Assessing adaptation options for climate change:
A guide for coastal communities in the Coral Triangle of the Pacific

4. Decision-tree and partial cost-benefit analyses

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Introduction

Assessing options for adapting to climate change is an important part of building resilient fishing and farming communities.

This brochure is part of a series that collectively detail how a community-based assessment of climate change was used in partnership with coastal communities and provincial and national-level stakeholders in Timor-Leste and Solomon Islands. The assessment contains four distinct, but related, steps (Fig 1) focused on supporting community-level decision-making for adaptation through a series of participatory action research activities. Each brochure in this series details a specific activity in the four-step assessment.

This series of eight brochures is primarily aimed for use where resources are limited or where it is more appropriate to use a rapid, qualitative and non-data intensive method of assessment. Community leaders, local NGOs and regional and national-level government representatives in developing countries may find this series useful.

In this brochure we provide details of an activity relating to the 'Evaluation of options' step of the assessment, research conducted with farmers and fishers to assess the economic implications of adopting different adaptation actions. More specifically, the following questions were posed:

- What are key decisions and design steps needed in developing specific fishing and farming-related adaptations to enable them to be implemented and managed over time?
- What are the relative partial costs and benefits of the different adaptations?

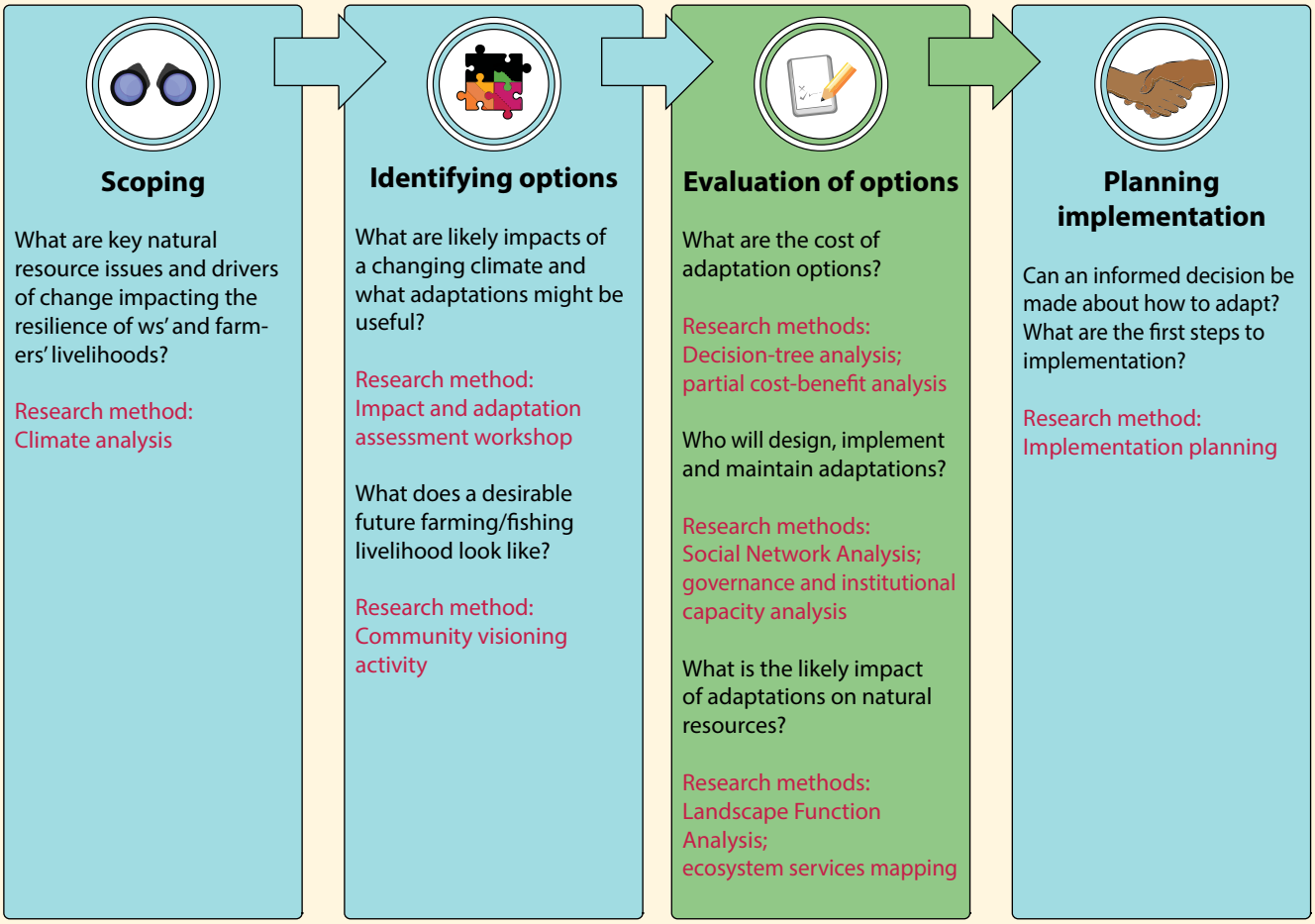

Fig 1: The four steps taken by community, local NGOs and regional and national government representatives in developing a plan to respond to climate change. Each step addresses specific questions likely to be asked by community members needing to adapt.

