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A GUIDE TO IMPACT ASSESSMENT IN COASTAL ENVIRONMENTS

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TABLE OF CONTENTS

	<u>PAGE</u>
PREFACE	vii
EXECUTIVE SUMMARY	viii
1 INTRODUCTION	1
1.1 What Is Impact Assessment?	2
1.2 Organization of the Manual	3
2. CONCEPTUAL FRAMEWORK	4
2.1 The Impact Assessment Triangle	4
2.2 Development Actions	6
2.3 The Environmental Setting	9
2.4 The Social Setting	14
2.5 The Impact Assessment Process	18
3. CHARACTERISTICS OF IMPACTS	19
3.1 Causal Factors, Effects, and Impacts	19
3.2 Direct and Indirect Impacts	19
3.3 Impact and the Baseline Condition	22
3.4 Cumulative, Synergistic and Antagonistic Impacts	22
3.5 Probability and Risk	27
3.6 Duration	27
3.7 Intensity and Spatial Extent	29
3.8 On-Site and Off-Site Impacts	29
3.9 Reversibility and Irreversibility	29
3.10 The Social Incidence of Costs and Benefits	29
3.11 Mitigation of Adverse Impacts	31
4. THE EVOLUTION, DISSEMINATION AND OBJECTIVES OF IMPACT ASSESSMENTS	34
4.1 Incorporating Impact Assessment into the Planning Process	37
4.2 Impact Assessment in Developing Nations	38
4.3 The Objectives and the Intended Benefits	42
5. THE IMPACT ASSESSMENT PROCESS	44
5.1 Description of the Proposed Action	48
5.2 Screening	49
5.3 Scoping	59
5.4 The Identification and Selection of Alternatives	62
5.5 Estimation	64
5.5.1 Estimation Methods	64
5.5.2 Data	68
5.6 Evaluation and Presentation	69
5.6.1 The Comparison of Alternatives	70

5.6.2 Comparison of Impacts to Adopted Plans or Standards	73
5.6.3 Incidence of Impact	76
5.6.4 Presentation	76
5.7 Review and Comment	78
5.7.1 Revision of the Review Draft	79
5.8 The Decision	80
5.9 Auditing Impacts	82
6. PROGRAM EVALUATION	85
7. INSTITUTIONAL ARRANGEMENTS FOR IMPACT ASSESSMENT	86
7.1 Public Participation	93
REFERENCES.....	98

LIST OF FIGURES

	<u>PAGE</u>
Figure 2.1: The Impact Assessment Triangle.....	5
Figure 2.2: Levels of Planning and Decision-Making in a Developing Country.....	7
Figure 2.3: The Project Cycle: Environmental/Natural Resources Inputs.....	10
Figure 2.4: Generalized Interconnections of Coastal Watersheds, Estuary Wetlands, and Ocean Basin Systems.....	13
Figure 2.5: Multipurpose Dam Projects and the Loss of Economic Development Opportunities.....	15
Figure 2.6: Various Aspects of the Social Setting that Influence the Impact Assessment Process.....	17
Figure 3.1: An Impact Network with Direct and Indirect Impacts.....	20
Figure 3.2: A Network Depicting the Impacts of Dredging.....	21
Figure 3.3: The Dynamic Baseline.....	23
Figure 3.4: Cumulative Impact of Four Different Parameters.....	24
Figure 3.5: Cumulative Impact of the Same Parameter, Estuary Sedimentation.....	25
Figure 3.6: Relationships Between Time and the Location in Which the Impact Occurs.....	28
Figure 5.1: Relationship Between IA Steps and Types of Development Actions..	45
Figure 5.2: Flow Diagram Showing the Main Components of an EIS System...	46
Figure 5.3: Sri Lanka Coast Conservation Department (CCD) Procedure for Reviewing and Issuing Permits.....	47
Figure 5.4: Overlay Mapping Process.....	55
Figure 5.5: Plan Compliance and the Co-Evolution of Impact Assessment and Environmental Management Plans.....	57
Figure 5.6: Categories of Boundaries which Determine the Region of Influence to be Studied for Environmental Impact Assessment.....	61
Figure 5.7: Interconnected Methods for Estimating Atmospheric Effects.....	67
Figure 5.8: Specification and Aggregation of Impacts.....	71

Figure 5.9:	A Simplified Scoring-Weighing Comparison of Three Alternatives.....	72
Figure 5.10:	A Summary Table for Choosing Among Alternatives.....	74
Figure 5.11:	Getting the Message into the Minds of Decision-Makers.....	77
Figure 5.12:	Two Contrasting Decision Contexts.....	81
Figure 5.13:	Eight Reasons Why Adverse Impacts Will Continue to Occur.....	83
Figure 7.1	Institutional Arrangements for Administering the Impact Assessment Process.....	87
Figure 7.2:	Relationship Between the Environmental and the Institutional Context.....	92
Figure 7.3:	The Tantalum Riot: Some Lessons Learned.....	95
Figure 7.4:	Capabilities of Public Participation.....	97

LIST OF TABLES

	<u>PAGE</u>
Table 2.1: Characteristics of Planning versus Project EIA.....	8
Table 3.1 Cumulative Impact Over Time.....	26
Table 3.2: Potential Monetary Returns from Various Mangrove Resources in Papua New Guinea.....	30
Table 3.3: Mitigation Measures for a Coal Pipeline.....	33
Table 4.1: Nations and States (or Provinces) with Impact Assessment Requirements.....	35
Table 4.2: Differences in Emphasis in Assessment Between Developed and Developing Countries.....	39
Table 5.1: List of Those Projects or Activities in Thailand Requiring Preparation of an EIS.....	51
Table 5.2: Potential Impacts of Particular Concern According to Coastal Habitats.....	53
Table 5.3: Screening Questions.....	54
Table 5.4: New York State Classification and Standards for Surface Waters...	75
Table 7.1: The Relative Strengths of the IA Process as a Function of the Institutional Arrangement.....	89
Table 7.2: Public Participation Objectives.....	96

PREFACE

Coastal regions are home to three-quarters of the world's population. They support many of the world's most productive and biologically diverse ecosystems, produce most of the world's fish catch, and support significant portions of the world's agriculture, industry and tourism. The number and variety of demands placed on coastal resources create a complex and urgent need for integrated rather than sectoral resource management strategies and programs.

Successful coastal management is issue driven and is achieved by resolving existing problems with a combination of science, policy, law making and administration. One important component of successful coastal management is impact assessment (IA), which attempts to determine the environmental and social consequences of proposed development actions. The goal of impact assessment is to provide public policy-makers with the best available information for minimizing the environmental and social costs and maximizing the benefits associated with a proposed development or deciding on the basis of objective information that the proposal should not be implemented. Impact assessment can help ensure the viability of a development action, and prevent wasting a nation's scarce financial resources. An effective IA process may also avoid shifting the costs of adverse impacts onto the less advantaged, less organized, and poorer members of society. IA procedures by themselves, however, are insufficient to guide environmentally sound sustainable development, but should be a feature of natural resources and integrated coastal management programs.

The process by which an IA is carried out is determined by a number of laws, policies and governance structure that determine who will participate and how. A common finding in the impact assessment literature is that the problems encountered in IA are attributable more to the institutional arrangement within which an IA occurs than the IA analysis itself. However, the steps by which an IA proceeds should be the same regardless of a nation's level and need of economic development or its culture: (1) description of the proposed action; (2) screening; (3) scoping; (4) identification and selection of alternatives; (5) estimation; (6) evaluation; (7) review and comment; (8) the decision; and (9) auditing impacts.

This Guide is an effort to map out the EIA process and to address the realities facing project managers in developing nations attempting to link this process with the goals of sustainable development. We invite comments from our readers and hope this Guide proves useful to all those striving to achieve responsible and effective development around the world.

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EXECUTIVE SUMMARY

Environmental impact assessment attempts to determine the environmental and social consequences of proposed development actions. Impact assessment (IA) is, in essence, the same as the adage “look before you leap.” The general goal of impact assessment is to provide public policy-makers with the best available information that will minimize costs and maximize benefits associated with a proposed development.

During the last two decades, the scope of EIA has broadened from its initial focus on the physical environment to include socio-economic factors. In fact, it is not uncommon for socio-economic factors to dominate the assessment. Therefore, the term ‘impact assessment’ usually refers to the analysis of both socio-economic and physical environmental factors. It should be noted that impact assessment has historically measured the quantifiable socio-economic effects of development projects. Today, it is more commonly used to describe the process of identifying and measuring environmental effects.

The practice of environmental impact assessment emerged in the early 1970s with the first United Nations conference on the environment (the Stockholm Conference) and the enactment in the United States of the National Environmental Policy Act (NEPA). The most important aspect of NEPA is the requirement that federal agencies prepare an impact statement, if their recommended development action might generate significant adverse environmental impacts. In the early 1970s environmental planners, including the authors of this manual, expected NEPA and The Stockholm Conference to produce a large shift in the government decision-making process toward adopting goals promoting environmental protection and conservation. Unfortunately, the expected shift toward adopting environmental planning and impact assessment did not happen in the United States nor in the other 40 or more nations and 50 states or provinces that require impact assessments.

Institutional Arrangements and the Politics of IA

An institutional arrangement is a composite of the laws, policies and governance structure that determines what the process will be and who will be the participants. It is difficult to draw the line between the institutional arrangement and the process, as each influences the other. A common finding in the impact assessment literature is that the problems encountered in IA are far more attributable to the institutional arrangement of IA than to the IA process. Certainly there are problems with the IA process, such as the lack of good cost-effective models and inadequate data. But these are relatively minor in comparison to institutional impediments, such as inadequate authority and insufficient budget. One cannot realistically examine IA as a planning tool or analytic procedure in isolation from institutional arrangements and the policy-making process. The study of impact assessment should include the study of institutional arrangements for conducting the IA process as well as the IA process itself.

Politics is usually defined as the allocation of scarce resources among competing interests. Environmental impact assessment is one of the many analytical techniques used to make decisions on the allocation of scarce resources. The IA process and institution can become a political instrument. It can alter the balance of power in government decision-making, providing more opportunity for placing environmental issues on the public agenda. It can easily change the status quo of political relations among all government and non-government organizations that have vested interests in natural resources or the environment. This potential power to change existing political relations is the primary

reason why most governments have not established an implementation arrangement that will enable environmental impact assessment to reach its full potential to both maintain environmental quality and accommodate sustainable socio-economic development.

Most developing countries have an institutional arrangement for preparing national plans and programs for appraising projects. However, rigorous economic or social criteria are rarely applied to internal project planning and approval. Many decisions are politically determined and a few are reviewed according to multiple criteria, such as environmental and socio-economic impacts.

After nearly twenty years of history, a significant amount of knowledge is available to governments about all aspects of the impact assessment process. Is impact assessment merely a procedure to appease the conservationists or is it intended to provide information to be incorporated into the decision-making process? Although there is a relatively small amount of literature on the practice of impact assessment in developing nations, a common theme can be identified. Impact assessment provides a procedure whereby environmental and other concerns regarding the impact of development activities are raised, however, these concerns are not necessarily incorporated into the decision-making process. Most international assistance organizations, such as the World Bank and the U.S. Agency for International Development, require recipients to include IA as a component of program and project planning. If the governmental or authoritative structure in a developing nation views impact assessment as an imposition, it can be expected that the IA institutions will not be given the resources or authorities needed for the process to achieve its objectives.

In local, state, or national governments where there is strong support for environmental quality, impact assessments provide an effective tool. In these governments, IA is integrated into all aspects of planning and project design. However, most governments in the world, particularly in developing nations, are more oriented to immediate gains in socio-economic conditions than the long-term maintenance of environmental quality and the sustainable use of national resources.

Changing the Focus from Products to Process

Generally impact assessment has been viewed far more as a product -- usually an impact statement -- than as a continual process to improve public policy-making. The emphasis of impact assessment programs should be on the process of providing better information, not the package of information presented. The IA process should be designed to provide useful information to decision makers at the right time in the evolution of a plan or project. IA should enhance and augment the project planning process. Only by actually shaping projects in their early phases can IA become an important instrument for protecting the environment and society. Clearly more work must be done to incorporate impact assessment principals and methods into all phases of development planning.

Administrators of IA programs need to be realistic about the opportunities that exist to include environmental concerns in the decision-making process. Ideally, the IA process should influence the choice of alternatives. If that is not possible, the process should influence the location and design of the alternative chosen. If this fails, they should attempt to mitigate any adverse impacts.

The importance of early liaison between governmental agencies involved in an IA process cannot be overemphasized. Not only does early liaison enhance the potential for coordinated government action on projects affecting the environment, it also enhances the

potential for identifying the most effective and efficient alternatives in the design of development actions.

Changing the Focus from Projects to Plans

Almost all the literature on the topic of environmental impact assessment is focused on the preparation and circulation of impact statements, particularly EIAs for very large-scale development projects. It is relatively easy to assess the impacts of large projects. The size of the project and the magnitude of potential impact will attract the interest of those groups and individuals that may be adversely affected by the proposed development. Also, large projects are few in number. By contrast, middle- and small-scale projects are large in number and often do not come to the attention of affected interests. They also burden regulatory agencies with continuous work.

Conducting impact assessments at the project level does not achieve economics of scale. Many individual impact assessments conducted within the same environmental system will exceed the total cost of conducting one regional impact assessment for the entire system. National, state, or local coastal management programs provide an excellent illustration of the comparative costs of assessing impacts on a project by project basis or by comprehensive land and resource use plans.

Most coastal management programs start off by assessing the impacts of each project that might generate significant impacts. Soon it becomes very apparent that project by project review not only fails to adequately assess cumulative impacts but it is also very costly. The more efficient and cost-effective alternative is to prepare a system-wide plan that integrates all the relevant environmental and social factors. Once the plan is complete, impact assessment then becomes a relatively simple and low cost determination of whether the proposal conforms with the plan. If the coastal plan is based on a sound environmental assessment, only those proposed projects that fail to conform to the plan are likely to require detailed environmental assessment.

The management of cumulative impacts is one of the most persuasive arguments for changing the focus from projects to plans. The cumulative impact of many middle- and small-scale projects is often much greater than the impacts of one or two large-scale projects. Cumulative impacts are insidious, like a slow death from the ingestion of small amounts of poison over time. Each development action adds an imperceptible amount of poison to environmental systems such as estuaries and watersheds. By the time cumulative impacts become apparent the system has been substantially degraded and often is beyond recovery or at least a recovery to its original productivity. Cumulative impact assessment is a basic and essential requirement for the management of coastal resources and environments. The coastal zone is an aggregation of at least eight environmental and physical systems, such as estuaries and watersheds. Each must be managed to control cumulative impacts. Environmental planning on a system-wide basis is the most effective means to assess and manage cumulative impacts.

Benefits and Costs

Many critics of impact assessment decry the process for delays and the additional expenses it generates. They argue for a streamlined impact assessment and permit process. Clearly, there is an inverse relation between the added expense of identifying and correcting mistakes in the assessment of proposed development proposals and the additional costs to mitigate significant adverse impacts once the development is in operation. It is better to be

on a slow train that is traveling in the right direction than to be on a fast train headed in the wrong direction.

While benefits of IA can be qualitatively enumerated such as saving rare and endangered species, there is comparatively little quantitative information. Examples such as, "the EIA savings of six million dollars in implementation costs," are few and far between. It has been estimated that the EIA process costs between one to two percent of the total capital costs of a project. In very few cases the IA studies exceeded five percent of a project's capital cost. Even at five percent, the portion of the budget spent on the EIS is very small in comparison to the overall costs of project planning and development.

