Narikoso Relocation Project

Cost-benefit analysis update note

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With support from the SPC/USAID project: 'Vegetation and land cover mapping and improving food security for building resilience to a changing climate in Pacific Island communities'

1. Role of this note

This note summarises the data and methodology that underpins a cost-benefit analysis (CBA) of the Narikoso Relocation Project. Its main purpose is to ensure the scenarios and assumptions used in the CBA are appropriate with the key stakeholders – the Climate Change Division of the Fiji Government (CCD) and the Narikoso Relocation Taskforce. The information outlined below is preliminary and every reasonable effort will be made to accommodate the opinions of the stakeholders in the final stages of the analysis. It is hoped the feedback to this summary will guide the development of the final report.

To enable quick reading, long explanations are avoided and replaced with tables where possible. It is supposed the reader is familiar with the Relocation Project and therefore background information that will be included in the final report is excluded here. Information on the technical details of CBA in general is not provided in this note. Please refer to Buncle et al. (2013) for a guide on CBA.

2. Purpose of the CBA

The CCD requested the assistance of SPC economists to produce a CBA of the Narikoso Relocation Project in October 2015. The overarching objective of the analysis is to assess the economic dimensions of relocation due to climate change in Fiji, using Narikoso as a case study. The analysis provides a view of the costs and benefits – both direct and indirect – of Narikoso's adaptation options. The results of the analysis are expected to feed into the development of national relocation guidelines currently being finalised by the CCD.

The original request related to supporting the Fiji Government's efforts to institutionalise the use of CBA through a 'real-life' capacity building exercise. To this end, a CBA team consisting of one economist from SPC (James Jolliffe) and one official from the CCD (Vina Dilikuwai) was formed in early November 2015. The CBA has received financial support from the SPC/USAID project '*Vegetation and land cover mapping and improving food security for building resilience to a changing climate in Pacific Island communities'*.

3. Scenarios analysed

An important initial step in the CBA process is to identify potential interventions that deal directly with the problem, in this case coastal inundation in Narikoso. The following scenarios outline the different interventions that were analysed by the CBA team. The costs and benefits of these options are measured against a scenario where no intervention takes place.

No intervention

Under this scenario, no further support is provided to Narikoso and therefore nothing is done to prevent the impacts of coastal inundation on the village. Households in the red zone continue to be damaged and require fixing, a problem exacerbated year-upon-year by climate change. This means less time is spent earning incomes or attending to subsistence activities. The community also

remains exposed to the dangers of an extreme weather event. The resources spent excavating and stabilising the new site effectively goes to waste.

Relocating the entire village

This scenario is based on the proposal to relocate the entire village in the Project Design Document prepared by the CCD and submitted to the EU/GIZ Adapting to Climate Change and Sustainable Energy (ACSE) programme. To move the entire village, more land must be cleared and prepared for building houses. A new water source must be identified and developed. As every household is away from the shoreline and above sea level, those households currently in the red zone no longer face the impacts of coastal inundation. The provision of climate resilient housing, in addition to relocation, reduces the risk of losses caused by an extreme weather event.

Relocating the 'red zone'

Under this scenario, only the households currently situated in the 'red zone' are relocated. As fewer houses must be built, no further groundwork is required.[1] A new water source must still be identified and developed. The red zone is relocated away from the shoreline and therefore no longer faces the impacts of coastal inundation. However, climate resilient housing and relocation reduce the risk of losses caused by an extreme weather event in the red zone only.

Relocating the 'front line'

This scenario is similar to relocating the red zone, but only the households situated on the shoreline are relocated. No further groundwork is required but a new water source must be developed. The front line no longer faces the impacts of coastal inundation but the rest of the red zone continues to do so. The risk of losses due to an extreme event is reduced only in the houses relocated.

Building a new seawall

As suggested by a number of respondents to community surveys and focus groups carried out in Narikoso between 18 and 25 November 2015, this scenario focusses on removing the old seawall and building a better functioning replacement. The new seawall protects the village from the impacts of coastal inundation and reduces the risk of losses due to an extreme weather event. This means no household requires relocation. To remain effective, the seawall must be maintained regularly. However, sea-level rise renders the seawall increasingly ineffective as time goes on.