What Are Decision-Tree and Partial Cost-Benefit Analyses?

Decision-tree analysis identifies the decision structures and possible decision pathways for planning, implementing and managing climate change adaptation actions (Fig 2).

Once a decision-tree has been developed, partial cost-benefit analysis can be used to assess the relative costs and benefits of each decision pathway. This helps guide community members in making decisions about:

i) which adaptation options are likely to be best suited to their needs;
ii) steps to be considered when developing and implementing the adaptation actions;
iii) what may need to be considered to manage the adaptation in the future.

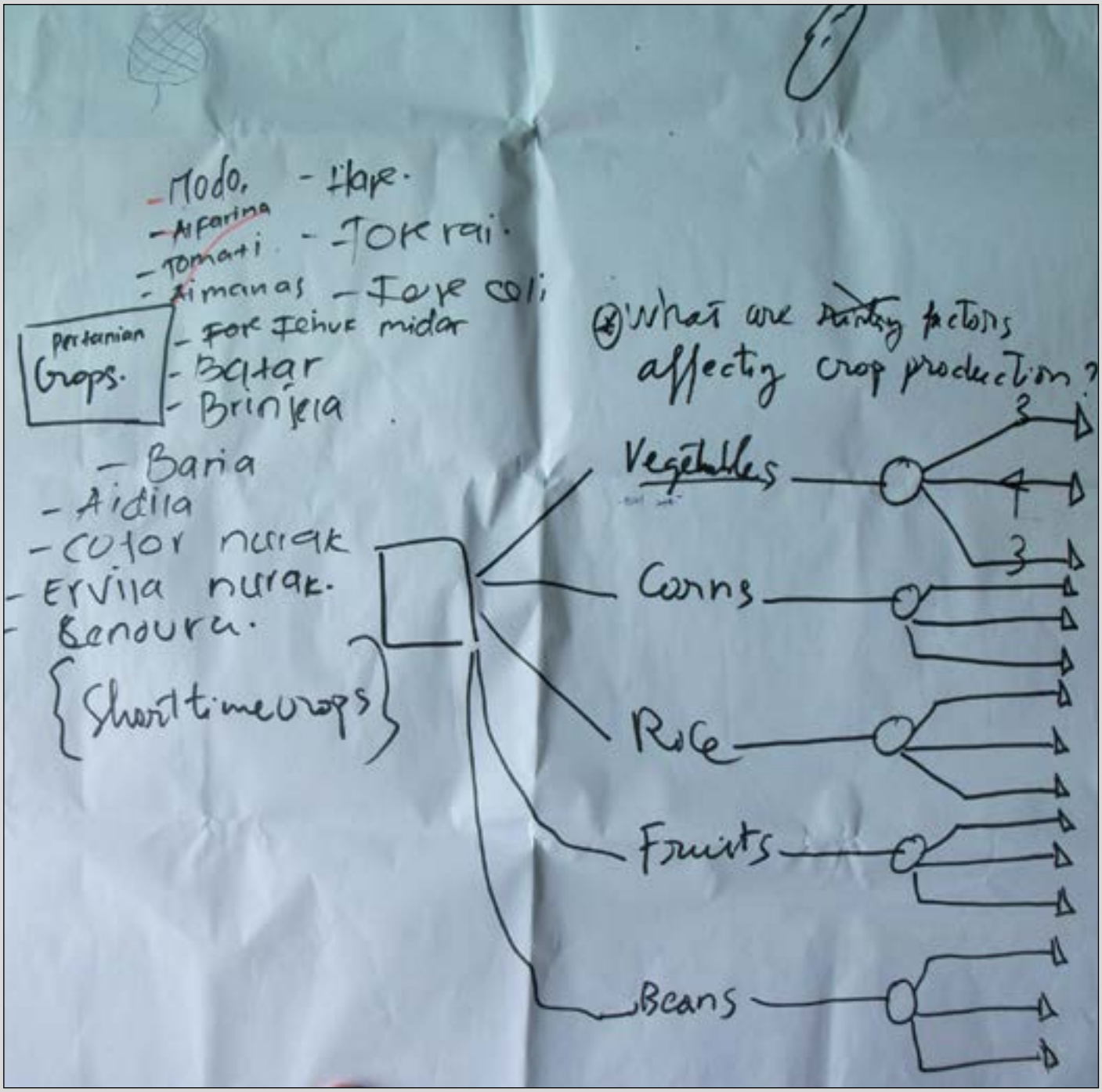

Fig 2: Decision-tree analysis is a tool for understanding which decisions need to be taken to develop and manage an adaptation. Drawing a decision-tree can help understanding about differences in levels of certainty and risk related to a range of adaptation options. Farmers in Batugade, Timor-Leste, produced a decision-tree analysis to help them make decisions about which cropping options (e.g., vegetables, beans, rice) might be useful given likely changes in future climate.