In the late 1970s, the U.S. Environmental Protection Agency conducted an evaluation of 58 environmental impact statements done on waste water treatment facilities (Canter, 1987). The average EIS produced two and a half major changes in the characteristic of the facilities. These changes generally were: the location of the facility; the capacity of the facility; and the area served by the project. Moreover, the evaluation concluded that changes caused by the EIS resulted in an average net benefit of US \$6 million dollars (the average cost of the changes was US \$6 million and the average reduction in total project costs was US \$12 million).

Hundreds of millions of dollars have been spent in the US on preparing and reviewing impact assessments, most of which are large ponderous documents that discourage all but the most intrepid reader or a paid reader employed by the government to review such documents. In comparison, a small percentage, probably less than one percent, of the amount spent on the preparation and review of EIAs has been spent on improving the state of the art or improving institutional arrangements. Consequently, the state of the art as well as the administration of EIAs has not made substantial improvements in the last twenty years. Most of the analytical and institutional problems that were identified and discussed 15 years ago are still with us now.

Developed and Developing Nations

There are several differences in emphasis between developed and developing countries. Five differences are summarized in the text by Horberry, 1984. Experts observe that the process in developed countries is often too rigid, too expensive, too methodologically ambitious and too separate from the planning process. Most authors do agree that emphasis should be put on IA approaches that are :

- not exhaustive and unnecessarily elaborate;
- do not involve complicated methodologies;
- are geared towards identifying mitigation and management measures; and
- take account of multiple objectives and consequent trade-offs.

All this is a tall order for any country. Perhaps what is really needed is a demystification of IA and an emphasis on sound policies supported by realistic procedures and suitable technical analysis. If the policy concern exists and there are mechanisms for ensuring effective implementation, the most pressing need is for skilled and experienced planners. If a procedural approach is necessary to ensure compliance, then planners should specify the most flexible, cost-effective and simple methods for obtaining the appropriate information and analysis.

Improving the Impact Assessment Process

There is a general consensus among IA practitioners and researchers of a common impact assessment process, which does not vary significantly among different nations regardless of their level and need of economic development or their cultural setting. This manual divides the IA process into nine steps: (1) description of the proposed action; (2) screening; (3) scoping; (4) identification and selection of alternatives; (5) estimation; (6) evaluation and presentation; (7) review and comment; (8) the decision; and (9) auditing impacts.

The IA process is initiated by a description of the proposed action. The description is then screened to determine if an IA should be conducted. Screening should also indicate the relative scale of assessment that is needed. If screening indicates that an IA should be conducted, the scoping step establishes the terms of reference for the IA. Closely aligned with the scoping step is the identification and consideration of alternatives to the proposed action. A comparative evaluation is then conducted of the proposed action and its alternatives. Next, it is common to circulate a draft assessment for review and comment prior to the decision step. The last step is monitoring the actual impacts of the action taken.

The periodic updating of this manual is facilitated by dividing the impact assessment process into discrete steps. There is a continual stream of new IA literature. The steps in the IA process provide a systematic means of incorporating new ideas from the continual flow of IA documents. The IA information system that is recommended in Appendix A also uses the steps in the IA process as the organizing framework.

Description of the Proposed Action

This step starts the process of impact assessment. The basic objective of this step is for the description to provide adequate information to conduct the next seven steps of the process. If the impact assessment is to be prepared by an institution other than the unit that has described the action, it is obvious that the description must provide the information needed to conduct an adequate assessment. Similarly, and no less importantly, the description must provide reviewers unfamiliar with the proposed (or completed) action sufficient information to conduct an adequate independent review. This means that the action description has to provide enough information for reviewers to conduct their own impact assessment, if deemed necessary. This personal impact assessment is independent from the impact assessment done by the institution that conducted the impact assessment.

Screening

The second step of the impact assessment process, screening, determines whether an IA is needed. Ideally, this step quickly and easily identifies those actions that should have their impacts assessed and identifies those projects that do not warrant the IA process. In practice the screening step sorts actions into three categories:

1. those clearly requiring IA;
2. those clearly not requiring IA; and
3. those for which the IA need is unclear and therefore further analysis is required.

The manual outlines six analytic methods that have been used to screen development proposals.

Scoping

The scoping step in the IA process establishes the terms of reference for the impact assessment. It is one of the most important steps in the process.

The scoping step should be designed to overcome one of the inherent pitfalls in impact assessment—the initial tendency to identify all potential impacts without regard to what is important to decision-making. The impact assessment process often goes through an evolutionary phase whereby initial efforts are devoted to compiling massive compendia of scientific and technical data, much of which is of marginal relevance to the most significant issues. Therefore, the scoping step needs to identify those which will be the most likely and severe impacts.

The expenses of IA are closely related to the number of issues selected, the inherent complexity of those issues, the amount of time needed to complete the assessment, and the geographic boundaries of the assessment. One reason that impact assessment is expensive in developing countries is due to limited amounts of existing information. As a result, a large amount of baseline information must often be collected. Information collection and analysis is one of the most expensive aspects of the impact assessment process. Scoping is important as it prevents the costly collection of information that may be irrelevant or marginally important to the ultimate decisions for the proposed action.

The most important factor in the scoping step is who participates. It is common for scoping to be done only by the lead agency. This is particularly true of projects that are not large scale in size or impact. In the scoping stage, the lead agency will have to decide on the participation of other government units as well as non-government interests that may be affected by the proposed development action. This is particularly true of large scale projects. In many cases public participation in the scoping step is required by law or administrative guidelines. It has been repeatedly demonstrated that public involvement can produce acceptable terms of reference for the impact assessment and reduce the likelihood of controversy once the assessment has been prepared.

Identification and Selection of Alternatives

The identification and consideration of alternatives is one of the key aspects of impact assessment. This step provides the means by which the action's assumptions, goals and needs may be examined. A range of alternatives provide the basis for a comparative assessment of the different means to achieve the stated objective of the development action. In an assessment of alternatives, decision-makers should be provided with the information on how each option compares in respect to the relative costs and benefits for each impact.

One common difference between large-scale projects and small-scale projects is that large-scale projects usually pose a full range of alternatives. If any alternative is proposed by a small-scale project, it is the "no action" alternative.

The identification and selection of alternatives usually involves three questions:

- How should alternatives be identified?
- What is the reasonable range of alternatives to be considered?

- What level of examination should be applied to each alternative?

Estimation

Once the significant impacts have been determined by the scoping step, an estimation should be made of each impact. Ideally the estimation would provide quantification of four dimensions:

Probability of Occurrence - To what extent is impact likely to occur? The probability can range from 1 (absolute certainty that the impact will occur) to an infinitely small percentage such as .0001 for the likelihood of a coastal development being destroyed by a tsunami.

Duration - Will the impact occur only during a phase of the proposed development action, such as soil erosion during the construction phase, or will the impact be permanent, such as the extinction of a species?

Magnitude - What will be the spatial dimensions of the impact? What will be the intensity of the impact - such as decibels of noise, parts per thousand turbidity, or the number of new employees?

Social Distribution or Incidence - What social groups and interests are positively or negatively affected by each impact?

Making a quantitative or even a qualitative estimation of impact usually requires data and one or more estimation methods. There are a number of general criteria to use when choosing between different estimation methods. Such criteria include accuracy, appropriateness of the task to be undertaken, replication, consistency, and economy in the use of time and other resources.

Evaluation and Presentation

The sixth step of the impact assessment process consists of presenting the estimated impacts in terms that are understandable to both those potentially affected by the impact and the decision-makers. Deciding what action to take involves determining the significance of estimated impacts as well as their socio-economic consequences. Evaluation can also be likened to the task of comparing 'apples and alligators,' for example, 'biochemical oxygen demand' and 'tax revenue.' Such a task does not have a simple or well-defined solution.

The objective of most impact assessments is to ensure that environmental and socio-economic problems are foreseen and directly addressed by decision-makers. To achieve this, decision-makers must fully understand the IA's conclusions. Lack of sufficient attention to the presentation and communication of findings has been one of the major reasons for the limited usefulness of impact assessments and impact statements. Most decision-makers are unlikely to use information, no matter how important it is, unless it is presented in terms and formats that are both easy to understand for a non-technical person and are immediately meaningful.

Review and Comment

One common distinction between large and small scale projects is the requirement for external review of the impact assessment. Most IA legislation or executive orders require a draft statement be circulated to affected units of government for review and comment. Many EIS procedures in developed countries also require that the draft statement be broadly circulated to members of the public whose interests may be affected by the proposed development action. By contrast, impact assessments of actions that do not require or merit an EIA usually are not circulated outside the lead agency for review and comment, particularly not to the public. Most projects would benefit from external review. In this respect, the review step is very similar to the scoping step since impacts are multi-disciplinary in nature and expertise must often be sought outside the lead agency. If the lead agency has the multi-disciplinary expertise, then external review might produce little additional information. The review process takes time (usually at least thirty days) and usually imposes additional costs by delaying initiation of a development action.

The effectiveness and efficiency of the review and decision steps are largely a function of two factors: (1) the powers that an IA administrative agency has over development actions; and (2) requirements for the participation of those who may be affected by the proposed action.

The Decision

The impact assessment process is designed to improve decision-making. One distinction that can be made among governments practicing IA is the extent to which decision-making is a "professionalized" process or an interactive process.

One of the major objectives of initiating an impact assessment process has been to open up the decision-making process, particularly to those affected by a proposed development action. The interactive decision-making process is usually mandated by laws that establish an EIA requirement.

The quality of the impact assessment will be measurably improved if the administrative agency has the power to prevent the development action from occurring and the power to force adoption of measures to mitigate adverse impacts. Generally, the administrative agency's basis for denial would either be the inadequacy of the impact assessment or the finding that a development proposal's adverse impacts outweigh its beneficial impacts.

Auditing Impacts

Auditing in the context of IA usually refers to monitoring the actual impacts of the action undertaken. The term 'monitoring' has also been used to describe this step. Government units involved in the IA process should establish an auditing step both to ensure that their decisions are carried out according to the conditions of the decision and to determine the actual impacts of the action as implemented. Knowledge of the actual impacts is necessary if improvements are to be made in each of the steps of the IA process—particularly the scoping and estimation steps.

Public Participation

The role of the formal IA procedure and its implementation in developing countries depends greatly on the political context and the prevailing institutional arrangements for development

control. The term 'public' is commonly used to denote non-governmental institutions, groups, and individuals. All national and state (or provincial) IA programs can be arranged on a spectrum that indicates the degree to which the process involves the public in the impact assessment process. At one end of the spectrum are a number of developing countries that limit participation to the review step and circulate an IA to only a few government agencies with direct connection to the proposed action. On the other end of the spectrum is full public participation in almost all of the nine steps. The need for public participation usually increases in relation to the amount of controversy generated by the potential adverse impacts of the development proposal.

Conclusion

Far too many decision-makers in developing nations appear ignorant or non-responsive to the fact that long-term sustainable development of a nation's resources requires the practice of impact assessment on all types of proposed development actions. Impact assessment can not only help ensure the long-term sustainability of a development action, but it can also prevent wasting the nation's scarce financial resources. In addition, IA may avoid shifting the costs and burdens of adverse impacts onto the less advantaged, less organized, and poorer members of society.

1. INTRODUCTION

This manual was written to assist in assessing the impacts of development actions. The focus is impact assessment in coastal developing nations. The manual was written with two audiences in mind. One audience is individuals that must routinely conduct impact assessments, and the other is students specializing in environmental planning and management.

Impact assessment and impact statements are two of the basic practices used to design and implement coastal management programs. However, this manual does not provide an in depth review of the full set of coastal management options. This manual should be used in conjunction with other documents that describe approaches to managing coastal resources and environments. One such document is **Institutional Arrangements for Managing Coastal Resources and Environments** (Sorensen and McCreary, 1990).

The work on this manual began with an extensive literature search. The key words used in the search were: impact assessment, environmental impact assessment, environmental impact statements, social impact assessment, technology assessment, and risk assessment. These key words were combined with various descriptors of developing nations in order to focus the search. Information bases accessible through the University of Rhode Island were searched first. Next, searches were done of data bases that held extensive collections of documents on the environment and developing nations. These included the World Bank libraries, the U.S. Agency for International Development information system and the Library of Congress information systems. The search identified approximately 2,000 articles and reports as well as 100 books. An annotated bibliography has been prepared of the documents we feel are most relevant to impact assessment in developing countries. The report, entitled, *An Annotated Bibliography on Environmental Impact Assessment for Developing Countries*, is available on request from the Coastal Resources Center, The University of Rhode Island.

Most of the literature on impact assessment is directed to developed nations, particularly in the context of preparing and reviewing environmental impact statements. There is relatively little literature on environmental or social impact assessment in developing nations. Nevertheless, the impact assessment literature on the third world's experience with IA is growing as more developing nations adopt and implement environmental impact assessment (EIA) programs. The great majority of impact assessment literature is directed to assessing the impacts of large-scale projects such as river impoundments, new factories, the exploitation of an oil or mineral resource, or a new airport. We found very little literature on assessing the impacts of small-scale projects whose potential impacts do not warrant the preparation of a full impact statement. Our literature search also identified five training programs on impact assessment. All the training programs and case study examples were oriented to large-scale projects, such as impoundments, refineries, offshore oil development, and power plants.

In 1989, the East West Center in Honolulu, Hawaii, published a manual, **How to Assess Environmental Impacts on Tropical Islands and Coastal Areas**, by Richard Carpenter and James Marigos that also covers the topic of impact assessment and coastal management. The Carpenter and Marigos manual is complimentary to this manual since it is primarily devoted to the topics of analytical techniques, assessment design for major development sectors (e.g. forestry, commercial fisheries) and environmental sciences as the basis for EIA. Less than a quarter of the Carpenter/Marigos manual focuses on the

topic of EIA processes and institutional arrangements. Consequently, this manual focuses on these two central themes.

Furthermore, this manual is designed to apply to medium- and small-scale projects, as well as large development projects. Big projects usually have some large and significant impacts. There are, however, relatively few large projects built over time in developing nations. The physical size of large projects and the apparent magnitude of potential impacts will usually stimulate reactions from those who may be adversely affected. This reaction often takes the form of public participation. By comparison, medium- and small-scale projects are much more numerous than large-scale projects and the range and magnitude of impacts is usually less. Accordingly, small- and medium-scale projects commonly get little if any impact assessment by government agencies and receive much less attention from affected interests. There is little, if any, public participation in the assessment of medium- and small-scale projects unless there is an environmental regulatory program, such as state and regional coastal management programs in the United States and Australia.

Two problems arise when small- and medium-scale projects do not receive adequate impact assessment. First, small-scale projects are frequently capable of generating large-scale impacts—such as a small factory producing highly toxic pesticides and an accidental release of the products into a watershed system. Secondly, because small- and medium-scale impacts are often more numerous than large-scale projects, cumulative impacts, when a number of them locate in the same region, can collectively generate impacts that are far greater than those that might be generated by one large-scale project.

1.1 What Is Impact Assessment?

There is no general and universally accepted definition of environmental impact assessment (EIA). The following examples, selected from a number of authorities, illustrate a great diversity of definitions. Impact assessment:

- "...is an activity designed to identify and predict the impact on man's health and well-being of legislative proposals, policies, programs and operational procedures, and to interpret and communicate information about the impacts." (Munn, 1979)
- "...identifies, predicts and describes in appropriate terms the pros and cons (penalties and benefits) of a proposed development. To be useful, the assessment needs to be communicated in terms understandable to the community and decision-makers. The pros and cons should be identified on the basis of criteria relevant to the society affected." (UNEP, 1988)
- "...evaluates all relevant environmental and resulting social effects which would result from a project." (Battelle 1978)
- "...is the study of the full range of the consequences, immediate and long range, intended and unanticipated, of the introduction of a new technology, project, or program." (Rossini and Porter, 1983)

Such definitions provide a broad indication of the objectives of impact assessment (IA), but illustrate different conceptions of it. The United Nations Environment Program (UNEP) definition implies that a decision-maker's estimation of the relative importance of beneficial and adverse impacts in their environment should be part of EIA. The other

definitions suggest that EIA is an objective, technical, and forecasting exercise with no relationship to decision-making. In this manual, the impact assessment process is considered to be an integral part of the decision-making process.