4. Costs and benefits identified

Once the scenarios had been decided, the impacts of each were identified. Any negative impact is considered a cost and any positive impact a benefit. The main costs are concerned with clearing the land for the new site and building new households. The main benefits are associated with removing households from the path of coastal inundation and resultant harm. Environmental and social impacts were also considered. The table below indicates the costs and benefits that were identified and a brief comment on the expected magnitude of the impact. Expected magnitude has been assigned three ratings; low, medium and high. A 'low' rating implies that the CBA team expected the impact to have comparatively low monetary value. The opposite is true of those impacts assigned

[1] The current excavated site is probably not big enough to house all 15 inhabited households contained in the 'red zone' but no reports on how many households may be accommodated have been made available to the CBA team.

'high'. This exercise was performed prior to valuation and is included here for informative purposes only.

Impact	Expected magnitude
Direct relocation costs	
Clearing site A	High
Stabilising site A	Medium
Preparing site B	High
Building houses	High
Identifying new water source	Low
Constructing new water supply	Medium
Direct relocation benefits	
Avoided loss of subsistence production	Medium
Avoided loss of cash incomes	Medium
Avoided damage from coastal inundation	Medium
Avoided damage from extreme event	High
Environmental costs	
Removal of mangroves	Low
Removal of coastal plants	Low
Clearing of land	Low
Social costs	
Moving to smaller houses	High
Loss of ease-of-access for older generation	Medium
Removal of incentives to improve situation without government assistance	High

5. Data assumptions used in the CBA

The CBA compares the impacts of the interventions outlined above against a 'baseline case' where no intervention takes place. Where possible, the costs and benefits of the different options have been quantified monetarily and discounted. When impacts could not be expressed in monetary terms immediately, a number of assumptions have been made in order to quantify them. The data sources and key assumptions used to calculate the costs and benefits in monetary terms are provided below.

General assumptions

To ensure comparability between the quantified impacts, the general assumptions in the table below have been applied to every cost and benefit.

Assumption	Value	Explanation
Base year	2015	All prices in 2015 FJD as is the latest inflation figures published by Fiji Statistics
Evaluation period	50 years (2016-2066)	The period should be long enough to capture all the costs and benefits associated with the project but also acknowledge that forecasts become more uncertain as timeframes increase
Discount rate	Central: 10%	Asian Development Bank recommends 10-12%

	High: 12% Low: 7%	(Zhuang et al., 2007) 7-10% commonly used in Pacific (Buncle et al. 2013)

Community survey and focus groups

To ensure the costs and benefits faced by the community were considered throughout the CBA, a series of interviews, household questionnaires and focus groups were conducted in Narikoso between 18 and 25 November 2015. A number of the survey results have fed into the analysis. Despite the best efforts of the survey team to ensure accuracy, the results are not definitive and should be interpreted with care. The following results are used in the CBA.

Factor	Value	Explanation
Average working days per week	6	People try not to work on Sundays
Number of households	27	Number of households inhabited during survey
Number of households in red zone	15	17 households in total but only 15 inhabited
Population	111	Reported number of household occupants
Average subsistence production		Estimated from household questionnaire
Village monthly total	$42,057	
Per household per working day	$61	
Average cash income (red zone)		Estimated from household questionnaire
Yearly total	$107,652	
Per household per working day	$23	
Household damages due to inundation (red zone)		Estimated from household questionnaire
Average days spent fixing things per year	8	
Average amount spent on repairs	$940	

Pacific Catastrophe Risk and Financing Initiative (PCRAFI)

The costs of restoring damage caused by a potential extreme weather event in Narikoso were estimated using data provided by PCRAFI, an SPC/World Bank/ADB project that provides Pacific Island Countries with disaster risk modelling and assessment tools. Although the data collated by PCRAFI in Fiji is extensive, none exists for Narikoso. The CBA team therefore used PCRAFI data to estimate the following figures by methods that will be explained in full in the final report.

Costs	Value	Explanation
1/100 year event replacement costs	$339,513	Projected total cost of damages for whole village caused by 1/100 year extreme event
1/50 year event replacement costs	$208,760	Projected total cost of damages for whole village caused by 1/50 year extreme event

ACSE Project Design Document and other sources

Data provided in the Project Design Document prepared by the CCD and submitted to the EU/GIZ Adapting to Climate Change and Sustainable Energy (ACSE) programme has been used in the CBA. The data concerns the direct costs of relocating the village. The table below outlines these costs.

Cost	Value	Explanation
Preparing second site ('site B')	$90,000	Generic unit cost of clearing land for relocation
Building one climate resilient house	$12,000	No designs available

There are further direct costs associated with the relocation that are not included in the PDD because they have already been faced. They are the costs of clearing the new site and stabilising the excavated land.

