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Socioeconomic Assessment Framework and Guidelines for Integrated Coastal Management

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MISSION STATEMENT

The primary objective of the Global Environment Facility/United Nations Development Programme/International Maritime Organization Regional Programme for the Prevention and Management of Marine Pollution in the East Asian Seas is to support the efforts of the eleven (11) participating governments in the East Asian region to prevent and manage marine pollution at the national and subregional levels on a long-term and self-reliant basis. The 11 participating countries are: Brunei Darussalam, Cambodia, Democratic People's Republic of Korea, Indonesia, Malaysia, People's Republic of China, Republic of the Philippines, Republic of Korea, Singapore, Thailand and Vietnam. It is the Programme's vision that, through the concerted efforts of stakeholders to collectively address marine pollution arising from both land- and sea-based sources, adverse impacts of marine pollution can be prevented or minimized without compromising desired economic development.

The Programme framework is built upon innovative and effective schemes for marine pollution management, technical assistance in strategic maritime sectors of the region, and the identification and promotion of capability-building and investment opportunities for public agencies and the private sector. Specific Programme strategies are:

- Develop and demonstrate workable models on marine pollution reduction/prevention and risk management;
- Assist countries in developing the necessary legislation and technical capability to implement international conventions related to marine pollution;
- Strengthen institutional capacity to manage marine and coastal areas;
- Develop a regional network of stations for marine pollution monitoring;
- Promote public awareness on and participation in the prevention and abatement of marine pollution;
- Facilitate standardization and intercalibration of sampling and analytical techniques and environment impact assessment procedures; and
- Promote sustainable financing mechanisms for activities requiring long-term commitments.

The implementation of these strategies and activities will result in appropriate and effective policy, management and technological interventions at local, national and regional levels, contributing to the ultimate goal of reducing marine pollution in both coastal and international waters, over the longer term.

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GEF/UNDP/IMO Regional Programme
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Acknowledgments

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Introduction and Background

This document provides a framework and guidelines for conducting socioeconomic impact assessments for integrated coastal management (ICM) programs. The framework and guidelines consist of (1) concepts and methods to contribute to a better understanding of the potential benefits and costs from ICM, and (2) indicators that might be used to help assess how well the ICM process is working. The concepts and methods described herein are drawn from the fields of environmental and natural resource economics and applied benefit-cost analysis and are intended to make information available that might better inform, and by that contribute to ICM efforts.

As described below, the framework and guidelines presented in this paper differs somewhat from many other socioeconomic frameworks for ICM:

a. They focus on the impacts of ICM on people rather than on resources per se, the basic argument being that ICM is intended to make people better off as they see it (Grigalunas and Congar, 1995);

b. In a related vein, the impacts emphasized in this paper are the changes in the well being of people rather than overall measures of total expenditures or other indicators of gross activity; and

c. Indicators are suggested that might be used after-the-fact to assess how well the ICM process is doing (although inherent problems with developing reliable indicators are also noted).

Organization

First, the section on the concepts for ICM provides an overview of central concepts relevant for ICM. The concepts emphasize the role of coastal resources as natural assets; the valuable services they can provide, if maintained; and the importance of market failure as an underlying source of many coastal problems requiring ICM.

The section on the general framework for ICM discusses linkages among commercial and domestic activities, their impacts on environment and natural resources and, ultimately, on services to people. Further, a benefit-cost (and cost-effectiveness) framework provides an operational approach for assembling data to identify and assess the socioeconomic consequences of ICM programs or policies.

Two examples of the use of a benefit-cost framework to assess ICM programs are provided. These examples illustrate the concepts, framework and guidelines given in this paper. Finally, indicators that could be used to assess the effectiveness of ICM efforts are described and some of the challenges involved in developing useful indicators are noted.

Concepts for ICM

Coastal Resources as Natural Assets

Coastal resources can be viewed as natural assets that can provide a stream of valuable services (dividends) to people over time, if maintained (Freeman, 1993; Kopp and Smith, 1993). Services include use of the water surface and channels for transportation, use of the water column and tidal flushing for (within threshold limits) assimilating wastes, and use of the water column and shorelines for beaches, recreation, mariculture and aquaculture, commercial sites, port services or parks. Other important services coastal resources provide include use of the natural ecosystems and habitats for the production of fish and other resources, enhancement of biological diversity and scenic views.

Services can occur onsite, such as mariculture, ports, parks, beach use or withdrawal of water for industrial use. Services also can be indirect or offsite, for example, when an ecosystem in one area supports the "production" of fish or wildlife that are harvested or viewed elsewhere, perhaps many kilometers away.

Key Sources of Coastal Problems: Market Failure and Government Failure

Proper management of coastal resources can promote sustainable use and maximum benefits to the population. Sustainable and efficient use of coastal areas, however, remains an elusive goal for coastal areas, virtually worldwide. Major sources of coastal problems of concern described in this paper are pervasive and important market and government failures. Market failures could be in the form of externalities, public goods and ill-defined property rights.

Market Failure

Market failure is a root cause of many coastal resource management problems:

a. *Externalities* arise when one party imposes costs on others without compensation. By not considering the costs it imposed on others, the true costs of the polluter's activity are understated, too much of the environmentally unfriendly good is produced, and users of the good are subsidized by locals who bear the environmental costs.