The terms 'environmental impact assessment' (EIA) and 'impact assessment' (IA) will be used interchangeably in the text of this manual. The most common term in the literature is environmental impact assessment or EIA. However, during the last twenty years, the scope of EIA has continually broadened beyond its initial focus on the physical environment. Today, socio-economic factors are usually included in an EIA and it is not uncommon for socio-economic factors to dominate the assessment. Therefore, the term 'impact assessment' includes the analysis of both socio-economic and physical environmental factors. It should be noted that the term 'impact assessment' has also been used historically to describe the practice of measuring the quantifiable socio-economic effects of development projects, not the environmental effects.

At present, the literature search indicates at least four distinct forms of IA: technology assessment, environmental impact assessment, social impact assessment, and risk assessment. Each of these forms has its own collection of literature, all of which are growing. Technology assessment denotes comprehensive study of the potential impacts on society resulting from the introduction or modification of a particular technology, emphasizing the unintended, the indirect, and delayed impacts (Coates, 1971). Social impact assessment objectives are to forecast the ability of a community or group to adapt to changing conditions, to define the problems or clarify the issues involved in a proposed change, to illuminate the meaning and importance of anticipated change, to identify mitigation opportunities and requirements, and to fulfill or comply with regulations or policies (Branch et al., 1984). The last two objectives are in common with the other three forms of IA. Risk assessment is the probability of occurrence of an undesirable event within a certain span of time (Rossini and Porter, 1983).

1.2 Organization of the Manual

The manual is organized according to the conceptual framework presented in Section 2. The third section defines impact assessment terms in order to provide semantic clarity to the presentation as well as to the practice of impact assessment. The evolution of impact assessment and its utilization by developing nations is the topic of Section 4. The heart of this training manual is Section 5, which presents a nine step process for impact assessment. The final section, Section 7, focuses on institutional arrangements for conducting impact assessment.

2. CONCEPTUAL FRAMEWORK

Persons who have to prepare or review an IA often find it difficult to get a perspective on how his or her particular work relates to the larger picture of public policy-making. The conceptual framework presented here is intended to place impact assessment in the context of the larger process of public policy-making. The framework of this manual is built on five concepts. These five concepts are the topics of the following sub-sections. They include:

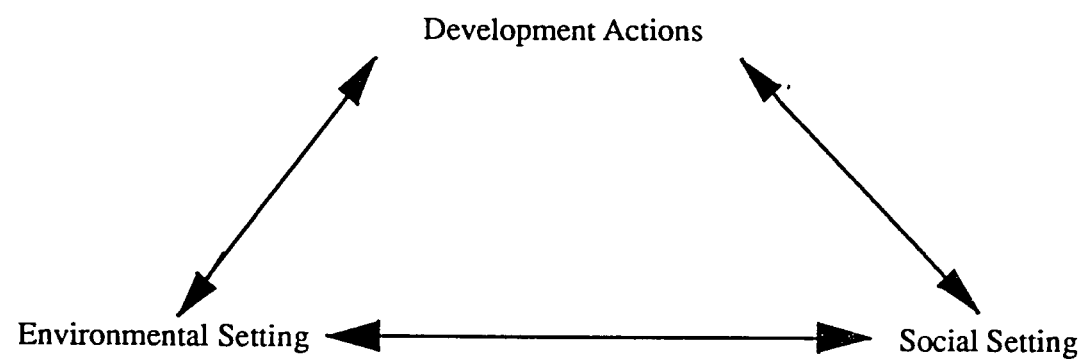
1. Impacts are created by the dynamic interaction of three elements. These are development actions, the environmental setting, and the social setting;
2. development actions can be clustered into four interacting groups. These groups include overall national or provincial plans or programs, sectoral plans or programs, regional multi-sectoral programs, and projects;
3. the environmental setting of the coastal zone is characterized by the number and complexity of interacting systems;
4. the social setting can be divided into three components including institutions, culture, and individuals; and
5. the IA process is composed of nine steps which are action description, screening, scoping, alternatives, estimation, evaluation, review, decision, and auditing.

2.1 The Impact Assessment Triangle

Almost invariably three elements interact to produce an impact. These are the development action, the environmental setting, and the social setting. This arrangement is depicted in Figure 2.1. Knowledge about all three elements of this impact assessment triangle is necessary if IA is to be either an effective or efficient process.

In most situations the impact assessment process is initiated by a development action that has been proposed, such as the construction of aquaculture ponds or the building of a resort hotel complex. Generally IAs are conducted to determine how development actions will affect the environmental and social setting. However, as the diagram indicates, impact assessment is also used to determine how the social or environmental setting will affect the proposed development action. The most common example of this situation is assessing the extent to which natural hazards, such as floods, erosion, and coastal storms will threaten proposed development activities as well as imperil public safety. It is not uncommon in developing nations to conduct an IA after the development action has been initiated or even completed. The latter situation occurs when there is unanticipated public reaction to the actual or potential impacts of the action. Obviously, after-the-fact assessments can achieve few of the objectives for conducting IA. Only three substantial benefits could be achieved by such assessments. They are: to identify and comparatively assess measures of mitigating the actual adverse impacts; to set up a monitoring program; and to determine if the development action complies with conditions of permits issued by government units.

Figure 2.1. The Impact Assessment Triangle



2.2 Development Actions

The broad range of development action can be divided into four interacting groups:

- 1) overall national or provincial plans and programs;
- 2) sectoral plans and programs;
- 3) regional multi-sectoral programs; and
- 4) large, medium, and small-scale projects.

The hierarchical or tiered arrangement among the four types of development actions and examples of each are depicted in Figure 2.2. In developing nations, national economic planning generally involves the setting of goals for each sector of the economy, including the allocation of investment capital, labor, resources, and land. National economic plans commonly affect coastal management by national investment in offshore oil and gas development, fisheries development, and tourism development. Sectoral plans are the means usually used to implement national economic development plans. Developing countries routinely prepare sectoral plans that will directly affect coastal resources and environments. Sectoral plans for fisheries, oil and gas production, tourism, and transportation (particularly ports) are the clearest examples. However, other sectoral plans such as forestry, agriculture, and water resources development often have profound impacts on the coast. Forestry and agricultural practices commonly increase soil erosion, which leads to sedimentation of estuaries and lagoons. Agricultural development often means impoundments for irrigation schemes. The impoundments can affect the quantity, quality and timing of fresh water flows to the coast, thereby changing the water quality and circulation of estuary systems.

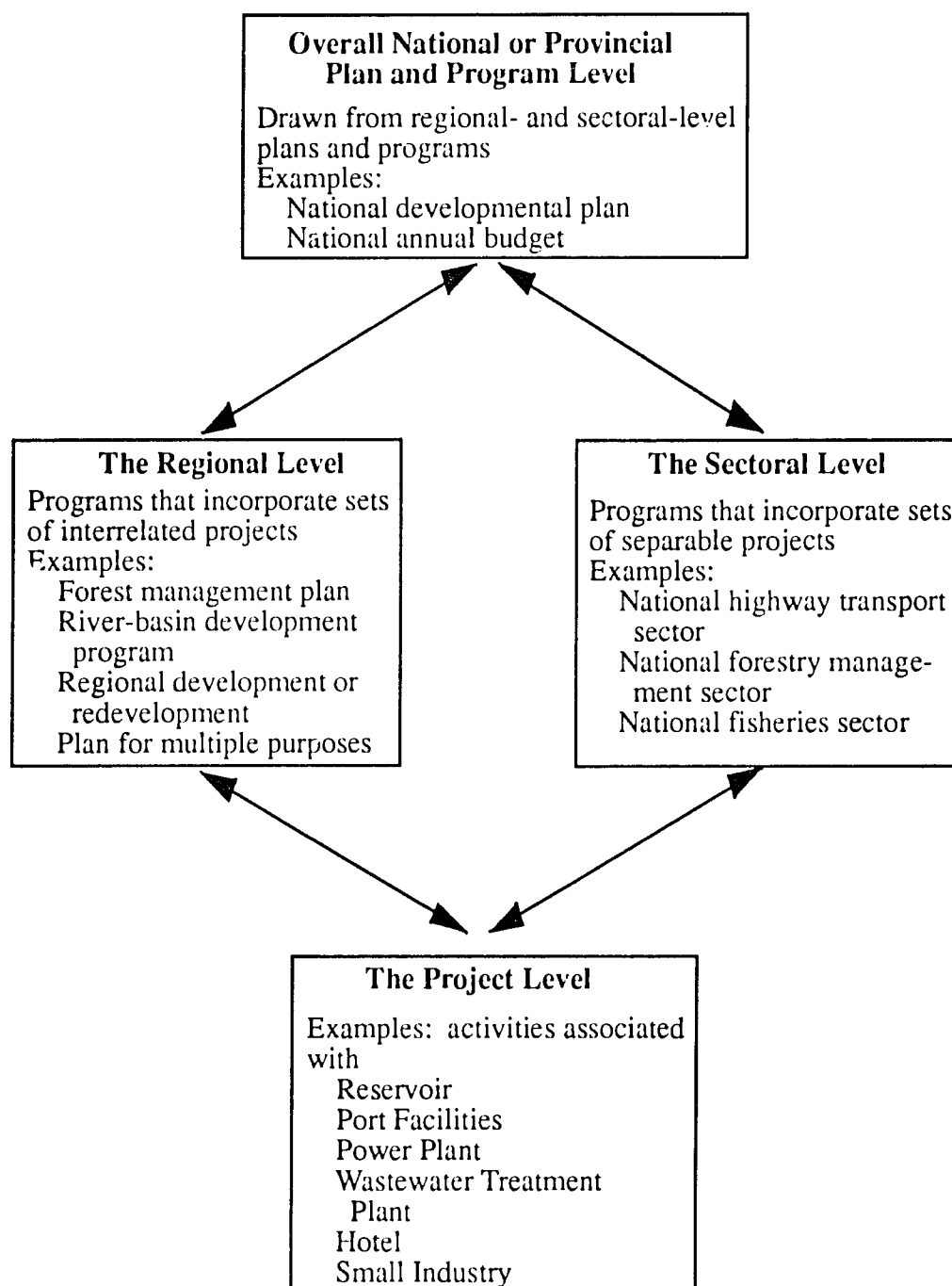
Regional plans or programs are usually multi-sectoral efforts to develop or conserve a particular geographic area. Watershed development appears to be the most common form of regional planning. Also, the creation of a new port or new centers of tourism are frequently part of regional planning programs. Since regional development programs usually cover a sizable geographic area and often include a number of large-scale projects, they routinely require the preparation of an environmental impact statement, particularly if the effort is being funded by an international assistance institution.

In most cases, projects are the means by which sectoral and regional plans are implemented. A project is a discrete type of development activity. Table 2.1 lists seven characteristics that distinguish plans from projects. Regional water basin development plans typically include an impoundment project and numerous irrigation projects. In most nations, particularly developing nations, government units initiate and implement most projects. However, non-governmental organizations (NGOs), such as private corporations and conservation associations, often design and implement projects, and may occasionally include regional and multi-sectoral plans.

The great majority of impact assessment done by all governments in the world is focused at the project level. Impact assessment is not usually a component of national economic or sectoral planning or regional plans. When it is done, impact assessment is often conducted after the fact, such as the national plan for the Mahaweli region in Sri Lanka. A government's tendency to concentrate its practice of impact assessment at the project level is one of the greatest impediments to achieving the basic objectives of IA. This critical problem is discussed in greater detail in Section 4.

There are always small-scale projects that do not normally require the preparation of impact statements but merely require routine review by those institutions with regulatory

Figure 2.2. Levels of Planning and Decision-Making in a Developing Country



Source: Environment, Natural Systems and Development: An Economic Valuation Guide, Hufschmidt et. al., 1983. Figure 5, *Illustration of Levels of Planning and Decision-Making in a Developing Country*

Table 2.1. Characteristics of Planning versus Project EIA

ASPECTS OF PROCESS OR CONTENT	PROJECTS	PLANS
Goals and Objectives	Restricted Consideration	Potentially broad—increasing with higher levels
Alternatives	Sites/Technologies	Technical/Institutional Cross departmental
Lead Time	Short	Long
Effective Period	Immediate Implementation	Medium- to Long-Term
Knowledge of Future	Reasonably Predictable	Imprecise
Environment to be Studied	Reasonably Specific	Not Specific
Environment to be Monitored	Specific	Limited

Source: Clark, Chapman, Bisset and Wathern, 1981

authority. Common examples are the construction of houses, bulkheads, and piers or docks, which require permits if built in the coastal zone. Although a small-scale project may not generate significant impacts by itself, if there are numerous other such development projects within the same coastal system, they can collectively generate cumulative impacts of a significant magnitude. This problem is addressed in Section 3.4.

The process commonly called the project cycle is illustrated by Figure 2.3. The connection between projects and higher levels of development action such as regional and sectoral plans comes in the project identification stage. The figure also indicates one of the most commonly stated maxims in the IA literature: impact assessment must be integrated into the project cycle. By designing the process so that it provides useful information to decision-makers at just the right time in the project cycle, IA can have a real effect on decision-making. In other words, IA should enhance and augment the project planning process. Only by actually shaping projects in their early stages can IA become an important instrument for protecting the environment and society, thereby ensuring sustainable economic progress.

The impact assessment process should have direct economic benefits. In the late 1970s the United States Environmental Protection Agency (EPA) conducted an evaluation of 58 environmental impact statements done on waste water treatment facilities (Canter, 1987). The average EIS produced 2-3 major changes in the characteristics of the facilities. These changes generally include the location of the facility, the capacity of the facility, and the project area. Moreover, the evaluation concluded that changes caused by the EIS resulted in an average net benefit of \$6 million dollars (the average cost of the changes was \$6 million and the average reduction in total project costs was \$12 million).

