

ECONOMIC AND FINANCIAL ANALYSIS

A. Approach and Methodology

1. The economic and financial analysis of the Coral Reef Rehabilitation and Management Program—Coral Triangle Initiative Project (COREMAP—CTI) consists of analyses of (i) one national and one district marine protected area (MPA) core subprojects that will be supported under the project (the selected national MPA is Anambas and the selected district MPA is Bintan), and (ii) representative microenterprises that are expected to be supported under the project. Since the exact nature and scale of either the support and infrastructure investments in MPAs or the type and number of microenterprises to be financed under the project cannot be determined in advance, no overall project economic analysis has been undertaken. The MPA analyses are based on estimates of quantifiable incremental benefits that will accrue from project financing of MPA costs. The microenterprise analyses are based on incremental revenue and investment and operating cost estimates. A range of microenterprises were supported under the COREMAP II project financed by the Asian Development Bank (ADB).¹ Although these were shown to be viable at appraisal, at project completion it was determined that success rates and sustainability were low for a variety of reasons.² The viability of the more successful examples has been re-evaluated based on prevailing 2013 prices. Alternative microenterprises have also been considered in the analysis.

2. The methodology used in the economic and financial analysis is consistent with ADB's guidelines for the economic analysis of projects.³ For ease of comparison with previous COREMAP projects, in particular COREMAP II, the methodology replicates that used in the project completion review (PCR) of COREMAP II (footnote 2). Aspects of the methodology that are common to the MPA and microenterprise analyses include:

- (i) The use of the domestic price numeraire, under which domestic financial prices of goods and services are assumed to reflect their economic value, while traded goods and services are assumed to have an economic value higher than their financial prices. The economic price of traded goods and services are derived by applying the shadow exchange rate factor (SERF) to financial prices.
- (ii) Prices are in constant mid-2013 United States dollars for MPA analyses and in Indonesian rupiah for microenterprise analyses. An exchange rate of \$1 equal to Rp10,000 has been used.
- (iii) The opportunity cost of capital against which economic viability is judged has been assumed to be 12%.
- (iv) No residual value of investments in MPAs or microenterprises has been assumed at the end of the cash flow period.
- (v) A 30-year cash flow is assumed in determining the economic internal rate of return (EIRR) of MPAs. For microenterprises, financial internal rates of return (FIRRs) are estimated on the basis of a 15-year cash flow, which is considered to better reflect the duration of such small-scale activities among local communities.

¹ ADB. 2002. *Report and Recommendation of the President to the Board of Directors: Proposed Loan to the Republic of Indonesia for the Coral Reef Rehabilitation and Management Project Phase II*. Manila.

² ADB. 2012. *Project Completion Report Coral Reef Rehabilitation and Management Project Phase II (Indonesia)*. Manila.

³ ADB. 1993. *Guidelines for the Economic Analysis of Projects*. Manila.

- (vi) Sensitivity analysis based on switching values has been undertaken to assess the impact of potential adverse movements in key variables in the analyses.

1. Marine Protected Areas⁴

3. **Benefits.** In the absence of detailed valuations of potential benefits that may be derived from project-financed MPAs, the benefit transfer methodology has been applied to estimate benefits.⁵ Three main sources of benefit have been estimated: (i) commercial fisheries; (ii) other economic activities, including non-commercial fisheries and other microenterprises such as those to be supported under the project (but excluding tourism); and (iii) erosion prevention. All outputs from commercial fisheries, other economic activities, and erosion protection are assumed to be nontraded. Commercial fisheries have significant potential for international trade in high-value species. However, the type of fish and the volume of catch resulting from project investments cannot be determined in advance. Further, the Ministry of Marine Affairs and Fisheries (MMAF) has targeted a significant increase in fish consumption in Indonesia (para. 16), suggesting that a significant proportion of the output of commercial fisheries will be consumed domestically. Outputs from economic activities will for the most part be sold in local and national markets, and benefits from erosion protection will accrue within local areas. The output of microenterprises producing commodities such as high-value fish species that are marketed internationally will be tradable, but the number and scale of these operations are likely to be small.