Externalities abound in coastal areas and represent the classic example of inter-sectoral effects that provide the rationale for ICM include:

1. blast fishing and use of poison in fishing affecting the coral reefs which cause major costs for society in terms of lost sustainable fishing, tourism and reduced protection of coastal lands and property from storms and flooding;

2. households who dispose of garbage in vacant lots, by that creating blight and posing health risks;

3. vessel operators who discharge wastes into coastal waters, causing water pollution by oil, grease and debris;

4. industry which discharges metals, or agricultural activity that causes runoff of pesticides or animal waste that put human and ecosystems health at risk;

5. aquaculture that leads to pollution of coastal waters and perhaps of adjoining lands (e.g., through saltwater intrusion);

6. coastal development and land reclamation that eliminates habitats or scenic views

b. *Public goods* have the unusual feature that if provided for one, they are available to all. Since no one can be excluded from the benefits of good water quality, attractive views, and clean streets, rivers, and bays, few will voluntarily pay for these goods (the free rider problem), and businesses will not provide them. As a result, public goods often are under provided, unless government, communities or other collective entities assume a leadership role.

Public goods, such as good water quality, attractive views and litter-free waters and streets are often central issues in ICM. Yet, for all of the above reasons, very little is known about people's preferences for, or the value they attach to, public goods, unless special surveys or studies are done.

c. *Lack of well-defined property rights* is the source of overexploitation of virtually all open access fish stocks, as well as overexploitation of mangroves and other ecosystems. Lack of clear property rights also contributes to erosion from upland areas when, for example, land users with insecure ownership are unwilling to invest in measures to prevent erosion or pollution because they are unsure whether they can capture the gain from their investment.

Government Failure

In some cases, actions-or inaction-by government contribute to coastal problems. For example, the failure of many governments (1) to address open access fishery management problems, (2) to provide well defined property rights in general, or (3) to adopt policies that control externalities and provide public goods not available through commu-nity or other collective action is a major contributor to coastal problems. Lack of implementation due to inadequate budgets, or lack of enforcement due to rent seeking by public officials are also sources of government failure contributing to coastal problems.

Summary

In sum, ICM programs hoping to achieve sustainable use of coastal resources must confront the sources of market failure outlined previously. However, the collective efforts necessary to design and implement policy and ensure compliance necessarily involve choices among resource uses-tradeoffs-and the benefits to be achieved by, and the costs of such actions are not always clear. To contribute to effective ICM programs, a framework is needed to assess these tradeoffs.

Assessing Socioeconomic Impacts of ICM: Framework and Guidelines

Overview of Socioeconomic Impacts: A Descriptive ICM Framework

Figure 1 depicts the critical, common links between economic and domestic activities, environmental stressors, such as the generation of wastes and/or alteration of landscapes that may result to potential changes in environmental and natural resource quantity or quality, and ultimately impacts on people. The role of national and international government economic policies, although largely outside the influence of local government policy, are also reflected in Figure 1. Several points should be emphasized:

a. Economic developments that are largely outside the control of local officials present a major challenge for local ICM planning efforts concerned with balancing growth with environmental quality.

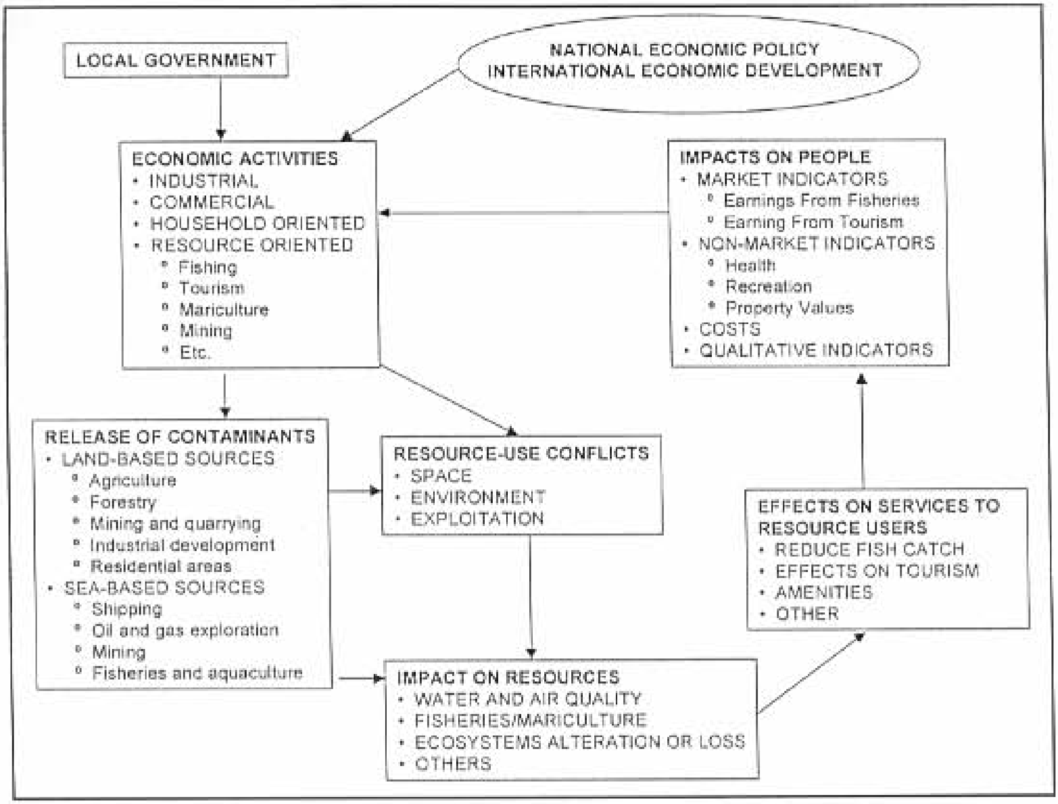
b. Environment and natural resources issues arise from a variety of sources (industry, agriculture, households) and take many forms (water pollution, amenity effects, habitat loss, resource conflicts and overexploitation of resources).