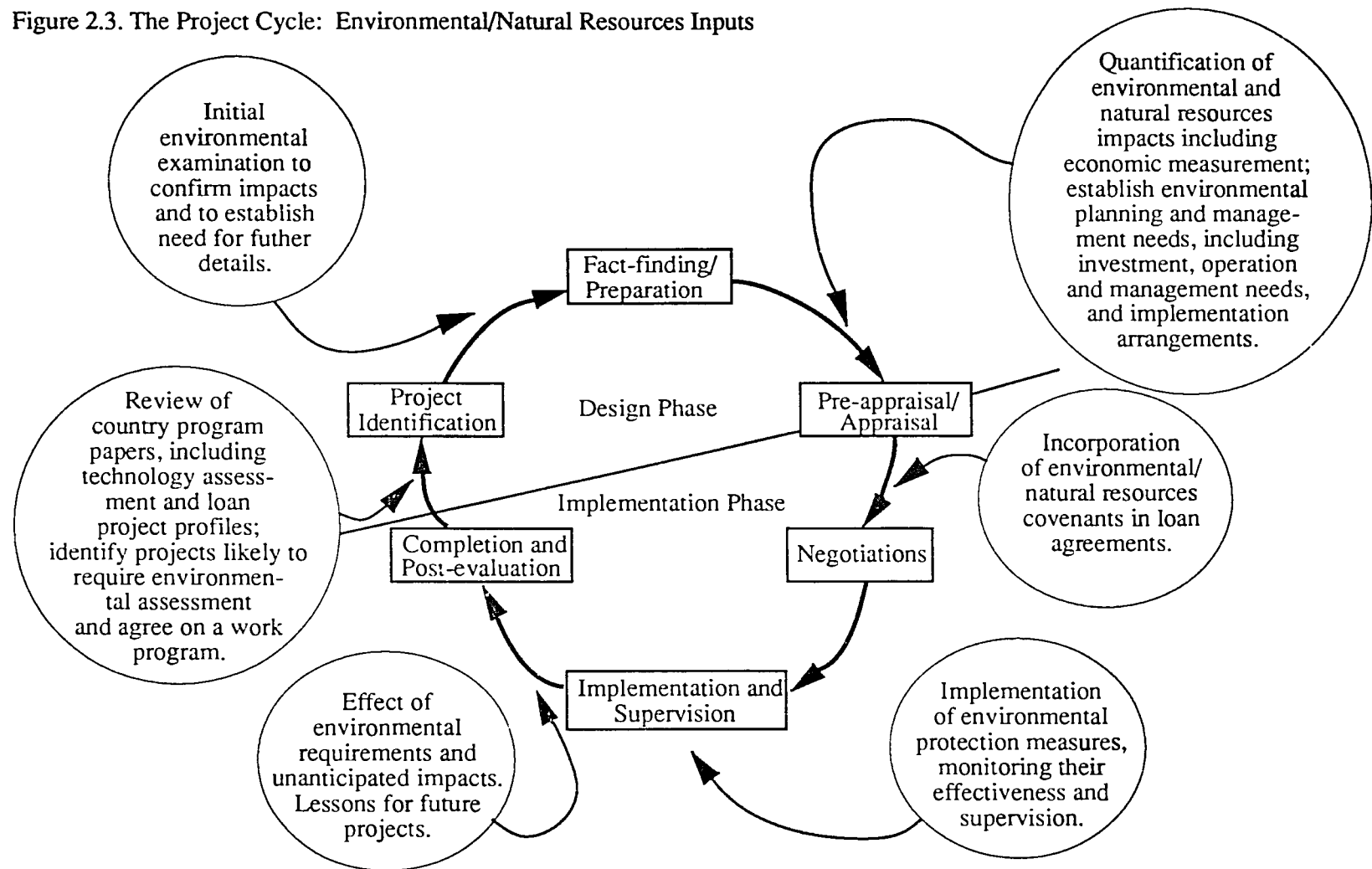
2.3. The Environmental Setting

Most substantial development actions will have some effect on the environment. The reverse is also true. The environmental setting often directly affects proposed actions. Development projects on the coast may be swept away by hurricanes or estuary floods. Coastal erosion is another common impact of the environment on a project.

The most distinctive and challenging characteristic of the coastal zone is the concentration of interconnected environmental and physical systems in a compact area. No other environment - deserts, mountains, lakes, or deep ocean - has so many systems concentrated in one area. During the twenty year history of coastal management, numerous reports and books have been written on managing coastal systems. Some of the more notable examples include: Clark, 1977; Conant et al, 1983; Soysa et al, 1982; Snedaker and Getter, 1985; and Clark 1985. There is not total consensus in the literature on the different types of coastal systems. Each analysis has a somewhat different listing. The differences appear to depend mostly on both the author's disciplinary perspective and the objectives of the analysis.

Review of both past and present coastal management efforts indicates that the following nine systems need to be considered in program design and implementation. For each of the systems, we have identified some of the major impact issues.

Figure 2.3. The Project Cycle: Environmental/Natural Resources Inputs



Source: *Economic Analysis of the Environmental Impacts of Development Projects*, by John A. Dixon, Richard A. Carpenter, Louise A. Fallon, Paul B. Sherman, and Supachit Manipomoke, 1988. London: Earthscan Publications

1. Large-scale geomorphic or oceanographic units

Issues:

- sea level rise from global warming and/or subsidence or emergence of tectonic plates;
- the formation, growth, and decay of barrier islands and barrier beaches, coral reefs, and atolls;
- large-scale coastal and ocean currents such as the Gulf Stream or the Humboldt Current.

2. Coastal watersheds (particularly estuary watersheds)

Issues:

- ground water or surface water pollution, estuary water quality, and effects on biota;
- ground or stream water flows, estuary and wetlands salinity, and effects on biota;
- land use practices, run off, stream water flows, and stream or estuary flooding;
- stream sediment loads, estuary sedimentation, and effects on biota; and
- stream sediment loads and deposition of beach materials on estuaries or open coast shore, and then into the system of longshore circulation cells (see #5).

3. Estuary Circulation Systems

Issues:

- direct discharge of wastewater into estuaries from all sources; estuary water quality, and effects on biota; and
- the functioning of estuarine habitats such as wetlands, mangroves, and seagrass.

4. Ocean Basins

Issues:

- direct discharge of wastewater, oil, solid waste from all sources; quality of ocean waters and sediments, and effects on biota;
- estuary pollution, quality of ocean waters and sediment, and effects on biota; and
- the functioning of offshore habitats such as coral reefs and kelp beds.

5. Longshore Circulation Cells, Coastal Erosion and Deposition

Issues:

- control of coastal erosion and erosion-accretion dynamics within littoral circulation cells.

6. Air Basins

Issues:

- atmospheric emissions from all sources, ambient air quality, effects on biota and human health.

7. Populations of Sport and Commercial Fauna

Issues:

- degradation of coastal streams and habitat of coastal fish populations;
- degradation of estuarine habitats and size of waterfowl, wildlife, and fish populations;
- harvesting of commercial or sport species and maintenance of a sustained yield population and food web; and
- design guidelines for coastal development visible from recreation or tourism areas.

8. Viewsheds

Issues:

- development in areas visible from the first public road parallel to the coast, public recreation areas, or tourist facilities;
- control of development in areas visible from major public use facilities; and
- design of guidelines for coastal development visible from recreation or tourism areas.

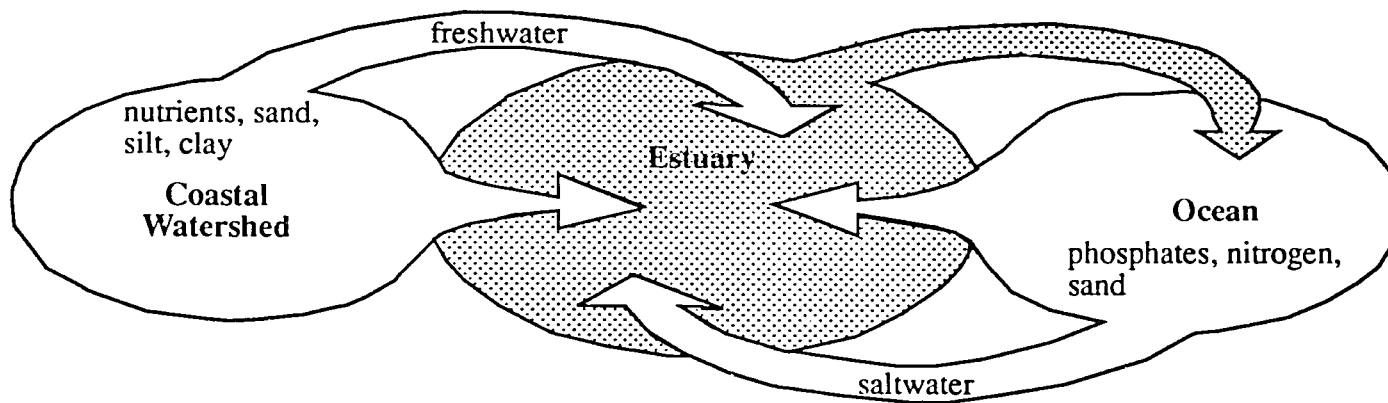
9. Public Service Systems

Issues:

- land use within a sewage district and the capacity of the sewage system;
- land use within water services district and the capacity of the water supply system;
- land use within highway service area, traffic capacity and highway congestion; and
- land use and the ability to evacuate residents from flood-prone areas before the advent of hurricanes, monsoon storms, typhoons, or tsunamis.

Of the nine systems, four are specific to the coastal zone. These include large-scale marine geomorphic units, estuary circulation systems, ocean basins, and longshore circulation cells. Five systems are connected by hydrologic dynamics. Figure 2.4 illustrates the general connection between three of the nine systems including the estuary watershed, estuary circulation, and ocean basin systems. A number of the nine systems can be further divided into sub-systems. For example, estuaries and ocean areas can be divided into types of habitats such as mangroves, seagrass, coral reefs, and kelp beds.

Figure 2.4. Generalized Interconnections of Coastal Watersheds, Estuary Wetlands, and Ocean Basin Systems



Source: California Sea Grant College Program, 1979

Developing nations have focused on managing coastal systems which have direct and significant effects on their economy or society, such as obtaining maximum production and employment from fisheries. By contrast, planning for future development to remain within public service system capacities, such as the supply of fresh water or the capacity of the sewage treatment plant, is not on the agenda of most developing countries. Usually these systems are either years away from construction or have not reached their maximum capacity. The exception may be the capacity of the coastal roads and bridges to evacuate residents from flood-prone areas.

Recognizing the coastal zone as an aggregation of systems is important because most conflicts among competing interests arise from impacts generated by the functioning of these systems. A development activity in one part of a system will usually generate a change in the environmental condition of the site of the activity (for example, the cutting of a forest removing ground cover). The changed environmental condition often generates effects that are then carried off the site of origin, such as surface erosion from the areas where forestry has removed the ground cover. The inherent characteristics of impacts and their linkages with the functioning of coastal systems is explained in more detail in Section 3.

In developing nations with limited experience in coastal systems planning, conflicts commonly occur because no one has anticipated potential adverse impacts that may arise from a proposed project. For example, there are several studies of coastal erosion in developing countries that describe how breakwaters or jetties have often been built at coastal inlets to stabilize harbor entrances. However, no consideration has been given to the sand supply starvation on the downdrift side of the inlet. In each case, massive erosion occurred in the area downdrift from the stabilized inlet. Redesign of the training jetties or sand bypassing system installed at the time of project construction could have reduced or prevented the downdrift erosion.

Figure 2.5 illustrates some of the interconnections in the management of a coastal watershed system. The impacts start with completion of dams and multi-purpose reservoirs. The changes in land use stimulated by the dam ultimately increase the costs and decrease the benefits of the project. The scenario depicted by the figure has been all too common in developing nations. Dams and multi-purpose reservoirs have commonly been both environmental and economic mistakes.

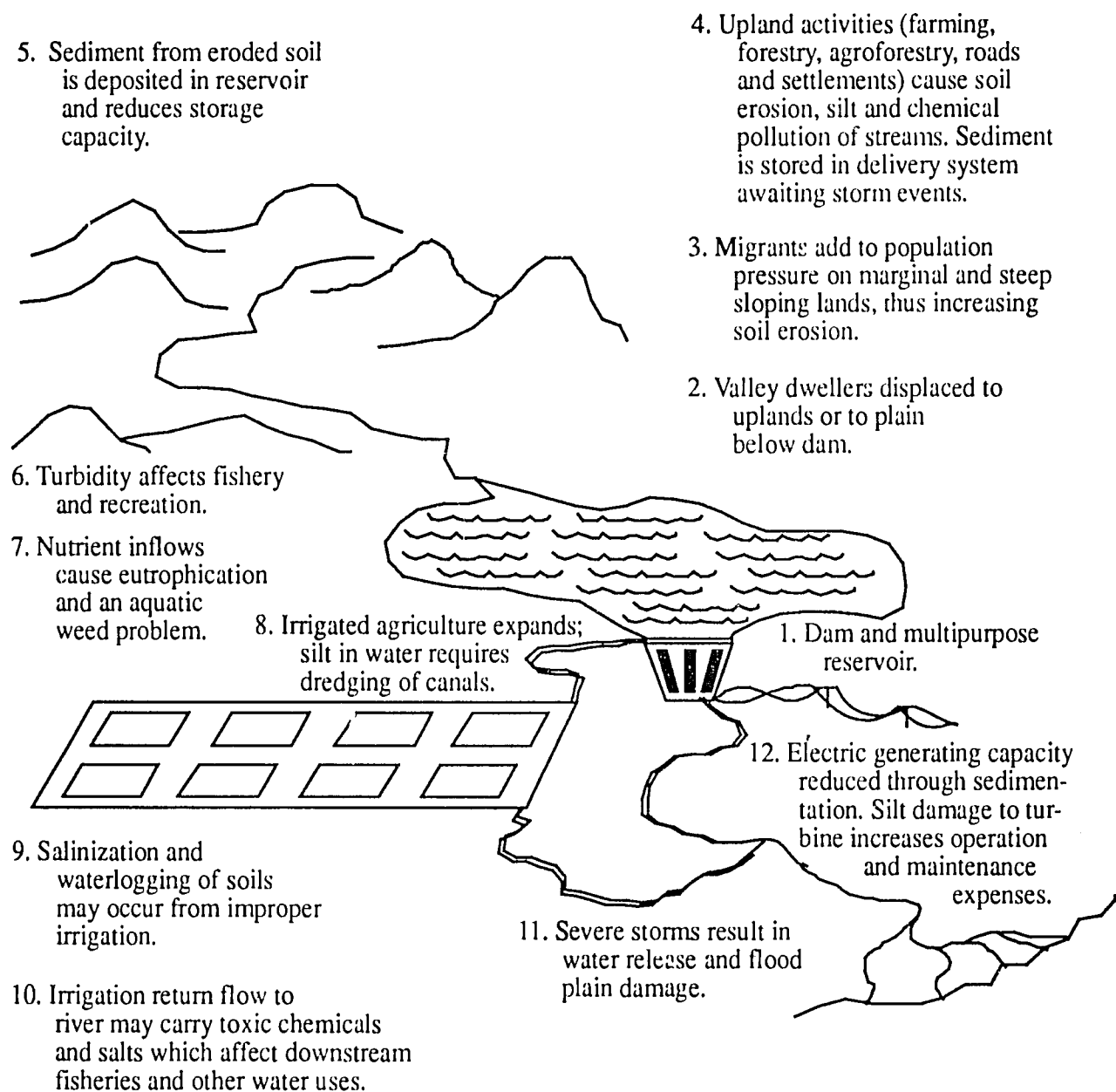
IA is particularly important in the management of coastal resources and environments because of the way in which the nine coastal systems function as an interacting set. The interconnected functioning of these nine systems is the primary reason that the consideration of cumulative impacts is imperative when conducting IA in coastal locations. Cumulative impact is discussed in Section 3.4.

2.4. The Social Setting

The literature that addresses social impact assessment often makes a distinction among four different components of the social setting. These components include:

- individuals;
- interpersonal groups;
- institutions; and
- culture.

Figure 2.5. Multipurpose Dam Projects and the Loss of Economic Development Opportunities



Source: *Economic Analysis of the Environmental Impacts of Development Projects*, by John A. Dixon, Richard A. Carpenter, Louise A. Fallon, Paul B. Sherman, and Supachit Manipomoke, 1988. London: Earthscan Publications

These four groups are interactive. For example, individuals are the building blocks of interpersonal groups and institutions. Interpersonal groups commonly consist of family and friends.

A proposed development action will usually have some effect on the social setting, such as changes in employment, income, or cultural practices. A proposed action can also affect the institutional arrangement and the government's impact assessment process. These are both components in the social setting. The social setting—like the environment—also has a reciprocal relationship with development actions. An action can have an impact on the social setting and the social setting can have an impact on the development action. In developed nations with IA laws, many—if not most—proposed actions are changed in some manner by the impact assessment process. Projects are commonly relocated or redesigned to mitigate adverse impacts.