4. Benefits are estimated in terms of the value in monetary terms per unit area of key ecosystem resources. For COREMAP—CTI MPAs these resources are considered to be coral reefs and mangroves, though not all MPAs contain both. The values estimated for each source of benefit for each ecosystem resource are presented in Table 1.

5. The value of benefits as presented in Table 1 is the potential benefit that may be derived from the exploitation of the resources.⁶ Not all such benefits can be attributed to the project. To reflect this in the analysis, response parameters have been used to determine the percentage of the total benefit that may reasonably be attributed to the project. COREMAP—CTI will build upon the successes of COREMAP II and will have a significant impact upon resource sustainability through Global Environment Facility (GEF) financing of biodiversity and ecosystem management. In the absence of any analysis to directly estimate new response parameters for COREMAP—CTI, the values of response parameters used in the current analysis have been conservatively set at 20% for both commercial fisheries and other economic activities, and at 5% for erosion protection in both coral reef and mangrove resources.

⁴ Detailed descriptions of each MPA and the potential for economic activities are provided in Detailed Economic and Financial Analysis (accessible from the list of linked documents in Appendix 2 of the RRP).

⁵ The benefit transfer methodology estimates the value of benefits accruing within a given ecosystem based on the valuation of benefits analyzed in studies of ecosystems of a comparable nature.

⁶ Though somewhat dated, these valuations are the latest available for ecosystems comparable with those within MPAs to be supported under the project. They are, however, considered by resource economists working on the preparation of COREMAP—CTI to adequately reflect actual values based on field investigations.

Table 1: Marine Protected Area Resource Benefit Estimates

Resource	Original Estimates		Adjusted Value 2013	Source
	Year	\$/ha/year	\$/ha/year	
Coral Reef				
Fisheries	2002	325	842 ^a	AMSAT
Other Economic Activity	2002	40	104 ^a	AMSAT
Erosion Protection	2002	578	1,498 ^b	WRI
Mangrove				
Fisheries	1997	600	2,484 ^c	Bann
Other Economic Activity	2002	340	881 ^a	AMSAT
Erosion Protection	2002	2,513	6,512 ^a	AMSAT

AMSAT = Australian Marine Science and Technology Limited, ha = hectare, WRI = World Resources Institute.

Note: Adjusted values are original values estimated by source updated to 2013 by application of escalation factors based on the Indonesian implicit gross domestic product deflator (ADB. 2010. *Key Indicators for Asia and the Pacific 2010*. Manila; ADB. 2012. *Key Indicators for Asia and the Pacific 2012*. Manila.) to 2011, and on Asian Development Bank inflation estimates for 2012 and 2013 (ADB. 2013. Domestic Cost Escalation Factors, 2012–2016. Manila [internal document of the South-East Asia Regional Department]).

^a Australian Marine Science and Technology Limited. 2002. *A Marine Rapid Assessment of the Raja Ampat Islands, Papua Province, Indonesia*. RAP Bulletin of Biological Assessment No. 22.

^b L. Burke et al. 2002. *Reefs at Risk in South-east Asia*. Washington DC: World Resources Institute.

^c C. Bann. 1997. *The Economic Value of Mangroves: A Manual for Researchers*. Ottawa: International Development Research Centre.

6. The estimates for each resource and source of benefit are potential benefits that are expected to accrue in the long term. The rate at which they are achieved will vary from one MPA to another given that (i) the coral reef and mangroves in each of the MPAs are in varying conditions and (ii) there may be site-specific factors that affect the rate of recovery of the resources and/or the attainment of the potential benefit. For each MPA analyzed, the attainment of the potential benefit has been phased over the cash flow period. An estimate has been made on when the full benefit will be attained, and an average annual increment has been applied on the basis of the number of years between the time when benefits start to accrue and the year when full potential is realized. In addition, there is likely to be an increase in the potential value itself as economic activities become intrinsically more productive and returns higher, and as the value of assets and resources protected from erosion increase in scale and value. To account for such growth, an annual increment of 5% has been added to benefit estimates starting in the year after the estimated potential value in Table 2 has been realized. The impact of zero annual growth is included under sensitivity analysis.

