was $63 billion (2008 replacement value). In 2003–04, an estimated $20 billion was spent on recreation and tourist activities directly involving coastal and ocean ecosystems[1].

The costs associated with negative climatic events can often be mitigated. For example, it is possible to take actions that reduce the risk of flooding (such as sandbags and wetland restoration) or reduce the damages in cases where flooding does occur (such as home elevation and early warning systems).

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1 Department of Climate Change and Energy Efficiency, 2009. "Climate Change Risks to Coastal Buildings and Infrastructure: A Supplement to the First Pass National Assessment", Australian Government, Canberra, https://www.environment.gov.au/system/files/resources/0f56e5e6-e25e-4183-bbefca61e56777ef/files/risks-coastal-buildings.pdf

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A central question in coastal adaptation planning is how to weigh the benefits of mitigation (reduced costs of negative events) against the costs of mitigation. This is challenging for a number of reasons. First, there are frequently an enormous number of potential mitigation options, especially when different combinations of options are considered. Second, there is substantial uncertainty regarding future changes to the climate, particularly at regional and local levels[2]. For example, it is certain that sea-level is rising however, the specific timing and magnitude of this rise is very uncertain. Such uncertainty makes estimating the benefits of coastal adaptation options and choosing the right time to implement them challenging.

2 Productivity Commission, 2013, "Barriers to Effective Climate Change Adaptation", http://www.pc.gov.au/inquiries/completed/climate-changeadaptation/report

As a result of these complexities, many adaptation plans only weigh the costs and benefits of one or two options, rather than the suite of options that is likely to be required to effectively mitigate against the risks posed by climate change over time. Furthermore, many adaptation plans only evaluate these options against a small number of possible future scenarios. The failure to account for important complexities leads to a range of suboptimal outcomes, including:

- not taking actions that should be taken, often because investors cannot be convinced of the genuine benefits of investment or the beneficiaries cannot be identified
- taking actions that should not be taken, frequently imposing significant costs today without the prospect of sufficient benefits in the future.

The current approach is not sustainable, does not meet the challenges posed by the inherent uncertainty of climate change and will therefore not effectively address climate change risks. However, economics and a robust approach to Benefit Cost Analysis (BCA), in collaboration with other disciplines, can contribute to overcoming these challenges, inform coastal adaptation policy and build confidence in long-term adaptation solutions.

Benefit Cost Analysis	A robust decision making approach
BCA provides a rigorous and transparent framework for assessing the implications of mitigation options for the wellbeing of the community. It has been widely used in evaluating policies and projects since the 1950s. As well as informing decision making, BCA can help in building support for worthwhile policies and projects. By increasing the probability that good policies and projects will be selected, BCA can result in substantial benefits to the community.	Traditionally, decision making frameworks assemble the available evidence into best-estimate predictions of the future and then suggest the best course of action given these predictions. Such methods work well when predictions are reasonably accurate. However, given the profound uncertainty of future climate change, adaptation strategies need to be robust across an array of possible future scenarios rather than those that are optimal under a single set of assumptions about the future.
BCA takes a broad perspective, accounting for all benefits and costs to all relevant parties. This includes social and environmental benefits and costs, as well as the benefits and costs to future generations.	A more robust approach can help decision makers distinguish those future conditions in which their plans perform well from those in which their plans perform poorly.
BCA is based on the preferences of the people affected by the policies and projects, not the preferences of the analyst or decision maker.	Strategies which are robust are those that are expected to perform well across the range of possible future conditions. Under uncertainty such strategies are preferable to those that are optimal for one scenario but sensitive to changes and may perform badly under a different scenario.
BCA expresses different types of benefits and costs in a common metric, typically dollars, to facilitate comparisons.	