c. Environmental issues are easy to describe as potential problems, but whether the degree to which they are actual problems (externalities) depends upon their effects on services to people—identified as resource users in Figure 1 and how they are managed.

d. Impacts on people take many forms: for example, changes in earnings in fishing, mariculture or tourism that are measurable through the market; and adverse (or beneficial) effects on health, recreation and property values that cannot be measured directly through the market and hence must be estimated using non-market techniques (e.g., Freeman, 1993; Kopp and Smith, 1993; Grigalunas and Congar, 1995).

e. ICM measures can avoid or reduce adverse impacts on people and hence generate market and non-market valued benefits; but nothing is free, and ICM can only be implemented with a cost, which is shown in Figure 1.

Figure 1. Simplified Depiction of Socioeconomic Impact within the ICM Framework.



Issues and Methods: Elements of an Analytical Framework

Assessments of the benefits and costs of ICM must be tailored to the issues of concern. The methods used must take into account the availability of data, time and finding, as well as the state of the art not only in environmental and natural resource economics, but also in complementary fields, such as biology and ecology.

Each coastal area will have its unique aspects and issues, as noted. Nevertheless, a useful framework for socioeconomic assessment for ICM has common features. It will include not only the benefits but also the costs of proposed actions, where costs and benefits are defined broadly to include both market and non-market valued effects. It will take into account costs and benefits over time and since ICM takes place in a political setting, the distribution of costs and benefits among stakeholders will be considered.

Of course, in some cases, it may not be possible to quantify all benefits. In such cases, quantification of those benefits and costs that can be estimated may be sufficient. Alternatively, cost-effectiveness may be used, whereby the lowest-cost approach for achieving a goal is adopted. Or qualitative arguments may be used to describe the nature and perceived importance of an unquantifiable benefit or cost.

A Benefit-Cost Framework

Benefit-cost analysis involves the estimation of a net present value (NPV) where benefits and costs are very broadly defined:

$$\text{Net Present Value} = (B_d - C_d) + (B_e - C_e) - M$$

where:

B_d = benefits to the program, development or activity

C_d = costs of the program, development or activity

B_e = benefits to the environment from the program, development or activity

C_e = costs to the environment from the program, development or activity

M = mitigation costs

Benefits, B_d, are the value of the additional goods and services provided. Benefits may be measurable through markets, either as (1) additional output (e.g., the value of tourism or aquaculture products, or the value of land created through coastal reclamation[1]), or (2) the benefits could be cost savings, e.g., from improved navigation due to channel dredging. B_d also could involve non-market goods and services, e.g., beach recreation, human health, shoreline protection or creation of a marine park.

C_d refers to the costs incurred to realize B_d-C_d divided into investment costs (planning, land acquisition, facilities, construction equipment, etc.) and annual operating and maintenance costs. Market cost usually provides an adequate measure of the opportunity costs of resource inputs[2].

B_e, benefits to the environment, could reflect lower environmental costs due to a program, development or activity, such as would result from reduced discharges of vessel wastes due to new or expanded port reception facilities, or reduced damages from agriculture pesticide or animal wastes runoff from improved management practices.

[1] *Note that the market value of land derives from the value of anticipated future annual revenues less costs, i.e., it is the net present value of the productivity of the land created.*

[2] *However, adjustments may be required, for example, when otherwise unemployed resources are used. See example in the next section.*

Costs to the environment, C_e, capture those environmental costs that result from the program, development or activity. Examples include the loss of ecosystem function when, for example, port expansion uses ecologically important land; the reduction in environmental amenities (scenic vistas or biological diversity) due to unattractive land use; or the loss of productivity of coral reefs or mangroves due to destructive fishing practices or conversion to alternative uses.

Finally, M, is the mitigation cost—the cost of avoiding the adverse effects of a development or activity. For example, aquaculture developers may be required to eventually restore the land to its original state; logging firms may be required to adopt best-practice environmental measures; or conversion of an ecosystem in one area might be allowed only if the developer restores or acquires, for preservation, a comparable ecosystem elsewhere.

It should be understood that all benefits and all costs described above are incremental. That is, they reflect the changes in outcomes "with" versus "without" the program or activity.

It should also be understood that all benefits and costs are discounted, that is, converted to a present value (PV), using a social rate of discount, r:

$$PV_B = B_1/(1+r)^1 + B_2/(1+r)^2 + ... + B_T/(1+r)^T = \Sigma_t B_t/(1+r)^t$$

$$PV_C = C_1/(1+r)^1 + C_2/(1+r)^2 + ... + C_T/(1+r)^T = \Sigma_t C_t/(1+r)^t$$

Thus, all future monetary flows are converted to their present value. The present value is the lump sum amount which, received or paid today, is equivalent to all future monetary inflows or outflows. In principle, one would be indifferent to receiving (or paying) the lump sum PV or receiving (or paying) all of the future flows.