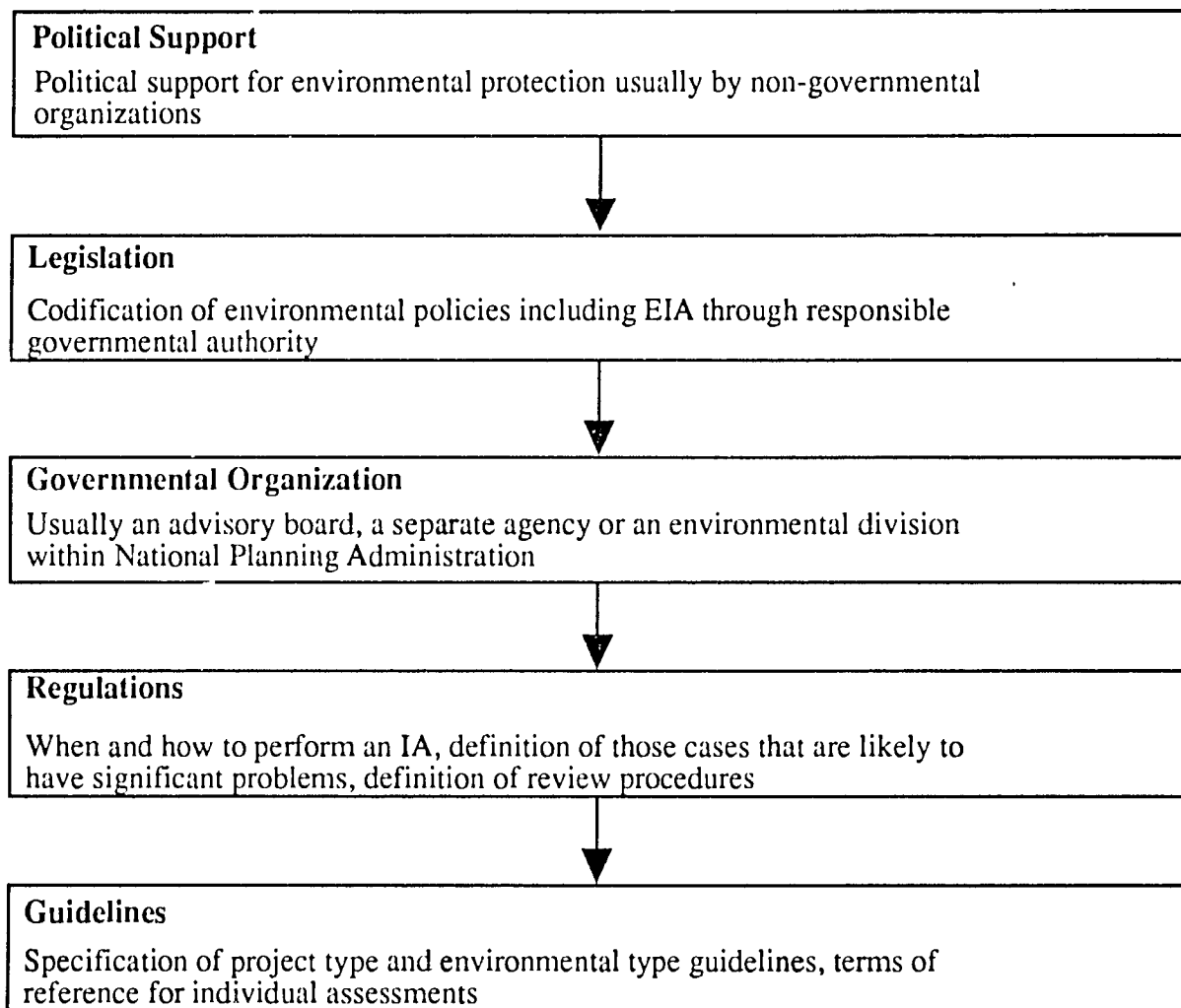
The term 'institution' is most commonly used to describe government units such as agencies and non-government organizations including private industries or conservation associations. The term also encompasses government laws and policies, as well as cultural and moral standards. Institutions are the rules (or policies) of a society that enable it to function as a social unit such as a nation, a state, or a cultural group. Institutions, then, are both governance structures, such as bureaucracies, corporations and tribes, and the rules that govern social action. The governing structures, such as a government bureaucracy or a corporate organization, are commonly called an 'institutional arrangement,' or governance.

Culture generally refers to learned behavior patterns that are characteristic of the members of any given society. Culture refers to the total way of life of particular groups of people. It includes everything that a group of people think, say, do, and make—its systems of attitudes and feelings. Culture is learned and transmitted from generation to generation. Essentially, culture is what we learn as opposed to what we inherit genetically.

Figure 2.6 illustrates various aspects of the social setting that influence the process and institutional arrangement of impact assessment. Political support is obviously a key component in any government program. The Figure shows it as a pre-condition for legislation. Political support is also a necessary pre-condition for the continued existence of impact assessment as an efficient and effective process. For example, if a proposed action is highly controversial, it can adversely affect the political strength of government units and private organizations that support IA. Controversy - particularly continual controversy - can weaken the rules that govern the IA process, thereby diminishing both the effectiveness and the efficiency of the institutions.

The IA process typically combines a tool for analyzing effects and a procedure for bringing this analysis to bear on decisions. The overall process is designed to ensure that actions cause minimal environmental and socio-economic damage. IA alone cannot solve problems by itself or substitute for the formulation and implementation of comprehensive planning. One cannot realistically examine IA as a planning tool or procedure in total isolation from institutional arrangements and the policy-making process. Thus, the study of impact assessment must include the study of institutional arrangements for conducting the IA process, as well as the IA process itself. Institutional arrangements are briefly discussed in Section 4 and are the topic of Section 6. The impact process is outlined next and is the topic of Section 5.

Figure 2.6. Various Aspects of the Social Setting that Influence the Impact Assessment Process



Source: Cockerel, M.J. 1984.

2.5. The Impact Assessment Process

There is general consensus in the IA literature that there is a common IA process which does not vary significantly among different nations - regardless of their level and need of economic development or their cultural setting. This manual divides the IA process into nine steps. There is some variation in the number of steps delineated in the numerous reference works on IA. The number of steps depends on how authors cluster the analytical and procedural requirements.

The IA process is initiated by a description of the proposed action. The description is then screened to determine if an IA should be conducted. Screening should also indicate the scale of IA effort that is necessary. If screening indicates that an IA should be conducted, the scoping step establishes the terms of reference for the IA. Closely aligned with the scoping step is the identification and consideration of alternatives to the proposed action. Following the consideration of alternatives, an estimation of potential impacts identified in the scoping step should be done. A comparative evaluation is then conducted of the proposed action and its alternatives. Next, it is common to circulate a draft assessment for review and comment prior to the decision step. The last step is an audit of the actual impacts. These nine steps are explained in detail in Section 5 and depicted in Figure 5.1.

3. CHARACTERISTICS OF IMPACTS

Even though the practice of IA is at least 20 years old, there is still some confusion regarding the terms used to describe impacts. This section is intended to provide semantic clarity for the terms used in this manual, as well as to portray the complexities inherent in the practice of impact assessment.

3.1 Causal Factors, Effects, and Impacts

A basic concept in IA is that of cause, condition change, and impact. This three-part linkage is often called an impact chain or an impact network. Figures 3.1 and 3.2 are depictions of impact chains or networks. Networks are formed by the radiation of two or more impact chains. In Figure 3.1 there are six impact chains. They all start with the same development action of agriculture development in an estuary watershed. The development action in turn requires an actual modification of the physical environment. These modifications are known as causal factors. In Figure 3.1, the causal factor is the removal of vegetation and exposure of the bare soil. Dredging is the causal factor in Figure 3.2.

The important point to remember is that development activities such as roads, housing, and ports do not initiate impacts per se. It is the respective causal factors they require, such as vegetation removal or dredging, that initiate impact chains and networks.

A distinction is often made between effects and impacts. Effects are the changes - usually measurable - in a condition of the environment (environmental conditions are usually termed 'parameters'). In Figure 3.1, the removal of vegetation produces the sequential condition changes of increase in erosion and increased sediment flows into an estuary and open coastal waters. The increase of sediments in the estuary in turn can produce three different effects, including deposition of sediments on benthic (bottom) organisms, increased turbidity in coastal waters, and change in the condition or composition of recreational beaches.

Impacts are an estimate or judgment of the value society places on the effects. In Figure 3.1, the three condition changes or effects produce four impacts including decreased growth rate and size of commercial shellfish, decreased recreational quality of coastal waters, decreased recreational quality of beaches, and increased sedimentation of navigation channels. If society does not place a value on a change in condition, it is termed 'an effect.' If society does place a value on the condition change, it is termed 'an impact.'

3.2 Direct and Indirect Impacts

Direct impacts can be defined as the first sequential change that has social value in the impact chain or network. Direct impacts are frequently called first order impacts. In Figure 3.1 each of the direct or first order impacts generates one or more indirect or second order impacts. For example, the decreased growth rate and size of commercial shellfish produces the indirect or second order impact of aquaculture operations becoming unprofitable and closing. This indirect impact in turn may produce two third order indirect impacts, such as an aquaculture area being filled in for urban development, and loss of employment and income to the region. The filling of an aquaculture area will in turn initiate new impact chains and a new impact network. A cause, condition, and effect chain is often linked at various points in its sequence to other chains. Figures

Figure 3.1. An Impact Network with Direct and Indirect Impacts

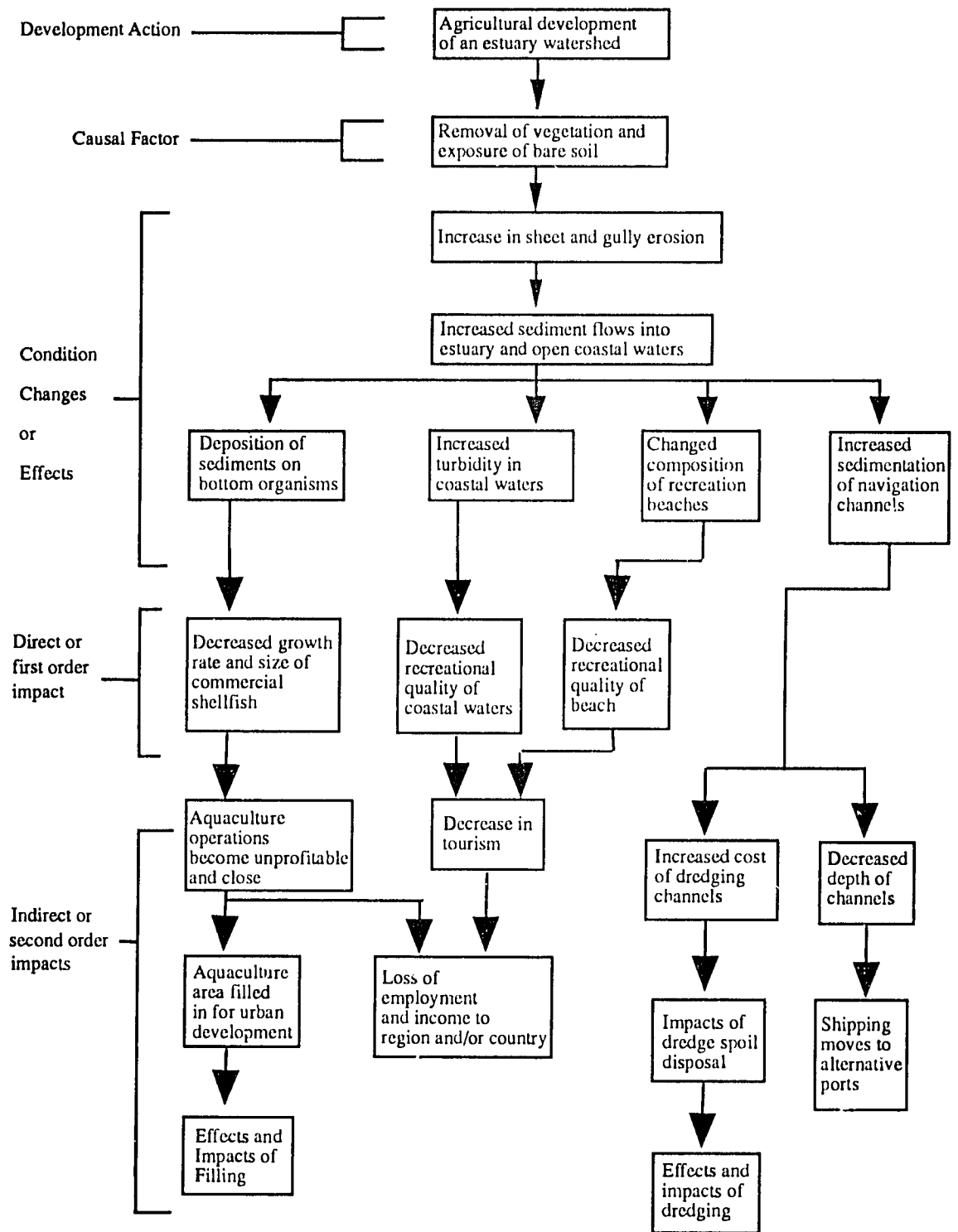
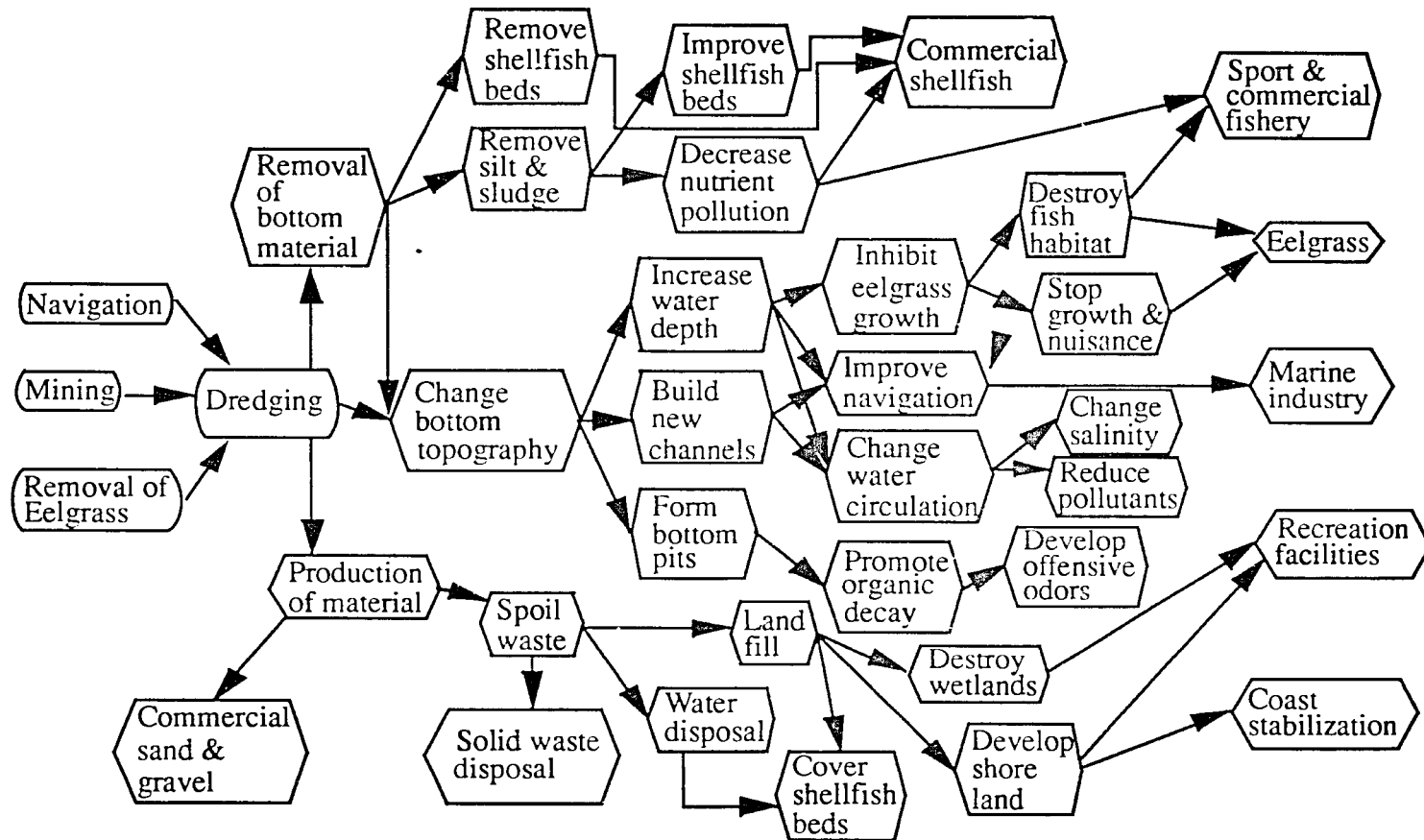


Figure 3.2. A Network Depicting the Impacts of Dredging



Source: Ellis, R.H., et al. 1969.