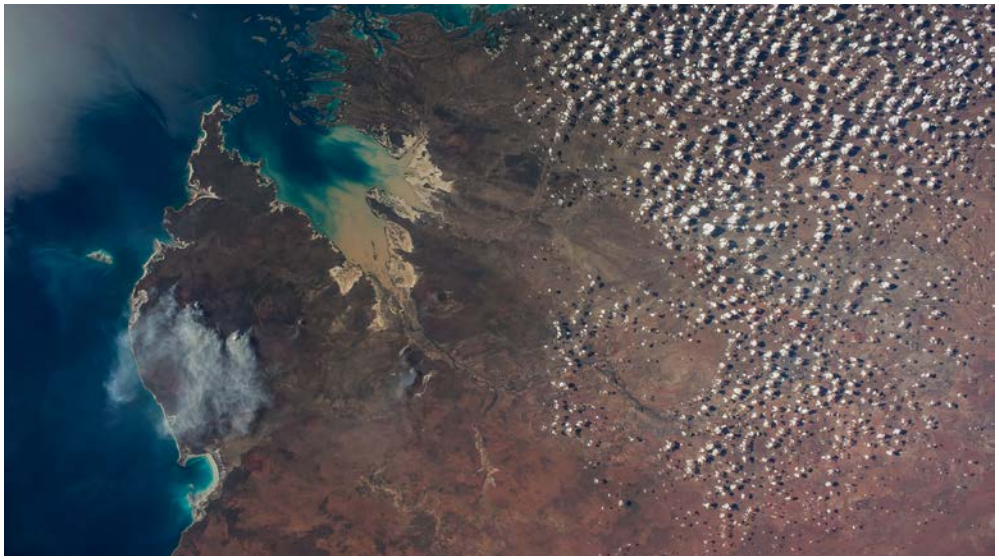
A robust BCA approach

As outlined above the current approaches to assessing adaptation options is not providing decisions makers with the information or confidence they require to make sound investments of the right scale at the right time. Revealing costs and benefits through BCA requires analytical rigour and provides transparent information about the value of adaptation options. Combining BCA with a robust decision making approach that analyses how investments will perform over a wide range of plausible future scenarios is an ideal method for assessing adaptation options. This robust BCA approach has the following benefits:

- is valuable in identifying the beneficiaries of coastal adaptation planning, both direct and indirect, which is also relevant for decisions in relation to cost sharing
- draws on well-established approaches to decision making under uncertainty, which helps to develop adaptive pathways comprised of suites of measures that can be triggered and refined over time to respond to conditions as they evolve. This will often lead to better outcomes than prescriptive solutions that are limited to a single measure.
- reveals strategies and pathways that perform well under a range of plausible socio-economic and climatic scenarios, rather than looking for the optimal strategy for a given climate future
- makes assumptions transparent which would otherwise be concealed and ensures that the conclusions drawn are consistent with the assumptions
- is in the language of investors
- can be simple or detailed, depending on the requirements of the project.

Steps for developing and implementing an effective coastal adaptation strategy

Economic analysis of adaptation options sits within a broader planning process. There are many existing methods designed to guide policy and decision makers through the development and implementation of adaptation strategies. These include resources such as NCCARF's coastal climate adaptation decision support tool and LGAQ's Coastal hazard adaptation strategy guidelines. While the number of steps vary, the process is broadly similar. Table 1 outlines the steps of an adaptations strategy and principles to consider when undertaking each step.



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All the steps in this process are important to developing a robust climate change adaptation strategy. In our experience, Steps 2 and 3 are not being done as well as they could be and in many cases, fail to properly incorporate the complexity and uncertainty inherent in coastal adaptation. This results in the suboptimal outcomes we have outlined above. By putting more effort into these steps, in particular, through a robust economic approach that better incorporates uncertainty, more effective and implementable coastal adaptation plans can be developed.

TABLE 1 DEVELOPING A COASTAL CLIMATE CHANGE ADAPTATION STRATEGY

Steps	Principles
1 Hazard and risk assessment	
• Identify areas exposed to current and future coastal hazards • Identify key physical, natural, social, economic and cultural assets which can be affected by coastal hazards • Assess the likely consequences	• Start open discussion with community early • Make information available and be transparent about risk and consequences
2 Identify options	
• Define a vision and future objectives • Consider what options are available and most appropriate for the specific context of the identified assets, their location and risks • Consider the indicative costs and benefits of options and their implementation timeframes • Identify if further information is required to identify or assess options	• Be clear about roles and responsibilities • Consider all types of options: private (autonomous) adaptation, regulation, infrastructure, community resilience etc. • Be realistic and signal what is possible and what will not be considered • Reference information about future risks and consequences
3 Evaluate and select options, develop an adaptation plan	
• Establish decision criteria to set priorities and make trade-offs • Undertake a cost-benefit analysis of selected suites of options • Determine timing of actions or decision points and pathways • Find funding sources and financing mechanisms • Design a monitoring an evaluation program • Develop an adaptation plan	• Have sensible and open discussion about realistic options • Include the costs and benefits of options in discussions • Don't just rely on one or two options. Ensure that assessment covers different combinations of options at different points in time • Consider behavioural responses to signals and incentives
4 Implement adaptation plan	
• Implement adaptation actions • Continue to gather information	• Understand the barriers to implementation before proceeding • Adaptation plans are not static. Implementation must include data collection, regularly updating information as well as monitoring and evaluation • The plan should be flexible to enable adaptation actions to respond to changing conditions
5 Monitor, review and adapt	
• Regularly monitor indicators • Review outcomes against those planned and expected • Publicly report findings • Adapt plan based on findings	• Monitor implementation as well as the accuracy of assumption and changes in available information • Regularly review decisions and plans and adapt actions and plans based on review outcomes

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