Note that the r in the denominator is the social rate of discount used to convert future flows to their present value. The correct social rate of discount is a matter of debate (see Hanley and Splash, 1993) that is far beyond the scope of this paper. Generally speaking, however, use of a long-term, real (i.e., adjusted for inflation) government bond rate is a practical alternative. This rate norm will be lower than the rate of interest on long-term bonds in the private sector, which reflect an element of risk[3].

The key criteria in benefit-cost analysis is NPV, which is the difference between discounted benefits and costs, i.e., $NPV = PV_B - PV_C$, where benefits and costs are broadly

[3] *In some cases, the government agency involved may require that a certain rate be used or that the rate on a particular security (e.g., a long-term bond) be employed. Thus, in these cases, r is administratively determined and is not a decision to be made by the analyst.*

defined (and understood to include mitigation costs). The "golden rule" is that activities with a positive NPV, that is, whose discounted benefits are greater than their discounted costs, are worthwhile, while those with a negative NPV are not.

Note that it is possible that:

$$(B_d - C_d) > 0 \text{ but } (B_d - C_d) + (B_e - C_e) < 0.$$

That is, the private or financial benefit to a developer or resource user may be positive, but the overall effect on society is negative. This is a very common case, in fact, and illustrates classic market failure in the form of externalities. For example, an individual reef blast fisherman or coral miner profits from their activity (i.e., B_d-C_d > 0). However, the environmental costs imposed upon society as a whole from the resulting destruction of coral reefs have been found to be enormous (lower sustainable fish stocks, increased shoreline erosion, reduced shoreline protection from storms and flooding) so that the overall effect is a negative net benefit to society as a whole. Similarly, clearing of a mangrove for shrimp aquaculture may yield high benefits to the developer but could impose substantial costs on society (increased sedimentation, erosion, storm damage, water pollution and higher salinity on nearby rice fields). Hence, in both of these cases the overall net benefits to society, taking into account all environmental benefits and costs, can be negative, even though the blast fisherman, coral miner or shrimp aquaculturist creating the externality may realize profits.

Common Pitfalls to be Avoided in Assessing ICM Benefits and Costs Analysis

Note that only direct benefits and costs have been included. Three common important problems arise when considering the scope of benefits and costs to be estimated and included in a benefit-cost analysis for ICM: (1) secondary or multiplier effects, (2) transfers and (3) double counting. These are to be excluded in benefit-cost analyses as explained below.

Secondary, indirect or "multiplier" effects. These are omitted from the framework for ICM presented in this report. Those who advocate including secondary effects often multiply an initial change in output or income from an activity by 2, 3, or even 4 to get a "total impact." When multipliers are used naively, virtually any activity-conceivably an activity with *no benefits* at all-is inappropriately cast in what appears to be a very favorable light (Grigalunas and Congar, 1995).

The problem in using secondary or multiplier effects is the implicit assumption that resource inputs such as labor, land or capital used in coastal activities have literally no alternative uses (zero opportunity costs). Yet, when land, labor or capital are used in one activity they are diverted from other activities, i.e., they have an opportunity cost, and this must be recognized. Failure to recognize opportunity costs treats resources as if they were free and greatly exaggerates impacts. If multipliers of 2, 3 or even 4 that appear in some claims were accurate, then any project would appear to be a desirable investment and a good use of society's scarce resources.

To be sure, in some areas unemployed labor may be a major issue, particularly in developing countries. In such cases, it is appropriate to take into account the use of otherwise unemployed resources. The correct way to do this is not through the use of multipliers. Rather, the appropriate approach is to adjust the market cost of the input to better reflect its true opportunity costs (its shadow value). A practical approach when calculating costs is to adjust downward the wage rate using the unemployment rate in the area. For example, if workers are paid $2 per hour, and the unemployment rate is 20%, then labor costs for a coastal activity or project could be calculated at $1.60 per hour (=$2 (1-unemployment rate)). The effect of making this adjustment to reflect use of unemployed resources is to lower C_d and by that, raise B_d - C_d[4].

Transfers. These also are excluded from a proper benefit-cost analysis. This is because transfers are mere redistribution of money among members of the community—and do not represent a real change in benefits or costs. For example, additional taxes paid by business due to an ICM program are increases in government revenue (and by that, gains to those who benefit from government programs financed with that revenue). However, the additional taxes are a cost to those in the community who pay them. Hence, taxes within the community are not a net increase in well being to the community as a whole, they are transfers among members of the community[5].

Double counting. This issue arises when a benefit or cost is counted twice. For example, increased benefits to recreational beach users due to an ICM program that improves water and beach quality is a benefit and should be counted as such. The same benefit, however, might be measured as the increase in shoreline property values due to the ICM. But it would not be appropriate to include *both* measures since they are just different ways of measuring the same benefit, and to use both estimates would be double counting.

Actual quantification of benefits and costs involves the use of market- or non-market valuation methods. An overall discussion of all the various methods available, their data requirements, and strengths and weaknesses are beyond the scope of this paper. Summaries of these methods can be found in, for example, Mitchell and Carson (1989), Braden and Kolstadt (1991), Freeman (1993) and Kopp and Smith (1993). A practical review of nonmarket valuation methods, focusing on examples for coastal areas is given in Grigalunas and Congar (1995).