3.1 and 3.2 show that an impact link in one chain can become the causal factor link in another chain.

3.3 Impact and the Baseline Condition

Environmental and socio-economic systems are not static but change over the course of time even without the influence of development actions. Some systems are very dynamic, while others change only imperceptibly. In order to estimate the probability and magnitude of impact, assumptions have to be made about the dynamics of natural change in systems. The functioning of environmental or socio-economic systems without the effects of a proposed development action is usually called the baseline condition. This is represented by the condition prior to the construction of a development activity. Figure 3.3 indicates the dynamic baseline. The effect or impact is the deviation from the baseline. To accurately assess the effect or impact of a development action, it is necessary to plot the base line condition over a sufficient time period to understand the dynamics of the system.

3.4 Cumulative, Synergistic and Antagonistic Impacts

Incremental impacts are marginal changes in environmental or socio-economic conditions that are directly attributable to the action being assessed. Incremental assessment is a process by which the marginal impacts of a project are evaluated rather than the potential system-wide impact.

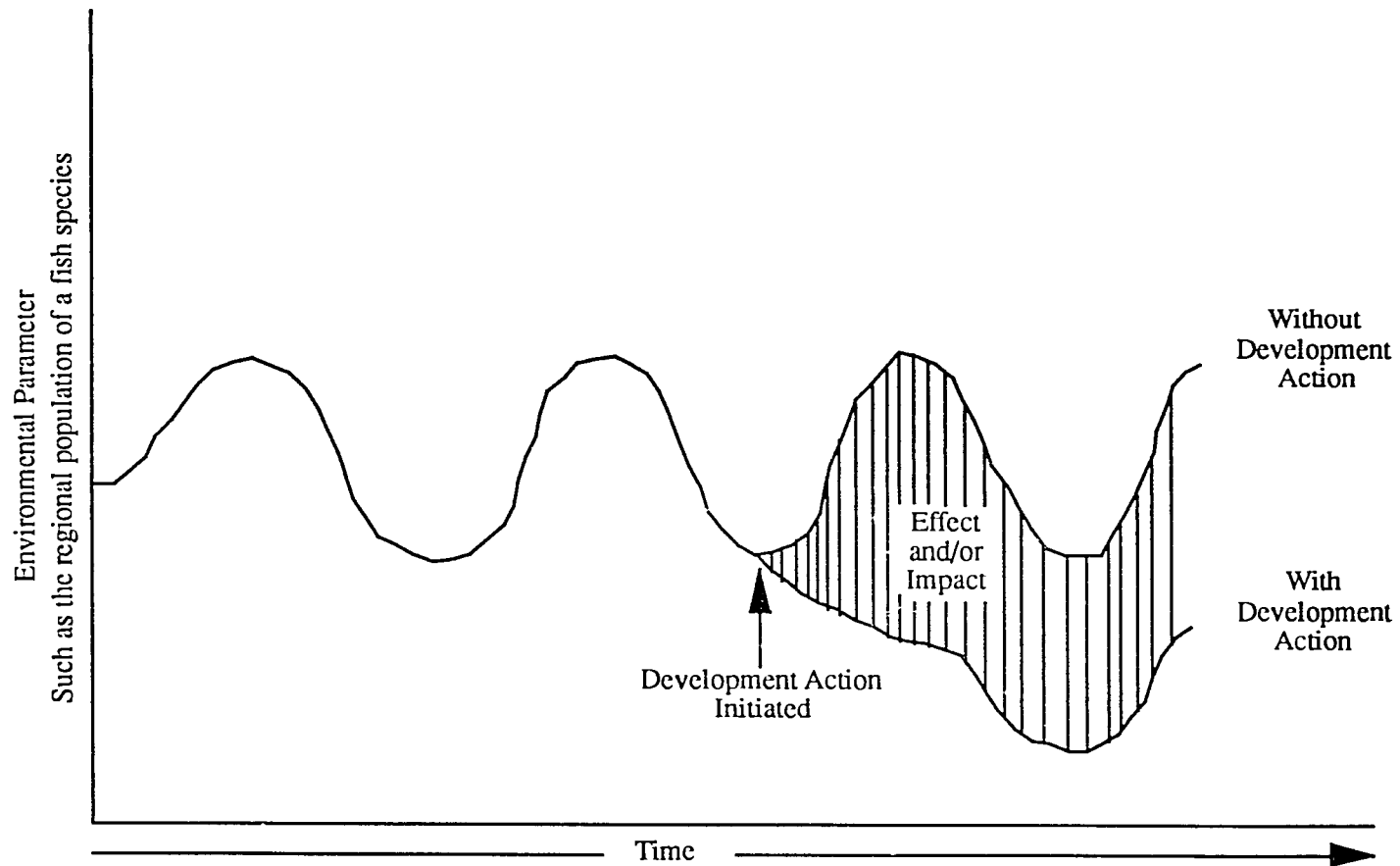
Cumulative impacts are the consequences of separate or related actions that may be minor by themselves, but add up to a significant total impact. The phrase 'cumulative impacts' normally conveys an image of accumulation or progressive increases of some sort. The progressive increase of carbon dioxide concentrations in the earth's atmosphere is a cumulative change, but so too are the progressive loss of soil nitrogen from farmlands, the loss of wildlife habitat in areas converted from non-cultivated to cultivated ecosystems, and the loss of soil and habitats due to erosion of shorelines and land surfaces.

There are two pathways for the generation of cumulative impacts. One pathway is that two or more of the same type of development actions change the same parameter within an environmental system. For example, the adverse effects of agriculture development, as depicted by Figure 3.1, are not just the effect of one development project. The effects and impacts in Figure 3.1 are the cumulative of many agriculture development projects over time in the same watershed. Generally, a small- to medium-scale agriculture development will not produce effects or impacts depicted by Figure 3.1 in a significant enough size to warrant concern to government or non-government interests.

Figure 3.4 illustrates the cumulative impact from four different parameters. The incremental addition of North Slope oil field facilities produces four effects including habitat loss, habitat alteration, avoidance by wildlife, and increased stress on wildlife. These four parameters then combine to produce a cumulative impact of decreased wildlife populations.

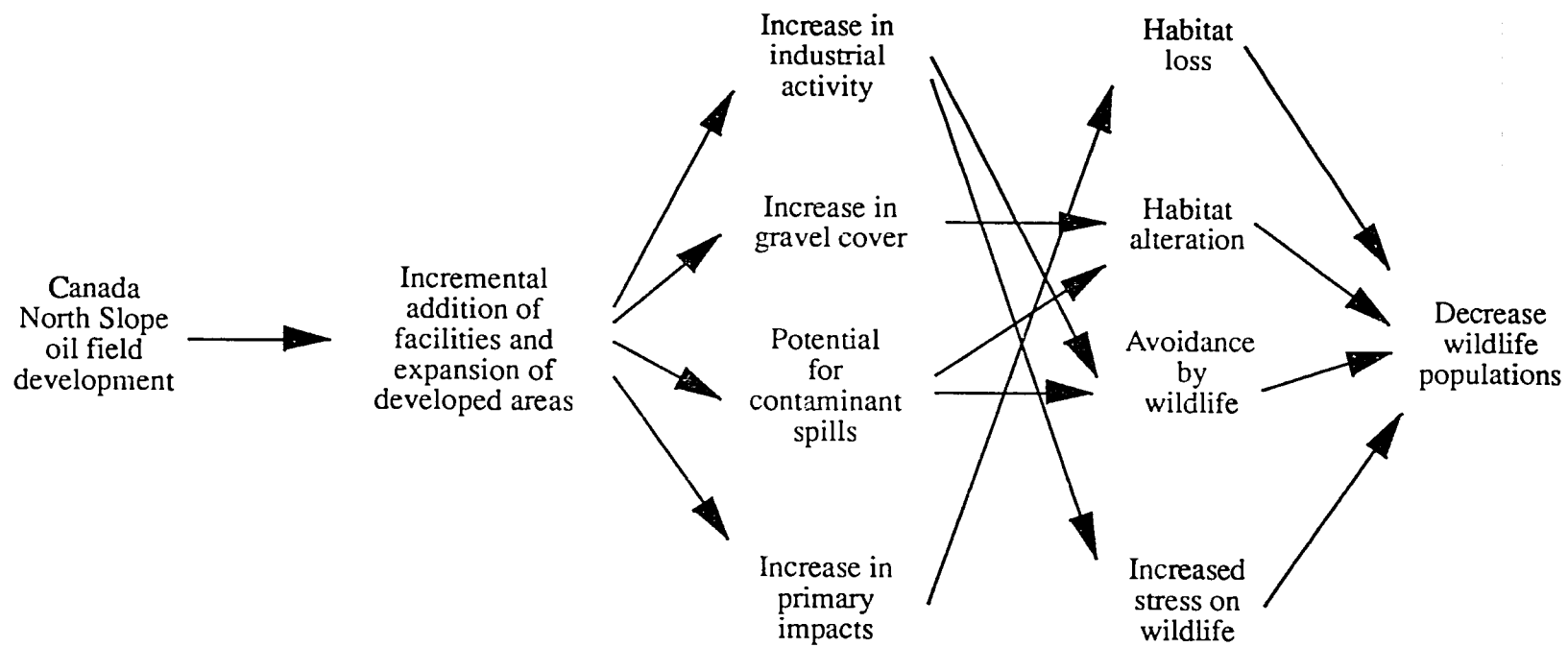
Figure 3.5 illustrates the cumulative impact of increased erosion in the watershed system and sedimentation of the estuary system. Most of the development projects were too small to produce significant increases in erosion and sedimentation. The government units that issued the permits for development in the watershed only considered the potential impacts of **each** proposal, as if they were not interconnected. However, in the time period from 1972 to 1989, 594 housing units were constructed and 3,608 acres of

Figure 3.3. The Dynamic Baseline



Source: Extract taken from ENVIRONMENTAL IMPACT ASSESSMENT: THEORY AND PRACTICE, edited by Peter Wathern, reproduced by kind permission of Unwin Hyman Ltd. ©1988 by Unwin Hyman Ltd. All rights reserved.

Figure 3.4. Cumulative Impact of Four Different Parameters



Source: Meehan and Webber, 1986.

Figure 3.5. Cumulative Impact of the Same Parameter, Estuary Sedimentation

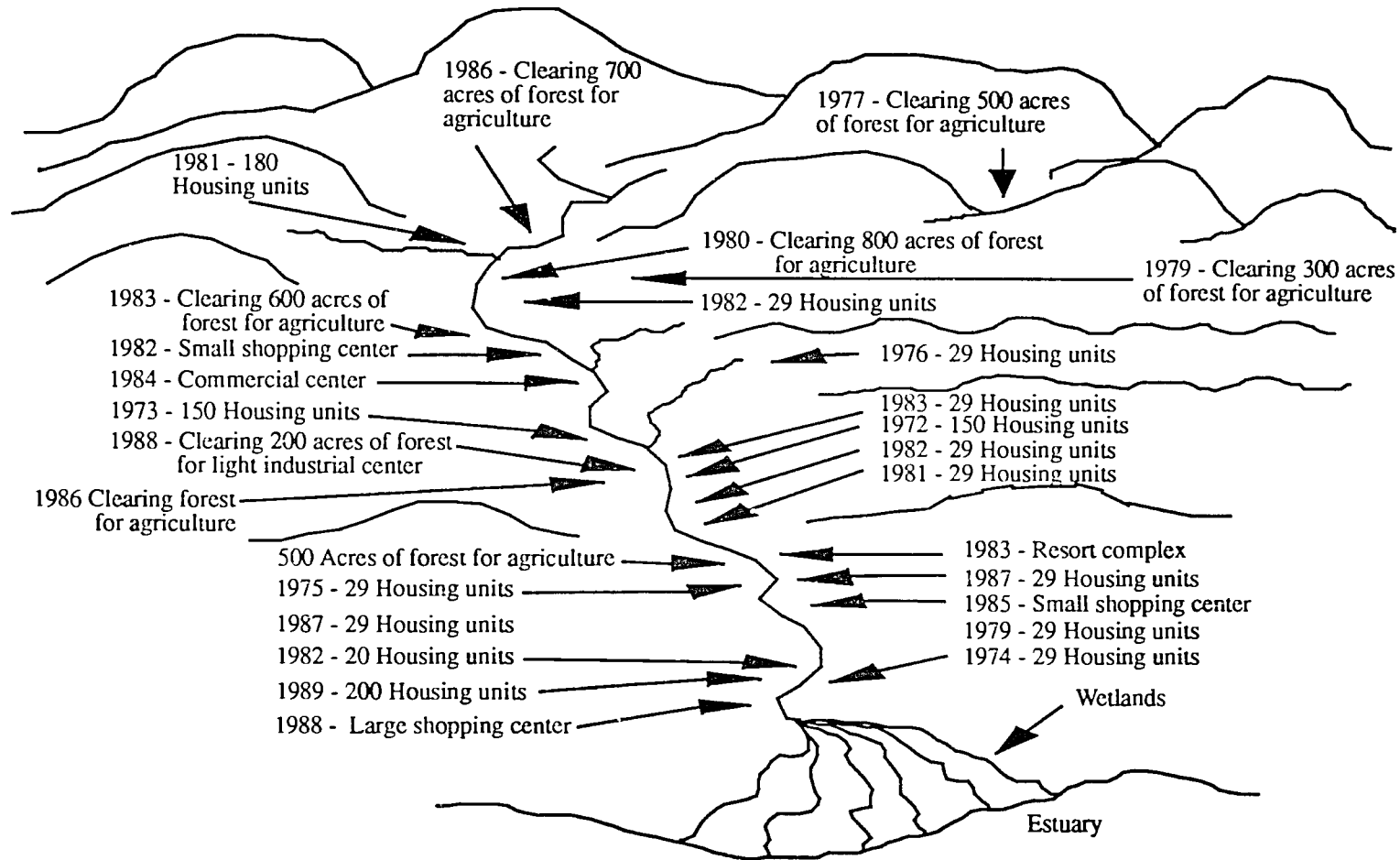


Table 3.1. Cumulative Impact Over Time

1972	150 Housing units
1973	Impact Assessment Act passed, 29 housing units
1974	150 housing units
1975	29 housing units
1976	29 housing units
1977	Clearing 508 acres of forest for agriculture
1978	No significant development
1979	Clearing 300 acres of forest for agriculture
1980	Clearing 800 acres of forest for agriculture
1981	29 housing units, 180 housing units
1982	29 housing units, 20 housing units, and small shopping center
1983	Clearing 600 acres of forest for agriculture, 29 housing units and a resort complex
1984	Commercial center
1985	Small shopping center
1986	500 acres of forest for agriculture, clearing 700 acres of forest for agriculture
1987	2 sets of 29 housing units
1988	Light industrial center, large shopping center, and 200 acres of forest for agriculture
1989	200 housing units

forest were cleared for agriculture. Two shopping centers, one industrial center, and one resort complex were also built in the watershed during the last 17 years. Table 3.1 is a chronology of the development. The construction of 594 units of housing and the clearing of 3,603 acres of forest produced a very significant sedimentation impact. The chronology depicted by Table 3.1 shows that in 1973 a law was enacted by the local government to require impact assessment for all housing projects with 30 or more units. The passage of the law had the effect of reducing most housing projects to 29 units or less in order to escape the impact assessment requirement. This strategy is discussed in section 5.2.