7. The analysis also aims to determine incremental benefits deriving from the project by including an estimate of potential benefits from tourism based on estimates of the share of tourism in gross regional domestic product (GRDP) and an assumed annual rate of growth in tourism benefits.⁷ Nationally, tourism accounted for 4% of gross domestic product in 2012.⁸ Tourism benefits will vary significantly between MPAs. In many, they are constrained by the remoteness of the MPA and limited transport and communications and tourism support infrastructure. In addition, not all tourism in an MPA area can be considered to be marine-based

⁷ Under this assumption, the without-project scenario is based upon no increase in tourism above the total value estimated from the contribution to GRDP. Benefits in the with-project scenario are based on the annual increase in tourism value.

⁸ Statistics Indonesia. Ministry of Tourism and Creative Economy, 12 December 2012.

and, therefore, dependent upon project investments. These varying characteristics of potential tourism benefits in each MPA are reflected in the analysis by the year when benefits are expected to accrue and the assumed annual rate of growth.

8. **Costs.** Detailed investment costs have been estimated for the establishment of MPAs. Costs have been determined from estimates of physical quantities and unit costs obtained from MPA management plans, field investigations, and MMAF data. These financial costs have been converted to economic costs by removing taxes and duties and multiplying local currency costs by the standard conversion factor and foreign exchange costs by the SERF. Operation and maintenance (O&M) costs have been included in the cash flow at the rate of 5% per year on the cumulative cost of investment in civil works and vehicles and equipment.⁹

2. Contribution of Global Environment Facility Funding

9. GEF financing ensures the sustainability of nationally and globally important resources through demarcation and zoning of MPA boundaries and institutionalization of ecosystem monitoring within MPAs according to international best practice. Direct financial support will be provided to MPAs for resource surveys and valuation, reef health, biodiversity and ecosystem management, monitoring, and surveillance. In order to assess the contribution of GEF to MPA viability, assumptions have been made of the contribution to each benefit stream that may be attributed to GEF financing. The following GEF contributions have been assumed: (i) 25% for fisheries benefits from both coral reef and mangrove areas, (ii) 50% for other economic activities and erosion protection, and (iii) 40% for tourism benefits.¹⁰ The resulting reduced level of benefits has been combined with MPA investment and O&M costs after deduction of the cost of GEF-financed activities to derive a cash flow net of benefits derived from and costs funded by GEF financing. The EIRR based on this cash flow provides an indication of the MPA viability without the GEF contribution.

3. Microenterprises

10. Financial analysis has been conducted on microenterprises by estimating a net cash flow from revenue and investment and operating cost estimates. In cases where microenterprises have a gestation period of more than 1 year, with a negative cash flow in the first year, the analysis assesses viability in terms of an FIRR that is subjected to sensitivity analysis. Where it is not possible to estimate an FIRR (i.e., where revenue exceeds costs in the first year of operation in microenterprises that have a product cycle under 1 year), viability is assessed on the basis of net profit earned during an average cycle. Microenterprises analyzed include some of the microenterprises promoted under COREMAP II, which have been re-evaluated.

⁹ While this may overstate the level of O&M costs for certain investments, it allows scope for replacement of short-term assets that are not specifically included in the cash flow.

¹⁰ A GEF contribution to a benefit stream of 40% implies that the project without GEF financing would generate only 60% of the total benefit of that benefit stream.

B. Economic Analysis of Marine Protected Areas

1. Anambas National MPA

a. Economic Viability

11. Benefits in the Anambas MPA derive from fisheries, other economic activities, and erosion protection in coral reef covering 3,706 hectares (ha) and mangrove areas covering 766 ha. Benefits begin to accrue after 3 years and are expected to reach full development after 10 years. After 10 years, benefits from the coral reef amount to \$1.0 million per year and from mangroves \$0.8 million per year. Benefits continue to rise thereafter and are projected to reach a maximum of \$2.6 million per year from coral reefs and \$2.0 million per year from mangroves at the end of 30 years. In 2012, all forms of tourism accounted for 3% of GRDP. In the absence of estimates of the level of marine-based tourism within the Anambas MPA, the share of tourism benefits deriving from the project has been conservatively estimated at 1%. On this basis, tourism benefits are expected to reach a maximum of \$2.5 million per year. Under these assumptions, the relative contributions to total benefits of \$7.1 million at full development are 35% from coral reef areas, 29% from mangrove areas, and 35% from tourism.