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[4] *Attention is focused on unemployed labor, a major input in most projects, but similar arguments apply to all resource inputs.*

[5] *Taxes paid by "outsiders" are a gain to the community and should be taken into account, if important.*

It is recognized again that in some cases, benefits and costs may not be fully quantifable, and some perhaps cannot be quantified at all. It is important to stress, however, the value of a benefit-cost framework as a means of organizing disparate data to be used in ICM, even if the NPV results are incomplete or are not precise. More information, objectively estimated, better informs decision-making than less information. The framework suggested makes those concerned with ICM confront fundamental and important questions: What are the benefits? The costs? What is the relative magnitude of costs vs. benefits? Who gains and who pays? This information, even if imperfect, can contribute to better-informed ICM. Thus, the inability to quantify all effects may be a limitation of benefit-cost analysis—and any other assessment method—in some cases, but need not be an insurmountable obstacle.

A Cost-Effectiveness Framework for ICM

In some cases, it may not be possible (due to time, budgetary or other reasons) to quantify certain benefits. Or society may have adopted a specific environmental goal, which is to be taken as a given. In these cases, the question becomes: What is the best way to achieve the given goal?

In such situations, cost-effectiveness analysis and information on incremental costs can contribute to ICM decisions. For example, cost-effectiveness is a critical element of many environmental laws in the United States dealing with restoration of coastal resources injured due to pollution.

Two situations are described below. One involves finding the least-cost alternative for achieving a given pollution-control goal, and the second concerns decisions about how much pollution to control.

Suppose two mutually exclusive alternatives, A and B, are available for reducing pollution by a given amount. Alternative A has high initial investment costs (I_{A0}) but low annual operating costs (C_{At}), while B has lower initial investment costs (I_{B0}) but higher yearly operating costs (C_{Bt})[6]. If both lead to similar results in terms of protecting or restoring marine resources, which is the preferred action?

Because the two alternatives differ with respect to their initial and annual costs, the choice between them may not be obvious. A cost-effectiveness standard would select the

[6] *Note that in the text, the initial investment cost, I, and other costs are distinguished to illustrate the point being made, whereas earlier for convenience, all costs were included in "C".*

option which has the lower present value (PV) of costs as in the following comparison:

$$PV_A = I_{Ao} + \Sigma_t C_{at} / (1+r)^t \qquad \text{Versus} \qquad PV_B = I_{Bo} + \Sigma_t C_{bt} / (1+r)^t$$

Note that the alternative selected depends upon (1) the costs and their time profile, (2) the discount rate, r and (2) the scale of the pollution control undertaken. Thus the selection of the best—least-cost—alternatives may not be obvious without careful study of the alternatives.

Suppose instead several mutually exclusive ways to reduce pollution in varying degrees exist, each with a different cost, and the decision concerns how much to remove. This kind of issue is common and arises, for example, when decisions are being made concerning cleaning up contaminated marine sediments (National Research Council, 1979; Grigalunas and Opaluch, 1989), controlling runoff, deciding upon the level of sewage treatment or deciding upon the least-cost combination of methods to reduce air pollution. Useful insights may be obtained in each case by examining the least-cost ways of addressing these issues and the incremental costs of more stringent control. Generally, limited, initial reductions can be achieved at relatively low cost. However, costs begin to increase after the "easy" clean-up measures are adopted and, at some point, the incremental costs of further pollution control increase sharply and can be very large.

Given this information on incremental costs, policy-makers are in the position to ask: "Are the additional benefits likely to justify the extra costs for the additional pollution control?" Hence, cost information alone, judiciously used, can provide useful insights and contribute to risk management, even when information on benefits is not available or cannot be used[7].

Finally, to be successful, ICM programs clearly must be implemented, which requires financing, a critical issue for a sustainable program. Most socioeconomic studies give little attention to financing, ignoring it as a transfer—not a real cost or benefit to society as a whole.

However, ICM officials increasingly are recognizing the need to draw upon a variety of policy instruments in order to implement and sustain programs. Economic incentives being used include user fees, penalties, subsidies, taxes and the polluter pays principle for damages. These financing mechanisms, beyond providing support for ongoing ICM operations, can provide incentives that reinforce ICM by, for example, reducing pollution and overuse of coastal resources. (Regulatory instruments, such as zoning, performance or technology standards, permits and licensing also are used frequently.)

[7] *Tradeable pollution permits, an incentive-based approach, is another alternative. For further discussion and examples, see Grigalunas and Congar (1995).*

When the choice of ICM financing has important effects on coastal uses or pollution, then it can affect B_d or C_e and thus may need to be considered as an integral part of a framework to assess the effectiveness of ICM. However, a detailed discussion of sustainable financing issues is outside the scope of this paper[8].

Summary

To sum up, the following steps are involved with assessing the effectiveness of ICM programs:

a. Identify the key issues.

   1. Programs to address these issues must be clearly specified.

   2. Scoping of issues will allow attention and limited resources to be focused on issues of greatest importance, putting aside minor issues.

b. Identify impacts and the associated types of benefits and costs.