Synergistic impacts are the result of interactions between impacts. They occur when the total effects are greater than the sum of the separate impacts. For example, the combined damage to agricultural crops from air containing high levels of both sulfur dioxide and oxidants is much higher than the sum of the damage from each of these pollutants alone. *Antagonistic impacts* occur when one adverse impact partially cancels out another. Antagonistic effects are less common than synergistic effects because additional stress usually disturbs partially degraded natural systems even more. An example of an antagonistic effect is reduced eutrophication of an estuary receiving effluent that contains chlorine and phosphates. While either by itself is harmful, together, in moderate amounts, they may be beneficial.

3.5 Probability and Risk

Since impact assessment is a consideration of what may happen in the future, the probability of occurrence must be taken into account. Impacts can be arranged in terms of probability, ranging from 1, representing certainty of occurrence, to near 0, indicating a very low likelihood of occurrence. In impact chains and networks, the probability of occurrence generally decreases with each added link away from the causal factor. In Figure 3.1, it is a virtual certainty that some measurable amount of sheet and gully erosion will occur if vegetation cover is removed and the soil is laid bare. There is far less probability that the eroded soils will eventually be carried into an estuary in sufficient amounts to increase turbidity in coastal waters to the point that it would decrease recreational qualities. Also, impact chains and networks have the characteristic of conditional probability. The probability of any one link in the chain is a function of the probabilities in all links of the chain that precede it. For example, if a .75 probability is assigned to each of the six links in the chain depicted in Figure 3.1, the probability of removal of vegetation having the ultimate impact of increasing the costs of dredging link is .13, or about one chance in eight. The calculation is $.75 \times .75 \times .75 \times .75 \times .75 \times .75 = .13$.

Risk assessment is a rapidly growing field of analysis. Some authors define risk as simply the probability that an adverse impact will occur. Others define risk assessment as both the probability of occurrence and the analysis of the adverse impact. The two most common adverse impacts are natural hazards, such as flooding, hurricanes and earthquakes, and industrial or transportation accidents, such as the release of radioactive materials from a nuclear power plant or the release of hazardous chemicals in a train derailment.

3.6 Duration

The temporal dimension needs to be considered in IA because impacts occur over time. There are short-term or immediate impacts and long-term or delayed impacts. Not only

Figure 3.6. Relationships between Time and the Location in Which the Impact Occurs

————— TIME —————→

Location in which the impact occurs		Construction	Intermittent during the life of the development action	Permanent throughout the life of the development action	Beyond the life of the development action*
	On the site of the development action	X	X	X	X
	Adjoining or adjacent to the site of the development action	X	X	X	X
	Distant from the site of the development action	X	X	X	X

* The development action has permanently ceased operation, such as the abandonment of an oil field.

are there different impacts in different phases of development (for example, the construction and operational periods), but also, each impact can exhibit different attributes over time. An example of a short-term or immediate impact is the irritation to nearby people of the noise produced by construction work. Alternatively, an impact may only appear after a long period of time has elapsed and assimilative thresholds have been exceeded. The lethal effects of the bio-accumulation of DDT in fish eating birds is an example of long-term or delayed impact. An example of an impact that extends beyond the life of the development action is the extinction of a species. Figure 3.6 portrays one way to delineate the time dimension.

3.7 Intensity and Spatial Extent

Usually one of the first questions asked about an impact is how big will it be? Some of the IA literature uses the term 'magnitude' to mean both a measure of the intensity of impact and the spatial extent of the impact. Since two different metrics are used to measure intensity and spatial extent, they should be kept separate. A basic problem in measuring the intensity is the absence of indicators for many types of impact. For example, changes in the aesthetics of an area are very difficult to measure, as perceptions may vary from one social group to another. How can one measure the visual impact of houses replacing grasslands on coastal lands between the coastal highway and the shore?

3.8 On-Site and Off-Site Impacts

A distinction is often made between impacts that occur on the site of the proposed action and impacts that extend beyond the site. Figure 3.6 makes three distinctions with respect to space. Impacts are divided into on-site, adjoining, and off-site. Adjoining or adjacent impacts are in most cases within view of the site. Proximity to the site usually enables those affected by the impact to easily identify the source. In general the difficulty of making a causal connection between the source of the impact (the causal factor) and the location where the impact occurs increases with distance. The exceptions to this rule are obvious and include such large-scale systems as acid rain and anadromous fisheries.

3.9 Reversibility and Irreversibility

Impacts can be characterized by their reversibility. Some impacts are irreversible once they have occurred and reinstatement of the original conditions is impossible. For example, the vegetation cleared from a building site cannot subsequently be replaced unless buildings are removed. However, other impacts are reversible. Noise levels during construction might rise by 10 decibels above ambient levels. Once the construction activity ceases, noise levels might return to previous ambient levels (if no other noise-producing activities are introduced). In between these two extremes there are gradations of reversibility. In some cases, it is possible to approximate a previous situation. For example, abandoned surface mining sites can be recontoured and replanted so the area resembles the environment before mining occurred. The most common, and tragic, example of an irreversible impact is the extinction of a species.

3.10 The Social Incidence of Costs and Benefits

There are very few significant environmental impacts that do not affect social groups or individuals. Impacts (both beneficial and harmful) are rarely evenly distributed among

Table 3.2. Potential Monetary Returns from Various Mangrove Resources in Papua New Guinea

Resource	US\$/ha/yr (1977) 1/	Effects on ecosystem	Cost of development
Subsistence building materials and fuel	n.a.	none-low	none
Subsistence wildlife	0.27	none	none
Subsistence fishing	0.75	none	none
Subsistence crabbing	0.27	none	none
Subsistence prawning	n.d.	none	none
Crocodile skins	0.27	none	none
Prawn trawling	6.80	none	high
Estuarine fishing and crabbing (commercial)	n.d.	low	low
Off-shore fishing (commercial)	n.d.	none	high
Brackish-water aquaculture	n.d.	high-moderate	high
Mangrove woodchip	0.60-1.37	high	high
Mangrove timber	n.d.	high-moderate	high
Tannin extraction	n.d.	high-moderate	high
Alcohol from Nypa	n.d.	none	low

1/ n.a.=data not available; n.d.=not developed at present.

Source: Table 4.1 on p. 72 from Food and Agriculture Organization of the United Nations, Environment Paper No. 3: Management and Utilization of Mangroves in Asia and the Pacific.

those affected. Some people may only benefit, suffering none of the adverse impacts borne by others. Others may only be harmed. It is important for decision-makers and members of the public to consider that certain social groups may be subject to more harmful than beneficial impacts, while other groups may be in a more favorable position. Issues of distributive justice, as well as political feasibility, should be considered by decision-makers evaluating future development actions. The social incidence of impacts is discussed in more detail in the section on the evaluation step (Section 5.6.2).

One way to determine the socio-economic impact is to calculate the value of the alternative resource uses. Table 3.2 presents potential monetary returns from various mangrove resources. Each alternative use has its own cluster of interest groups. For example, prawn trawling would involve shrimp fishermen, processors, boat owners, and the fisheries management agency.

3.11 Mitigation of Adverse Impacts

Mitigation has a variety of meanings in the IA literature. It can mean avoiding the impact altogether by not undertaking a certain development action. The term is used more commonly to refer to either eliminating adverse impacts, or reducing them to acceptable levels by taking one or more of the following steps:

- limiting the degree of magnitude of the development action (such as reducing the size of the area that will be converted from mangroves to aquaculture ponds);
- changing the design of the development action (for instance, having a road elevated on pilings over a wetland, instead of a solid-fill road base);
- changing the location of the action (this could mean either another location on the site or a different site);
- compensation for the impact by repairing, rehabilitating, or restoring the same type of environmental or cultural quality (for example, restoring degraded wetlands adjacent to wetlands that will be filled by a development action, such as a tourist resort);
- compensation provided by replacing or providing substitute resources or environments (e.g., fishermen are provided with affordable dock space in port development to compensate them for the loss of beach landing area taken over by a resort development);
- preservation and maintenance operations during the life of the development action (such as setting aside habitats that will continually protect rare and endangered species);
- restoring the environment to its former condition after the development action is completed (the reconstruction of dunes and the planting of vegetation after beach mining activities are terminated); and
- relocation or recording cultural and environmental features before the site is developed (for example relocating historic buildings or recording cultural practices on film and tape).

Table 3.3 identifies one or two mitigation measures that are appropriate to reduce or prevent each of the potential effects that may be generated by a coal slurry pipeline. The listing was incorporated into a set of guidelines published by the World Bank to minimize the impact of pollutants from industrial development projects.

A recent study of forecasts and environmental decision-making in respect to 29 impact statements found that:

Mitigation promises are generally quite accurate. Mitigations involve fairly well defined actions that are usually within the control of lead agency managers. Despite some general cynicism about the veracity of government promises, agency managers prove to be quite responsible in carrying out promised mitigations (Culhane et. al., 1987).

Table 3.3. Mitigation Measures for a Coal Pipeline

Activity	Environmental Effects	Mitigation Measures
1. Clearing and grading	Destroys wildlife habitat Encourages runoff and erosion Degrades esthetics	Revegetate quickly Slow runoff Leave screening vegetation
2. Ditching	Potential runoff from spoil pile Covering top soil may produce rock rubble	Close ditch as soon as possible Separate top soil and set aside Haul to appropriate disposal site
3. Hauling and Stringing Pipe	Increased truck traffic	Limit haul hours and route
4. Welding	None	None
5. Coating Pipe	Accidental spill of coating materials	Normal care in operation and availability of cleanup materials
6. Backfill	Extra top soil or ditch "padding" soil may be needed	Use existing or properly sifted borrow pits
7. Clean-up	Erosion of right-of-way	Adequate revegetation program Restore drainage patterns
8. Testing System	Requires large volumes of water	Careful selection of water source and discharge

Source: World Bank, 1978.

4. THE EVOLUTION, DISSEMINATION AND OBJECTIVES OF IMPACT ASSESSMENTS

Most writers date the birth of the impact assessment as 1970, with the passage of the National Environmental Policy Act (NEPA) in the United States. Since that time, at least 25 nations have enacted legislation or executive orders requiring environmental impact assessment and environmental impact statements. Numerous states and provinces have also enacted environmental impact requirements. Table 4.1 is a list of nations and states which have enacted EIA laws or executive orders. Table 4.1 should not be regarded as a definitive list. It is assumed that there are additional nations and states with EIA requirements since our literature review was not directed at identifying all the governments that require impact assessment. Table 4.1 is a by-product of our research.

Analysts who have examined the history of NEPA in the United States concur that the institution of EIA and IA has gone through distinct evolutionary phases. In reviewing the literature that discusses the experiences with IA in developed nations as well as developing nations, it appears that IA is going through a similar evolution in each country.

In the first phase of NEPA in the United States (1970-1973), assessment consisted primarily of casual and disjointed observations of the physical environment in the local project area. No attempt was made to conduct a comprehensive assessment of project impacts on the total human environment. Interrelationships among physical and social components of the environment were largely ignored. In this phase, the assessment effort was devoted chiefly to justifying decisions which had already been made when NEPA was enacted. Indeed, all countries initiating an IA program will endure several years of justifying actions that were initiated prior to the enabling legislation or executive order, when there was little regard for environmental implications.

In the second phase of NEPA (1972-1975), assessment efforts became much more highly organized and typically reflected the interests of highly trained professionals in the biological or other natural science disciplines. This was a period in which the so-called dandelion counts (descriptive inventories of resident species) came into prominence. Thus, in this phase, the primary assessment effort was devoted to compiling massive compendia of scientific and technical data without appropriate regard to how this information would be applied to decision-making.

NEPA's third phase (1976-present) began to focus on physical and social interrelationships among environmental components and dynamics. The approach was clearly systems-oriented and involved the construction and use of qualitative and/or quantitative models of the environment. In this most recent developmental phase of impact assessment, guidelines were implemented to streamline the EIS process. The focus has been increasingly on the early assessment of total environmental impacts and the inclusion of environmental considerations in early project planning.

The current direction of the development and refinement of the impact assessment process clearly reflects a growing awareness of the intellectual and practical challenges. According to one observer of the process there are at least fifteen trends, including:

- an increasing emphasis on the *importance of subjective and social issues* in overall impact assessment;

Table 4.1. Nations and States (or Provinces) with Impact Assessment Requirements

Australia:	Environmental Protection Act, 1975. Also, the states of Queensland and New South Wales have established an impact statement process
Brazil:	1986. Also, the states of Sao Paulo and Minas Gerias
Canada:	Environmental Assessment and Review Process, 1974
France:	Nature Protection Act of 1976
Germany:	Cabinet Resolution, Principles for the Environmental Impact Assessment of Federal Action, 1975
India*:	Department of the Environment has prepared a series of guidelines
Ireland:	Local Planning and Development Act of 1976*
Indonesia:	General Principles of State Policy, Ministry of Development, Supervision and Environment*
Korea**:	Environmental Preservation Law, 1977 and 1981
Malaysia*:	
Philippines:	Presidential Decree 1151, 1977
Sri Lanka:	Amendments to the National Environmental Act, 1988
Thailand**:	Improvement and Conservation of National Environmental Quality Act, 1978
United Kingdom**:	Town and Country Planning Regulation, 1988
United States:	National Environmental Policy Act of 1970. Also, thirty one states have requirements for certain types of proposals
<p>* Only for certain types of large-scale projects.</p> <p>** Project types on positive list.</p>	

Sources: Clark 1981, Clark et al. 1984, Baldwin 1988, Sudara 1984, Wathern 1988.

- an increasing emphasis on *indirect and cumulative impacts of project development*;
- *the development of qualitative and quantitative models* for the analysis of impacts on social and physical interrelationships;
- an increasing emphasis on *public participation* in all analytical and integrative tasks;
- the expansion of the disciplinary base of the assessment team in order to achieve a better *balance of the social and natural sciences disciplines*;
- the development of guidelines for evaluating the *significance of individual and cumulative impacts*;
- the development of guidelines and regulations that better ensure the *consideration of environmental impacts in early project development*;
- the *streamlining of environmental reports* in order to facilitate their actual use in project planning and development;
- the increasing emphasis on the assessment process as a means for *evaluation of alternative actions* (including the no-action alternative), and the decreasing emphasis on the *assessment process as a means for justifying decisions* already made;
- an increasing recognition of the *need to monitor the environmental consequences* of projects already subjected to the IA process in order to evaluate the quality of previous assessments and to *ensure the compliance of the completed project with planned mitigating and/or enhancing measures*;
- the development of manuals and monographs on the *mitigation of negative impacts and the enhancement of positive impacts* of different types of projects;
- the development of university and college departments, institutes, and curricula that *focus on interdisciplinary problem-solving and on analytical and integrative skills* required by the impact assessment process;
- the development of local, regional, national, and international workshops, programs, and *training courses on assessment-related issues*;
- the development of guidelines and regulations for *avoiding conflicts of interest* in the design and conduct of assessment projects; and
- the development of guidelines and regulations for *conducting programmatic assessments* that will consider how general types of actions can typically impact the environment regardless of site-specific conditions (O'Riordan, 1981).

