

Annex I. Multi-criteria analysis

The Role of Marine Protected Areas in Contributing to Poverty Reduction

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1. Introduction

Multi-criteria analysis allows one to combine different types of data. The main benefit of the tool is to deal with the difficulties that human decision-makers have when handling large amounts of complex information in a consistent way. Multi-criteria analysis techniques often use an explicit relative weighting system for the different criteria. A “weighted summation” is used in this study because it is simple, transparent and well founded in welfare theory. An appraisal score is calculated for each variable by first multiplying the value by its appropriate weight followed by summing of the weighted scores for all criteria. Weighted summation is a discrete quantitative method that judges the attractiveness of alternatives on the basis of two elements: the consequences of the alternatives in terms of the decision criteria and priorities denoted in terms of weights. The software package DEFINITE was used for the application (Janssen et al, 2006).

2. Method

To rank the four case studies, the large range of data collected during the household surveys were summarized into five focal areas for the category “opportunities”, three focal areas for the category “empowerment”, and four focal areas for the category “security” (see Table 2.1). The actual measurement unit used to generate a composite poverty reduction indicator differs between the various focal areas. Because eight of the twelve focal areas are available for both MPA and non-MPA communities, the relative difference between two groups has been used for these eight focal areas. Due to lack of scores for both MPA and non-MPAs, the remaining focal areas have been measured on the basis of absolute rather than relative scores. Thus, the scores within these categories represent the absolute share of the MPA sample supporting the statements about the specific impact of the MPA. The survey questions on which the indicators are based are shown in the second column.

Table 2.1 Effects table as main input for the multi-criteria analysis

	Unit	Based on question #	Navakavu (Fiji)	Arnavon (Solomon Islands)	Apo Island (Philippines)	Bunaken (Indonesia)
<i>Opportunities</i>						
- Income	<i>a</i>	42 and 53	112.2%	100.3%	8.7%	90.4%
- Housing	<i>a</i>	0	3.4%	37.2%	26.7%	30.5%
- Luxury goods	<i>a</i>	18 to 29	188.1%	31.6%	-15.3%	10.7%
- Fish catch	<i>a</i>	50	75.8%	5.8%	6.0%	56.4%
- Education	<i>a</i>	10, 11,12,14	8.5%	3.9%	33.7%	11.9%
<i>Empowerment</i>						
- Governance	<i>b</i>	78	78.2%	55.2%	70.7%	25.3%
- Benefits to women	<i>b</i>	76	73.5%	6.3%	69.5%	35.4%
- Access and rights	<i>b</i>	80	61.8%	79.4%	53.8%	37.2%
<i>Security</i>						
- Health	<i>a</i>	34 to 41	84.4%	-12.6%	24.8%	-1.8%
- Social cohesion	<i>a</i>	65,68,69,70	22.0%	16.2%	6.5%	1.3%
- Cultural tradition	<i>b</i>	82	65.8%	83.9%	65.4%	68.2%
- Safety net	<i>b</i>	83	81.8%	12.2%	28.7%	33.3%

a Relative share by which the MPA sample exceeds the score of the non-MPA sample

b Absolute share of the MPA sample supporting the statements about the specific impact of the MPA. This is not relative to the non-MPA sample.

The twelve focal areas were converted into a composite score for poverty reduction through the process of weighed summation. Ideally, this weighing process is done separately by consulting representative stakeholders for each country, so that local priorities are properly reflected. However, such a country-specific approach complicates the international comparison of the results. Therefore the most straightforward weighing system was applied: each poverty category weighs equal (accounts for one-third each) and each focal area subsequently contributes equally to its category (see Table 2.2).

Table 2.2 Weights used to for the weighed summation of the individual scores

	Weight level 1	Weight level 2	Actual weight
<i>Opportunities</i>	0.333		
- Income		0.167	0.056
- Housing		0.167	0.056
- Luxury goods		0.167	0.056
- Fish catch		0.167	0.056
- Alternative livelihoods		0.167	0.056
- Education		0.167	0.056
<i>Empowerment</i>	0.333		
- Governance		0.333	0.111
- Benefits to women		0.333	0.111
- Access and rights		0.333	0.111
<i>Security</i>	0.333		
- Health		0.25	0.083
- Social cohesion		0.25	0.083
- Cultural tradition		0.25	0.083
- Safety net		0.25	0.083

3. Results

By combining Table 2.1 and Table 2.2, the four cases can be ranked on the basis of their performance of the three poverty categories. As shown in Figure 3.1, Navakavu in Fiji is by far the best performing MPA in terms of poverty reduction. For all three welfare categories (i.e. opportunities, empowerment, security), Navakavu generates the highest score. The other three MPAs follow close after each other, with Apo Island at second place, Arnavon as the third best and Bunaken as the fourth MPA. Note, however, that the complications surrounding the control site in Apo Island depreciates its score of the category “opportunities”. Thus, Apo Island could have ranked higher if a more representative control site had been selected.