   1. Include all important benefits and costs-both market and non-market.

   2. Only incremental effects due to the proposed program or project are relevant.

   3. Include only direct benefits and costs-not secondary or "multiplier" effects.

   4. For use of otherwise unemployed inputs, adjust market costs downward to reflect their opportunity costs.

   5. Ignore transfers and avoid double counting of benefits or costs.

c. Quantify the impacts identified in #2.

d. Value the benefits and costs of the quantified impacts. Use market and non-market resource valuation techniques.

e. Compare total benefits and costs.

f. Consider the effects on stakeholders-who gains and who pays.

[8] *See* Ross et al. (1997).

Of course, it is easy to describe the benefits and costs of ICM in general terms. However, quantifying benefits and costs—especially non-market valued benefits and costs—can be challenging. In the next section, two case studies are used to illustrate the estimation of some benefits and costs, the data needed and other challenges.

Examples of Application of Benefit-Cost Analysis for ICM

Introduction

This section gives two examples of the application of the benefit-cost framework for ICM presented previously. One example (Hikkaduwa, Sri Lanka) reviews an economic study of actions to control environmental degradation to support sustainable coastal tourism. The second example considers resource conflicts in a busy port area and an important tourism destination (Xiamen, China) that has been designated a national port growth center.

Environmental Degradation and Sustainable Coastal Tourism-Sri Lanka

Hikkaduwa, located on the southwest coast of Sri Lanka, has been an important tourist destination and an important source of income for local businesses and residents. However, degradation of the environment threatens the sustainability of tourism activity at the site. Important issues include solid and domestic waste, destructive use of coral reefs (including coral mining and damage from tourism activities), and overfishing of reef fish. Barker (1995) has studied the private and the social benefits and costs of a Special Area Management (SAM) plan for this area. The results of her work are summarized below.

Summary of Methodology, Data and Results

Private benefits and costs. Barker's analysis of private (financial) benefits and costs assessed the returns to tourism businesses due to installation of solid and domestic waste facilities. She estimated the extra investment and annual operating costs for solid and domestic waste collection and treatment. She also estimated the benefits by comparing projected growth in tourism profits with improved waste collection and treatment as compared to the no-collection and treatment case. On the basis of a comparison of costs with benefits, she concluded that the provision of improved waste management facilities was a good investment from a financial point of view. As noted, she also examined broader benefits and costs.

Social benefits and costs. To estimate social benefits and costs, other broader factors involving non-market benefits and costs had to be considered, and certain adjustments of the private benefits and costs were required, as described below. For example, she used the results of two contingent valuation studies to estimate the economic value recreationists put on beach use and use of the coral reef. A market-based recreation, Visitors' Center, was also considered.

Briefly, a sample of users of the coral reef (divers) were asked, in survey, their willingness to pay to a fund to ensure preservation of the reef, which as noted has been threatened by mining and by damage from boats. Beach users were asked, in a different survey, their willingness to pay for access to the beach.

Also included were the net benefits of a new Visitors' Center, measured by estimated extra revenues minus the costs. The costs of prohibiting mining of coral was also considered (although the resulting benefits, e.g., reduced beach erosion, were not).

As noted, several adjustments of private costs were made to estimate social benefits and costs. For example, items such as taxes paid by tourism operations (mostly locally owned) are transfers from one group (tourism businesses) to another (society through government) within the same society and not costs to society as a whole. Hence, taxes had to be added back to private benefits to estimate social benefits.

Also, the unemployment rate in the area was high (13%) to take account of the use of labor that would otherwise have been unemployed. Money labor costs were adjusted downward by 13% to reflect better the true opportunity cost of labor. Costs of incremental social welfare operations were included, using staffing costs for these activities; possible increases in crime, prostitution and AIDS were described qualitatively.

Overall, the SAM had a positive NPV. To account for uncertainty, a series of sensitivity analyses were done. The NPV was positive for every scenario considered in a series of sensitivity analyses, except for one "worst case". The fact that the cumulative NPV was estimated to be positive (for all but the worst case) after only several years (i.e., there was a short payback period) provides some reassurance to those concerned about uncertainties associated with the investment.

Distribution of Benefits and Costs

An analysis of the gains and costs of the SAM concluded that most (72%) of the gains would accrue locally to the tourism industry. International visitors also gained 22% of all benefits in that their economic benefit from the use of the beach and coral reef (measured by their willingness to pay) was less than their cost (the cost in fact is near zero for those already at the site). National economic welfare also would increase by capturing part of the gain in locally generated tax revenues.

The SAM plan cost would account for most (72%) of the costs, and this would be distributed across various groups. A big loser would be a coral miner (27% of all costs); a search for alternative employment for this group is recommended.

Discussion

This study is an interesting application of benefit-cost analysis from several viewpoints. First, a benefit-cost analysis was done from a private as well as a social perspective, illustrating how financial and broader non-market valuation estimates can be judiciously assembled and integrated to address important, challenging and common coastal issues. Second, the analysis of the distribution of benefits and costs was important by demonstrating the substantial benefits that would be received by the tourism industry, this important stakeholder group became proponents of the SAM.

Note that several factors were not included in the analysis. For example, the improvement in environmental quality due to SAM would be expected to raise coastal property values, but such a study was not done. A study of property value increases is an alternative way to measure benefits, but note that including benefits to recreationists, to tourism operators and increased property values could create the problem of double counting benefits, since the value of property in this case is derived, in large part, from recreation and tourism.