12. Based on these estimates, the EIRR of the Anambas MPA is 15.3%. The EIRR after deducting the contribution to benefits and the cost of GEF-financed activities in the Anambas MPA is estimated at 14.2%. The results of the sensitivity analysis are in Table 2.

Table 2: Anambas MPA Sensitivity Analysis

Item	Switching Value ^a	EIRR (%)
Changes in Benefits and Costs		
Benefits		
Fisheries	83	12.0
Other economic activities	393	12.0
Erosion protection	158	12.0
Tourism	94	12.0
Total benefits	32	12.0
Investment costs		
Operation and maintenance costs	61	12.0
Total costs	193	12.0
Total costs		
46		
12.0		
Delay in Benefits		
Non-tourism benefits		
Attainment of full benefit after 15 rather than 10 years		11.7
Zero growth after attainment of full benefit in year 10		13.3
Tourism		
Zero tourism development benefits		11.7
Benefits commence in Year 8 rather than year 3		13.5
Zero annual growth after benefits commence in year 3		11.7

EIRR = economic internal rate of return.

^a Switching values indicate the percentage by which the variable can change before the EIRR is reduced to the level of the opportunity cost of capital (12%), and at which the economic net present value equals zero.

Source: Asian Development Bank estimates.

13. The sensitivity analysis indicates that the proposed program of investment in the Anambas MPA is robust with respect to adverse changes in key variables. Total benefits would have to fall by 32% before the EIRR fell to 12%. Delays in the attainment of benefits have a more significant impact. If full non-tourism benefits are not attained until 15 years after project start-up rather than 10 years, the EIRR would fall to 11.7%, marginally below the assumed cut-off rate for economic viability of 12%. The risk of such a delay in the attainment of benefits will

be mitigated by the intensive levels of support given by the project to MPA management and coral reef and mangrove resource enhancement. A failure to attain any benefits from tourism would reduce the EIRR to 11.7%. This possibility is considered to be unlikely in view of the Anambas MPA management plan to develop tourism and complementary infrastructure.

2. Bintan District MPA

a. Economic Viability

14. Benefits in the Bintan MPA derive from fisheries, other economic activities, and erosion protection in the 9,085 ha coral reef area and the 8,896 ha mangrove area. Benefits are assumed to begin to accrue after 3 years and are expected to reach full development after 10 years. Given the large coral reef and mangrove areas, benefits from these resources will make a significant contribution to overall MPA benefits. At full development, benefits from the coral reef will amount to \$2.5 million per year and from mangroves \$9.3 million per year. Benefits will continue to rise, reaching a maximum of \$6.4 million per year from coral reefs (20% of total benefits) and \$23.6 million per year from mangroves (75% of total benefits). In spite of significant tourist numbers in Bintan, the contribution to GRDP was estimated at only 0.5% in 2012. Given that not all tourism in Bintan is marine-based and that the contribution to tourism from the MPA area cannot be determined, it has been assumed that tourism within the MPA contributes only 0.1% of GRDP. This is expected to be worth a maximum of \$1.5 million per year, equal to 5% of total benefits. Based on these estimates, the EIRR of the Bintan MPA is 42.1%. The EIRR after deducting the contribution to benefits and the cost of GEF-financed activities in Bintan is estimated at 39.6%. The results of the sensitivity analysis are in Table 3.

Table 3: Bintan MPA Sensitivity Analysis

Item	Switching Value ^a	EIRR (%)
Changes in Benefits and Costs		
Benefits		
Fisheries	188	12.0
Other economic activities	636	12.0
Erosion protection	313	12.0
Tourism	2,045	12.0
Total benefits	94	12.0
Investment costs	2,141	12.0
Operation and maintenance costs	8,003	12.0
Total costs	1,689	12.0
Delay in Benefits		
Non-tourism benefits		
Attainment of full benefit after 15 rather than 10 years		28.5
Zero growth after attainment of full benefit in year 10		40.0
Tourism		
Zero tourism development/benefits		40.6
Benefits commence in Year 8 rather than Year 3		40.9
Zero annual growth after benefits commence in Year 3		40.6

EIRR = economic internal rate of return.