The assumption of equal weights for the three categories is a completely arbitrary one. Depending on the local preferences and conditions, one poverty category may be considered more important than another. For example, given the political instability in Fiji, the MPA communities may consider *security* or *empowerment* far more important than *opportunities*. To represent the impact of possible variations in preferences, a sensitivity analysis is conducted for the weights of the three poverty categories. Therefore, the weight of each poverty category is subsequently increased from one-third to two-thirds (reducing the weights of the other two from one-third to one sixth). Figure 3.2 shows how these different “perspectives” affect the ranking of the four MPAs in two of the three sensitivity scenarios. The ranking changes somewhat for the perspective “Opportunities”. Bunaken switches from fourth to second place because of its positive income performance. The ranking remains unchanged for the other two perspectives.

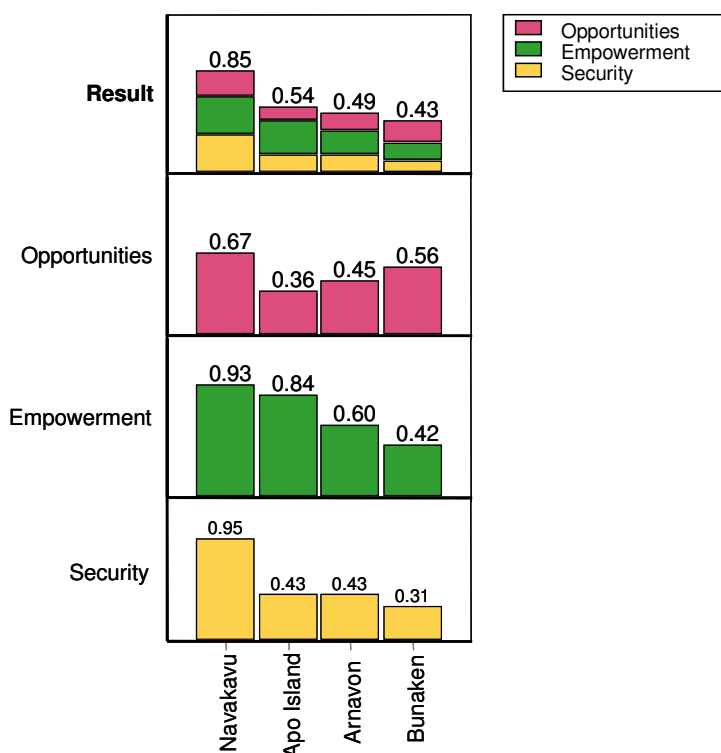


Figure 3.1 Results of multi-criteria analysis with equal weights for the three poverty categories

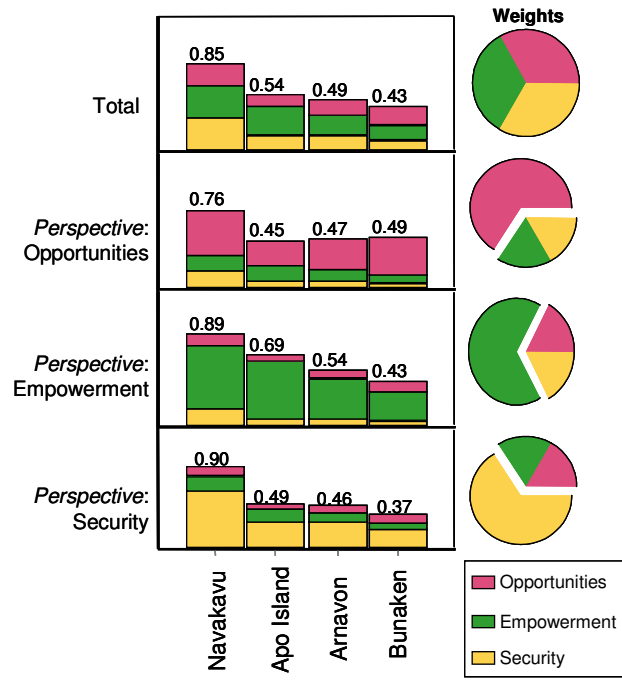


Figure 3.2 Sensitivity analysis for the weights of the three main components of poverty