INREASING WATERFLOW IN WESTERN SEA AREA, XIAMEN, CHINA

A medium-sized city of some 1.2 million people, Xiamen has extensive development along much of its shoreline. Port activity, tourism and recreation, and fisheries all are important coastal uses. Xiamen is one of China's major ports and has been identified as a port growth center by national authorities (ITTXDP, 1995).

With 5.5 million visitors in 1992, recreation and tourism are major activities. Marine sites, including beaches on Gulangyu and Xiamen Islands are important destinations for recreation. Commercial fishing in offshore waters is a large activity, as is extensive mariculture operations (over 75 km^2 in 1992) in shallow waters and extensive tidal flats around Xiamen (ITTXDP, 1995).

Following construction of the Maluan Dam, tidal flushing in the Western Sea Area (WSA) was reduced. As a result, the WSA experienced increased siltation and required more frequent dredging, threatening to limit shipping. Also, oil and rubbish from berths and vessels, and organic pollution from mariculture and domestic sewage have been serious sources of pollution. The reduced flushing in Maluan Bay has lowered the assimilative capacity of area waters, by that aggravating the effects of pollution. Bacterial pollution indicated by coliform has been a serious problem, and the reduced scenic quality of the

WSA's water apparently has had negative effects on Xiamen's tourist industry (although no study results are available for this last issue).

Several ICM studies have been done in Xiamen, primarily for the WSA. The WSA is the focal point of activity and is also near recreational sites, such as beaches on Gulangyu Island and Xiamen Island. These studies are outlined below.

Summary of Methodology, Data and Preliminary Results

One study examines the benefits and costs of widening two sluice gates on Maluan Dam for the purpose of increasing water flow in the WSA. A preliminary benefit-cost analysis by Yao and Hong (1997) examines some of the issues raised above. Their preliminary calculations are shown in Box 1.

Hence, the preliminary results show net benefits of RMB858.3 million (1,118.1 - 259.8) for a benefit-cost ratio of 4.3

Box 1. Calculation of Benefit and Cost: Increasing Waterflow in Western Sea Area.

Benefits (in RMB million)	
Reduced dredging costs-channels & anchorage area	61.9
Other reduced dredging costs	202.5
Increased shipping income	314.4
Decreased cost for sewage treatment	10.5
GDP increase from increased shipping income	528.8
Value of land added	not identified
Total benefits	1,118.1
Costs (in RMB million)	
Cost of opening and enlarging sluice gates	24.8
Cost of constructing bank revetment	160.0
Lost income to displaced mariculture	75.0
Total costs	259.8

Source: Yao Lixin and Huasheng Hong (1997).

Discussion

It is noted that additional benefits, such as increase in valuable land and added tourism and recreation benefits due to the project, have not been included in the preliminary estimates. These benefits could be considerable and warrant further investigation. On the other hand, the preliminary benefits appear to include substantial secondary effects

(RMB528.8 million) which normally are excluded from a strict accounting of benefits. Also, operating and maintenance costs were omitted from the preliminary benefit-cost analysis, by that understating costs.

However, Yao and Hong (1997) could expand their work to encompass important benefit issues not being addressed at the present time. Their ongoing work also could be strengthened and in general the program could benefit from more consideration of economic issues to complement their work in the natural sciences. In particular, no estimates have been made of recreational benefit; these are likely to be considerable. A travel cost study could shed much light on this issue. Also, no studies have been made of the public's value (willingness to pay) for environmental improvements, such as beach quality or prevention of beach erosion.

Indicators for ICM

Indicators can provide benchmarks against which the success of ICM programs can be measured. They also can complement benefit-cost analyses by providing information that captures the results of ICM programs that cannot be quantified in monetary terms in a benefit-cost analysis.

Given the focus of this socioeconomic framework on the impacts on people, an "ideal" indicator would capture the effectiveness of each ICM program in improving the well being of area residents. This means that interests are in those items listed in the north-east corner of Figure 1: Impacts on People.

Using this "ideal" standard, one would look at the stated objectives of particular ICM programs and attempt to link them with outcomes valued by people. For example, indicators of success of ICM policies designed to improve water quality with the goal of enhancing commercial fishing or water-based recreation would focus on changes in fish earnings and landings and recreational benefits and use. ICM programs intended to avoid or reduce illness from seafood consumption would use as an indicator the incidence rate and associated costs for these illnesses. Policies intended to improve general amenities (water quality, beach cleanliness, habitat or open-space preservation) will be reflected in higher nearby property values, so that changes in property values can be used as an indicator (e.g., Edwards and Anderson, 1984).

However, often serious challenges hinder development of clear indicators for particular ICM programs. These include: (1) establishing cause and effect, (2) the need for quality monitoring data—and its costs, and (3) ambiguity in individual indicators.

Perhaps the most difficult challenge for developing indicators is the issue of cause and effect, that is, isolating the effects of specific ICM actions from all other factors that influence any indicator used. This can be a major problem. Many factors determine what happens in an area, and not all of these are under local control of ICM managers. For example, institutional restrictions might limit the scope of an ICM program[9]. Developments within and outside the ICM program area, but not under the control of the ICM program,

[9] *For example, a watershed may be the ideal area for an ICM program, but prevailing rules may limit the ICM program to only part of the watershed. In addition, important activities causing environmental degradation, e.g., government facilities, might be outside the scope of an ICM program.*

may adversely impact ICM environmental objectives, and limit or swamp the positive effects of ICM actions. An uninformed observer might conclude that ICM programs were not sound, when the underlying reason for limited success might be the narrow scope of the ICM program, an institutional design or political issue.