Economic Analysis Method

Using decision-tree analysis and partial cost-benefit analysis, three specific adaptation actions, prioritized by community members in Atauro and Batugade, Timor-Leste, were evaluated. These were the following:

- non-fishing activities that improved income and food production (e.g., aquaculture).
- increased production of trees, crops and animals using sustainable agriculture techniques
- enhanced use of deep water fisheries through the use of technologies, such as echo sounders and fish aggregation devices (FADs)

1. Decision-tree analysis

A group of community members attending a participatory workshop were facilitated in drawing a decision-tree for their selected adaptation ideas (Fig 4) by working through the following three stages:

- brainstorming the key decision points associated with developing and managing the adaptations
- ordering the decision points in a logical time sequence
- noting assumptions associated with each decision point and how the decisions might change under different climate scenarios

Fig 3: Estimating the returns on different crops can help identify which ones may provide the greatest economic returns. However, some crops may be less reliable in providing good yields every year, due to warmer temperatures and variable rainfall patterns. This uncertainty needs to be factored into decision-making for adaptation.

2. Partial cost-benefit analysis

- Discussions with the fishers and farmers helped identify the data required to enable estimation of the relative payoff (net profit) of different designs of a particular adaptation option (Figs 4 & 5). Types of costs included as many cost items as participants could identify during group discussions. Key cost components included boat repairs/depreciation and fuel costs. Benefits included potentially different rates of income depending on the quantity and species of fish caught under the different designs of the adaptation action.
- Where possible, secondary data (e.g., fish catch records) were used to populate the decision-tree costs and benefits. Primary data (estimates provided by the fishers) were also used to conduct the partial cost-benefit analysis.
- Data on uncertainty of decision benefits (e.g., risks) were captured in terms of likely probability of costs and benefits being realized.
- Benefits and costs of each decision option were calculated by comparing costs and benefits of each alternative decision pathway, while accounting for uncertainty/risk (Fig 6).

Fig 4: Fishers in Atauro, Timor-Leste, used other resources (fish species posters) to discuss, develop and refine their decision-trees for considering a range of adaptation actions.

Fig 5: Fishers in Atauro, Timor-Leste, developed and refined decision-tree structures and estimated costs and benefits to enable partial cost-benefit analysis to be conducted on a range of fishing-related adaptation actions. This provided information to help make decisions about the most economically profitable adaptation option.

Tips for Implementing Decision-Tree and Partial Cost-Benefit Analyses

- Decision objectives should be clearly defined so that decision structures can be developed easily.
- A complete and non-overlapping range of decision options should be identified so that uncertainty/probability of each decision option can be estimated.
- Decision outcomes should ideally be validated with sample surveys rather than only depending on participatory focus group discussions.

Fig 6: Local stakeholders produced a detailed cost-benefit analysis for different fishing strategies such as net and longline fishing.

Key Decision-Tree and Partial Cost-Benefit Analyses Documents

Hobbs, B., Chao, P.T., and Venkatesh, B.N. (1997). Using decision analysis to include climate change in water resources decision making. *Climatic Change* 37: 177-202.

Hardaker, J., and Lien, G. (2005). Towards some principles of good practice for decision analysis in agriculture. Norwegian Agricultural Economics Research Institute, Oslo, 36 pp.

Olivas, R. (2007). Decision trees: a primer for decision-making professionals. http://www.lumenaut.com/download/decision_tree_primer_v5.pdf

Results and Recommendations in Timor-Leste

Some of the findings from the decision-tree and cost-benefit analyses for fisheries in Atauro include the following:

- Fuel cost is the most important cost item reported by fishers in Atauro. Adaptation options that make the most effective use of fuel are therefore important (Fig 7).
- Both traditional fishing and modern net fishing methods are potentially economically viable adaptation options, but regulation of the activity (by formal and informal governance systems) is necessary to maintain healthy fisheries in the area.
- Pool landline, longline and Rumpong fishing methods are unlikely to be economically efficient if they are operated in isolation, but when integrated with a diverse range of fishing activities, may result in an effective fished-based livelihood (Fig 8).
- Aquaculture may be a viable adaptation option to increase income and food production for communities in Balibo, Bobonaro District.

Fig 7: Fuel cost and boat maintenance are important considerations for fishers in Atauro.

Fig 8: Rumpongs (fish aggregating devices) were identified as a potentially useful adaptation option by community members in Timor-Leste. When evaluated using cost-benefit analysis, they appear most economically effective when part of a diverse range of fish-related livelihood activities.

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For further details on this project, visit http://www.ctknetwork.org/ and http://www.worldfishcenter.org/ongoing-projects/adaptationpathways-responding-climate-change

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