^a Switching values indicate the percentage by which the variable can change before the EIRR is reduced to the level of the opportunity cost of capital (12%), and at which the economic net present value equals zero.

Source: Asian Development Bank estimates.

15. The sensitivity analysis indicates that the proposed program of investment in Bintan is robust with respect to adverse changes in all variables. Delays in attainment of benefits would not have a significant impact. The failure to achieve any benefits from tourism results in only a marginal reduction in the EIRR.

C. Financial Analysis of Microenterprises

1. Overview of Demand

16. In spite of its large maritime area and fisheries potential, fish consumption in Indonesia is low compared to other protein intake. It was estimated at only 23 kilograms (kg) per capita per year in 2009, below the Food and Agriculture Organization (FAO) recommended consumption of 30 kg per capita per year, prompting the MMAF to set targets for fish consumption to rise to 40 kg per capita per year by 2015. Significant progress in raising fish consumption has, however, been achieved in the interim. In 2011 it had reached 38 kg per capita per year. To meet the target level of 40 kg, and including exports, the MMAF projected production to rise from 10.8 million tons in 2010 to 27.3 million tons in 2015. The share of aquaculture in supply is expected to rise from 50% in 2010 to 80% in 2015, with the supply from capture fisheries remaining virtually constant at 5.5 million tons. One of the government's goals with respect to fish consumption is to increase the amount consumed by low-income families. Achieving the production target of around 22 million tons of fish offers a significant opportunity for project-financed aquaculture. Project support to low-income households to establish aquaculture microenterprises at the same time addresses the low level of fish consumption amongst such households.

2. Microenterprise Analyses

17. Although the project will not invest directly in microenterprises, the investment in basic infrastructure and production hardware and software would indirectly increase the net benefits generated by marine-based microenterprises, which contribute to the overall economic benefit of the project. COREMAP II promoted several microenterprises and subjected four representative microenterprises to financial analysis at appraisal: grouper culture, seaweed production, fish cracker production, and mud crab culture. All microenterprises were found to be viable, with FIRRs above 20%. However, not all proved to be sustainable since several were no longer in operation at project completion. Causes of microenterprise failures included: (i) improper site selection, (ii) low quality feasibility analysis, (iii) marketing problems, (iv) high mortality rate of fingerlings, (v) fish diseases, (vi) climatic changes, and (vii) the high cost of commercial feed and fish as raw material for fish cracker production (footnote 2).

18. The economic and financial analysis of COREMAP—CTI includes a re-evaluation of the grouper culture, mud crab, and seaweed production microenterprises to determine their intrinsic viability. In addition, financial analysis has been undertaken for grouper hatchery, seahorse culture, and Napoleon Wrasse culture. To ensure that these enterprises are both viable and sustainable, COREMAP—CTI will also support upstream and downstream activities in fisheries value chains to address issues related to the supply of high quality inputs and market outlets and effective marketing processes. Such activities, including capacity building and small in-kind support, will be identified and appraised during implementation to complement production activities that have been appraised and selected for support. Table 4 provides a summary of the financial analyses of microenterprises.¹¹ FIRRs range from 17% to over 50%, indicating a high level of potential returns to project participants engaged in these microenterprises.

¹¹ Details of each analysis are provided in Detailed Economic and Financial Analysis (accessible from the list of linked documents in Appendix 2 of the RRP).

**Table 4: Results of Financial Analysis of Representative Microenterprises
(Rp '000)**

Item	Grouper Hatchery	Grouper (Cage Culture)	Mud Crab Culture	Sea Weed Production	Seahorse Hatchery	Napoleon Wrasse
Income	67,000	377,200	16,400	51,475	75,600	480,000
Investment cost	27,070	69,529	3,645	20,520	118,845	94,250
Operating cost	24,920	178,940	9,842	16,920	42,096	65,063
Net income	15,010	n/a	n/a	n/a	n/a	
FIRR (%)	n/a	63.2	35.6	77.7	23.5	17.0

FIRR = financial internal rate of return.

Source: Asian Development Bank estimates.