For example, policies at different levels of government may conflict, as when a coastal area is put under enormous development pressure due to national policies promoting port development or mangrove conversion in the area. Or, a national policy that taxes cement imports may encourage construction operators to use substitute materials from mined corals (as occurred in the Sri Lanka example, mentioned earlier).

Other challenges to establishing cause-and-effect arise when (a) several ICM measures are intended to address the same or similar problem (e.g. water quality), so that it may not be possible to isolate the effect that each program has, or (b) a single program effect has multiple indicators (e.g., water-based recreation and health) with varying degrees of effectiveness.

Another issue concerns the importance of obtaining valid and reliable monitoring data. Use of some indicators, e.g., water quality, requires that valid sampling design and testing protocols be developed. Monitoring that is valid and reliable, however, can be expensive (although cost-saving options, such as use of trained volunteers, might lower costs).

Problems with identifying unambiguous indicators is another potential problem and may be the reason why some use proxy or "second best" indicators, such as changes in water quality rather than changes in value, or in the level of an activity. Water quality may well be associated with benefits to people, but need not be, hence, water quality may not be an ideal indicator, if the goal is to assess benefits to people. However, adequate measures of water quality may not be available[10], so that resort may be made to "third-best" indicators, such as pollution loading. The tie between loading and benefits to people may be tenuous, but in some cases no better measures may be available[11].

Mindful of the potential difficulties with indicators mentioned above, a pragmatic approach is adopted. When possible, measures reflecting impacts on people are recommended. Hence, property values, health effects and value of fish landings[12] are suggested indicators.

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[10] *For example, any single indicator, e.g., a measure of water quality, such as dissolved oxygen, may vary over time and space, complicating efforts to assess trends and the effects of ICM programs in an area. Multiple indicators could be used, but may give inconsistent results.*

[11] *Inherent difficulty in providing objective measures of program effectiveness may be the reason why some officials cite the amount spent on programs, anecdotes or letters of appreciation when asked what they are "doing" about an issue.*

[12] *It is recognized that problems with over exploitation by municipal or outside fishers may be outside the scope of authority of officials charged with implementing ICM.*

However, less-than-ideal indicators may provide useful information in some cases. Thus, water quality is included with the understanding that monitoring is or will be an important component of ICM at demonstration program sites so that systematic water quality data based on sound sampling and testing should be available. Programs to reduce wastes in coastal waters or along shorelines would use such indicators as measures of the extent of debris or garbage (e.g., amount of solid waste per kilometer) recorded in simple survey, or perhaps measures of waste handled or treated. Other pragmatic indicators could include the number and/or area of open space, marine reserves or shore side beaches or parks.

References

Barker, V. 1995. Economics of sustainable ecotourism development: analysis of a special management plan. Coastal Resources Management Plan. Working Paper No. 06/ 1995. Sri Lanka.

Braden, J. and C. Kolstadt. 1991. Estimating the demand for environmental quality. North Holland Publishing Co., New York.

Edwards, S. and G. Anderson. 1984. Land use conflicts in the coastal zone. J. of the Northeast Agric. Econ. Coun. 13(1):73-81.

Freeman, A.M. III. 1993. The measurement of resource and environmental values: Theory and methods. Resources for the Future, Washington, D.C.

Grigalunas, T.A. and J. Opaluch. 1989. Managing contaminated marine sediments: Economic considerations. Mar. Policy 13(4).

Grigalunas, T.A. and R. Congar, Editors. 1995. Environmental economics for integrated coastal area management: Valuation methods and policy instruments. Regional Seas Reports and Studies No. 164, 165 p. United Nations Environment Programme, Nairobi, Kenya.

ITTXDP (Integrated Task Team of the Xiamen Demonstration Project). 1995. Coastal environmental profile of Xiamen. MPP-EAS Technical Report No. 6, 110 p. GEF/ UNDP/IMO Regional Programme for the Prevention and Management of Marine Pollution in the East Asian Seas, Quezon City, Philippines.

Hanley, N. and C.L. Splash. 1993. Cost-benefit analysis and the environment. Edward Elgar Publishing Co., Brookfield, Vermont.

Kopp, R. and V.K. Smith. 1993. Valuing natural assets: The economics of natural resource damage assessment. Resources for the Future, Washington, D.C.

Mitchell, R.C. and R. Carson 1989. Using survey methods to value public goods. Resources for the Future, Washington, D.C.

National Research Council. 1979. Polychlorinated biphenyls. Committee on Assessment of Polychlorinated Biphenyls in the Environment. Environment Study Board, Commission on Natural Resources, NRC National Academy Press, Washington, D.C.

Ross, S.A., C. Tejam and R. Rosales, Editors. 1997. Sustainable financing mechanisms: Public sector-private sector partnership. MPP-EAS Conference Proceedings No. 6, 352 p. GEF/UNDP/IMO Regional Programme for the Prevention and Management of Marine Pollution in the East Asian Seas, Quezon City, Philippines.

Yao Lixin and Hong Huasheng. 1997. Socioeconomic impact assessment on integrated treatment of marine environmental problems in Western Sea Area of Xiamen. Xiamen University (unpublished).