The initial groundwork on the new site was completed by Republic of Fiji Military Forces in 2012 with funds provided by the Office of the Prime Minister. It is assumed that the total cost of completing the excavations, including labour, transportation and equipment, was $200,000. This figure is consistent with that generally reported. However, it should be noted that no clear budget or reference for this cost has been provided to the CBA team.

Following the excavations, further work was required to stabilise the land. This was carried out by SPC, with support from the SPC/GIZ Coping with Climate Change in the Pacific Island Region and the SPC/USAID Food Security programmes, and involved the planting of 1000+ Vertiver grasses, 2000 pineapple tops and 80 tree seedlings of different species. It is assumed that the total cost of the stabilisation, including seeds, labour and transport, was $2,000. The CBA team are currently seeking clarification on this figure.

6. Quantified costs and benefits

As far as possible, the data was used to calculate monetary values for the costs and benefits outlined in section 4. The table below indicates the costs and benefits that were identified, whether or not they were quantified monetarily and a brief explanation of the data source. Impacts that have not been quantified will be included in the CBA qualitatively.

Impact	Quantified?	Source
Direct relocation costs		
Clearing site A	Yes	PM's Office budget
Stabilising site A	Yes	Estimated (waiting for SPC/GIZ budget)
Preparing site B	Yes	ACSE Project Design Document
Building houses	Yes	ACSE Project Design Document
Identifying new water source	Yes	ACSE Project Design Document
Constructing new water supply	Yes	ACSE Project Design Document
Direct relocation benefits		
Avoided loss of subsistence production	Yes	Estimated from household survey
Avoided loss of cash incomes	Yes	Estimated from household survey
Avoided damage from coastal inundation	Yes	Estimated from household survey
Avoided damage from extreme event	Yes	Estimated from PCRAFI data
Environmental costs		
Removal of mangroves	Yes	Estimated from satellite imagery
Removal of coastal plants	No	Discussed qualitatively
Clearing of land	No	Discussed qualitatively
Social costs		
Moving to smaller houses	Not directly	Proxy through sensitivity analysis

Loss of ease-of-access for older generation	No	Discussed qualitatively
Removal of incentives to improve situation without government assistance	No	Discussed qualitatively

7. Preliminary results

The quantified costs and benefits may then be aggregated to represent a single number or ratio so that each scenario may be compared easily. The table below displays the Net Present Value (NPV) and Benefit-Cost Ratio (BCR) of each intervention as they currently stand.[2] If an intervention has an NPV of greater than zero (less than zero), it is deemed to provide net economic benefits (costs) to society. The intervention with the largest, positive NPV would generally be considered the most beneficial to society. Likewise, if an intervention has a BCR of greater than one (less than one), more (less) benefits are received than costs faced. It must be emphasised that the analysis is still under development and therefore the results below are subject to change. Indeed, it is hoped that the feedback to this note will provide information that will enable the completion of the CBA and may change the results reported below drastically.

	Relocate entire village	**Relocate red zone**	**Relocate front line**	**Build new seawall**
NPV	-219,315	-55,482	-251,971	-6,187,852
BCR	0.68	0.88	0.37	0.07

The results above indicate that none of the proposed interventions provide net economic benefits. The intervention with the least negative NPV, and BCR closest to one, is relocating the red zone only. This suggests that, if one intervention must be pursued, it is to relocate the red zone only.

It should be noted that the results are a product of the methodology and data outlined above. Although acknowledged qualitatively, the unquantified impacts are not counted in the estimations of NPV and BCR. It is therefore important to discuss the potential effect the unquantified impacts may have had on the results of the CBA had they been quantified. In this case, every unquantified impact represents a cost and would act to lower the NPVs and BCRs reported in the table above. Each scenario would present a greater economic cost to society than the current calculations suggest.

8. References

Buncle A., Daigneault A., Holland P., Fink A., Hook S. and Manley M. (2013) Cost-benefit analysis for natural resource management in the Pacific - a guide. SPREP/ SPC/ PIFS/ Landcare Research, Suva, Fiji.

[2] The results reported are taken from the central case with a discount rate of 10% only.

Zhuang J., Liang Z., Lin T. and De Guzman F. (2007) Theory and practice in the choice of social discount rate for cost-benefit analysis: a survey. Economics and Research Department (ERD) Working Paper No. 94. Asian Development Bank (ADB), Manila, Philippines.