The NEPA experience over the last two decades, with approximately 500 EIS prepared and thousands of IAs completed annually, clearly demonstrates that IA is a dynamic and evolving institution. Moreover, each of the trends identified above will likely influence the impact assessment process in the next few years.

4.1 Incorporating Impact Assessment into the Planning Process

Most documents in the IA literature recommend that the IA process be applied to the four types of development actions defined and described in Section 2.2: overall national or provincial plans or programs; sectoral plans or programs; and local projects. This recommendation is generally referred to as the 'tiered' approach to policy-making, as depicted by Figure 2.2. There are at least four comparative advantages to the tiered approach.

Confining impact assessment to the project level has a number of inherent problems. Assessment of projects is limited to incremental impacts and usually fails to identify - much less assess - cumulative impacts. Yet cumulative impact assessment is a basic and essential requirement for the management of coastal resources and environments. As described in Section 2.3, the coastal zone is an aggregation of eight environmental and physical systems, each of which must be managed to control cumulative impacts. Regional planning on a system-wide basis is the most effective means to assess and manage cumulative impacts.

Conducting impact assessments at the project level does not achieve economies of scale. Many individual impact assessments, conducted within the same environmental system, will exceed the total cost of conducting one regional impact assessment for the entire system. National and provincial, or local coastal management programs provide an excellent illustration of the comparative costs of assessing impacts on a project by project basis **or** by comprehensive land and resource use plans. Most coastal management programs start off by assessing the impacts of each project that might generate significant impacts. Soon it becomes very apparent that project by project review not only fails to adequately assess cumulative impacts, but it is also very costly. The more efficient and cost-effective alternative is to prepare a system-wide plan that integrates all the relevant environmental and social factors. Once the plan is complete, project-level impact assessment then becomes a relatively simple and low cost determination of whether the proposal is in conformity with the plan. If the coastal plan is based on a sound environmental assessment, only those proposed projects which fail to conform are likely to require detailed environmental assessment. The evolution of the coastal management program in California is perhaps the best illustration of the change from project review to plan-making (Blayney and Dyett, 1988).

The range of location and design alternatives is much more limited at the project level than at the higher tiers of planning and policy-making. At the national, sectoral, or regional scale of planning, all locations and technologies that are economically feasible can be comparatively assessed with respect to their environmental impacts. By comparison, at the project level there are fewer location or design options. Impact assessment at the sectoral or regional planning levels usually offers a wide range of both location and design options.

A number of problems are encountered in conducting IA at the national or sectoral scale of planning. One basic obstacle is the reluctance of government bureaucracies to open up their higher levels of policy-making to outside review. Secondly, national and sectoral planning always has a future time span. The precision of impact assessment decreases as the time dimension increases. A third factor is the general and sweeping nature of national or sectoral planning activity. Commonly, national and sectoral plans cannot specify the exact location or type of technology that will be employed. If the location and the technology can not be established, only a generalized impact assessment can be conducted. A fourth impediment is the number of alternatives available at the national and sectoral level. If the location and technology can be specified, it is often too costly to assess all feasible alternatives in any depth.

Coastal management programs have often demonstrated that impact assessment is most effectively conducted at the regional system level, such as a coastal watershed or an entire estuary system. Regional impact assessment not only addresses cumulative impact but also can achieve economies of scale. Moreover, at the regional scale there is sufficient specificity in the technology and location options to conduct an in-depth analysis.

The preparation of plans must be based on adequate data relating to the existing environment and the implications of possible changes. The systematic collection, analysis, storage, and regular updating of such data will therefore greatly improve the quality of subsequent project IAs, as well as reducing time and costs. IA and environmental planning ought therefore to be seen as complementary and mutually supportive of each other.

'Areawide' environmental impact assessment is the term most often used in the United States to describe the regional approach to IA. Most areawide assessments have been done in urban areas where there is a cluster of proposed development actions that interrelate with each other. The areawide assessments are designed to reduce permit processing delays, reduce expenses in project-specific assessments, and address long-term comprehensive and cumulative effects of individual actions (Skidmore, Owings, and Merrill, 1981).

4.2 Impact Assessment in Developing Nations

Many authors of IA books and articles have suggested that impact assessment as practiced in developed countries cannot be directly transferred to planning and assessing development actions in developing countries. This topic is very well presented by John Horberry, who analyzed IA in both developed and developing nations. The following section is drawn from Horberry's analysis of transferability (Horberry, 1984).

There are several differences in emphasis between developed and developing countries. Five differences are summarized in Table 4.2. Experts observe that the process in developed countries is rigid, expensive, requires large numbers of highly trained specialists, too methodologically ambitious, and too separate from the planning process. Most authors agree that emphasis should be put on IA approaches that are:

- Not exhaustive and unnecessarily elaborate;
- do not involve complicated methodologies;
- geared towards identifying mitigation and management measures;
- adaptive to the uncertainty of natural system effects and implementation problems; and
- take account of multiple objectives and consequent trade-offs.

This is not a simple task for any country. Perhaps what is really needed is a demystification of IA and an emphasis on sound policies supported by realistic procedures and suitable technical analysis. If the policy concern exists and there are mechanisms for ensuring effective implementation, the most urgent need is for skilled and experienced planners. If a procedural approach is necessary to ensure compliance, then planners should specify the most flexible, cost-effective and simple methods for obtaining the appropriate information and analysis.

Critical analyses of the EIA process in developing countries usually conclude with a similar set of observations on the process and the institution. Developing countries should be wary of methods that reduce complex problems to meaningless ratings and rankings or demand expensive modeling and simulation. Too often what is proposed turns out to be less useful for providing the information needed for decision-making instead of a more common sense

Table 4.2. Differences in Emphasis in Assessment Between Developed and Developing Countries

The methods of industrial nations have emphasized:	Developing nations need information and analyses for:
<p>Identification of adverse impacts on environmental quality.</p> <p>Conservation of resources; decreased per capita consumption of energy and materials.</p> <p>Extensive consideration of alternatives to development of natural systems.</p> <p>Deferral of development until more knowledge of consequences is available.</p>	<p>Practical means of mitigating adverse environmental impacts.</p> <p>Increased per capita use of energy and materials.</p> <p>Increased productivity of managed ecosystems.</p> <p>New opportunities for intensified but sustainable exploitation of renewable resources.</p> <p>Immediate benefits even though consequences are uncertain.</p>

Source: *Environmental Impact Assessment Review*, "Balancing Economic and Environmental Objectives: The Question is Still How," Carpenter. Table 1, *Differences in Emphasis in Assessment Between Developed and Developing Countries*

and simpler approach. Certainly, there are problems that demand sophisticated analysis or judgment. However, suitable technical expertise and judgment is more important than elaborate methods.

More importantly, the method of assessment should be applied early enough in the project cycle to allow scoping to focus the analysis on expected problems. IA should also avoid reducing information to meaningless numbers. It should reflect true resource costs over time, and should focus on problem solving, management, and monitoring. These observations are reiterated in the subsequent sections on evaluation, review and comment, decision, and monitoring.

The role of the formal IA procedure and its implementation in developing countries depends greatly on the political context and the prevailing institutional arrangements for development control. The general political context is important. Political systems in developing countries are rarely pluralistic. Leaders and senior officials have considerable personal power and influence over individual decisions. The balance of inter-agency influence is less stable and usually depends on the power of the current minister. Sometimes line agencies and state enterprises are given autonomous authority to get things done, which inhibits coordination and comprehensive review. Public opinion rarely has an influence - at least directly - on major development investment decisions.

One cannot assume that there are good, cost-effective, systematic methods for selecting development projects and allocating scarce resources. Most developing countries have the institutional mechanisms for developing national plans and programs to assess projects. In practice, however, much of the effort to review and appraise projects is focused on the information requirements of international development institutions in the hope of obtaining funding. Rigorous economic or social criteria are rarely applied in internal project planning and approval. As stated earlier, many decisions are politically determined and few are reviewed according to multiple criteria, such as environmental and socio-economic impacts. This poses problems for implementing an IA system that requires a national review of proposed development actions.

The IA process in developing countries might be more accurately thought of as a mechanism for altering the balance of power in government decision-making. IA provides more opportunities for introducing environmental issues to the debate, and puts pressure on executive agencies to undertake mitigation measures. Those responsible for IA need to be realistic about the opportunities that exist to include environmental issues in the decision-making process along with all the other factors that come into play. Ideally, IA planners strive to influence the choice of policy alternatives. If that is not possible, they may try to influence the location and design of the alternative chosen, and the mitigation of the adverse impacts.

There are other barriers to effective IA implementation in developing countries. There is an unfamiliarity with the conceptual basis of IA and its potential role in the planning process. There is uncertainty about the methods and level of effort required for IA, an absence of clear procedural guidelines and regulations for implementation, a shortage of experienced staff in government and among project proponents, and a lack of baseline data. Above all, environmental agencies lack the authority with which to influence the design and implementation of projects. In general, they also lack staff with adequate training and expertise to conduct impact assessments.

In the developing countries that exercise the IA procedure, the evidence clearly indicates that environmental agencies do not have the legal authority or the political strength to enforce compliance by other ministries. Their efforts are usually focused on elaborating

procedures and guidelines and extending their influence and authority in development planning and decision-making. The environmental agency only influences compliance in exceptional cases, and judicial systems play only a minor role in reviewing the actions of public agencies. However, in some countries, such as Thailand, Sri Lanka and the Philippines, IA is implemented to some degree and plays at least a small part in planning, debating development, and implementation decisions. In the course of carrying out IA in these countries, environmental agencies try to enlist the cooperation of other ministries in addressing environmental problems and in incorporating environmental analysis in the planning process as well as regulating development actions.

A study of the use of IA for development project planning in Association of Southeast Asian Nations (ASEAN) countries, focusing mainly on Thailand and the Philippines, estimates the costs, delays and benefits of implementing IA (Horberry, 1984). Though the report is inconclusive, it asserts that costs and delays do not pose significant problems for projects required to conduct an IA. Nevertheless, there is a problem in influencing the implementation of projects on the basis of the results of the assessments. Completion of the report is the goal, not devising environmental management plans to assess human and environmental needs. Preparation of IA is not coordinated with the project feasibility study. IA reports concentrate on the description of environmental conditions and projected effects, but do not estimate the economic value of the effects or propose ways of managing problems within a cost-benefit framework that is intelligible to decision-makers. What is needed is attention to procedural questions, such as the identification of categories of projects that are likely to benefit most from IA, and the mechanisms for reviewing and estimating the economic value of IA results, so that practical solutions and measures can be identified.

The few developing countries that have implemented IA do not usually employ it as a direct planning tool, but use it more as an instrument to influence government decision-making. In some cases, however, IA has been successfully used as a planning tool. For instance the Electricity Generating Authority of Thailand used IA for the planning of power generation projects. The IA planning provided the basis for avoiding, mitigating and managing the impacts of hydro-electric projects and power stations (Horberry, 1984).

Many, if not most, IAs in developing countries do not result from government requirements, but are conducted at the behest of international assistance agencies either in fulfillment of a procedural requirement (such as USAID's compliance with NEPA) or on an ad hoc basis to demonstrate that environmental problems have been considered during the project's planning process. Development funding agencies also support the application of IA by certain agencies in developing countries whose operations require addressing serious issues of environmental degradation and natural resource productivity. For instance, the World Bank has supported the Electricity Generating Authority of Thailand, the Ministry of Transmigration in Indonesia, and the environmental agency of Sao Paulo state in Brazil. IAs carried out under these circumstances function as planning tools for project preparation and design. It is understandable that the project proponent in the developing country will not want to commit extra resources to environmental analysis, or risk the project's future by subjecting it to the review of non-sympathetic organizations with very different environmental and social interests. However, international assistance institutions can often convince such proponents that it is worth taking the trouble to anticipate adverse impacts in the long run in order to build in management or mitigation measures that will help ensure the success of the project. Thus, international development assistance institutions appear to be the greatest impetus to IA in developing countries.

4.3 The Objectives and the Intended Benefits

The general goal of impact assessment is to provide decision-makers with better information so that costs associated with a proposed development action will be minimized and the benefits maximized. This general goal, however, must be translated into a more specific set of objectives. A set of objectives serves two purposes:

1. provides government with the rationale for initiating an IA process; and
2. creates a standard for evaluating the IA program.

Impact assessment programs will continually be under assault from institutions who perceive that their interests will not be served by better information. The IA program will have to be repeatedly defended by demonstrating that it is achieving its objectives. Section 5.9 discusses the evaluation of impact assessment programs. In order to conduct a critical assessment of an IA program it is necessary to define the program's objectives and intended benefits. During the twenty year history of IA, the following eleven objectives commonly articulated include:

1. providing a systematic and coordinated means to identify and address the full costs of development on environmental and social values that will allow decision-makers to understand the ramifications of their actions;
2. identifying the benefits and costs that are not accounted for through standard economic evaluation because they are external to the proposed development and/or they are difficult to quantify;
3. selecting an option that ensures that all possible joint gains among competing interests have been secured (The identification and assessment of all reasonable alternatives and mitigation measures is necessary to achieve this objective.);
4. identifying and reducing the costs that arise from unexpected adverse impacts (An unexpected adverse impact often creates costs that if known in advance would have precluded consideration of the development action. Also, changes in a development action during the design and planning stage are less costly to implement than after a project is completed.);
5. assisting in the completion of a development action within its budget and time schedule (An action that has been designed to suit the environmental and socio-economic setting is more likely to be completed on time and within budget, and is more likely to avoid difficulties along the way.);
6. increasing the likelihood that a development action will achieve the level of self-support for which it has been designed (An action that conserves the natural resources it relies upon will continue to be sustained by the environment and local population for years to come.);
7. enhancing the political standing of the institution that is the proponent of the development action (An action that yields its benefits without causing serious problems is more likely to bring credit and recognition to its proponents.);

8. increasing coordination among different units within the government. (Improved coordination will both reduce the costs of government operation and provide better information to the decision makers.);
9. increasing scientific understanding of the dynamic functioning of environmental and social systems (Impact assessment creates projects that monitor changes in systems and improve the state of the art in models for estimating potential impact.);
10. providing the opportunity for public participation in the decision-making process (Public participation can improve the information base, reduce destructive confrontation, and build a social support structure for the development action. Social support will increase the likelihood that the development action will achieve its intended level of self-support.); and
11. complying with the requirements of international assistance institutions for impact assessment.

The last objective is not officially articulated by any of the developing nations but most observers of the international assistance institutions note that the practice of IA would be considerably reduced if the international donor institutions did not require the process.

5. THE IMPACT ASSESSMENT PROCESS

The impact assessment process should be organized so that it directly supports the many decisions that need to be taken about a proposed development action. It should start early enough to provide information to improve basic designs, and progress through several stages of program and project planning.

The nine steps in the impact assessment process are listed along the left side of Figure 5.1. Not all of the nine steps are equally appropriate for the five types of development actions previously defined in Section 2.2 and listed across the top of Figure 5.1. A distinction is made between large-scale projects that normally require an environmental impact statement (EIS) and the medium- to small-scale projects that are usually exempt from preparing an EIS.

All development actions must furnish a description and an estimation of their impacts, as well as an evaluation defining the significance of the impact. A decision must also be made in regard to all five types of development actions. The screening step is not applicable to national planning, sectoral planning, or regional plans. National planning and medium- to small-scale projects do not identify and consider alternatives. There is also minimal review and comment on national plans or medium- and small-scale projects. In developed nations that require impact statements, public participation often occurs in the scoping stage and is usually mandated at the review stage for the projects. By contrast, public participation is not mandated by many developing nations that require the preparation of impact statements. Auditing the actual impacts generated is often done in developed nations for national, sectoral, and regional plans. In developing nations, auditing is infrequently done on either of the two project types.

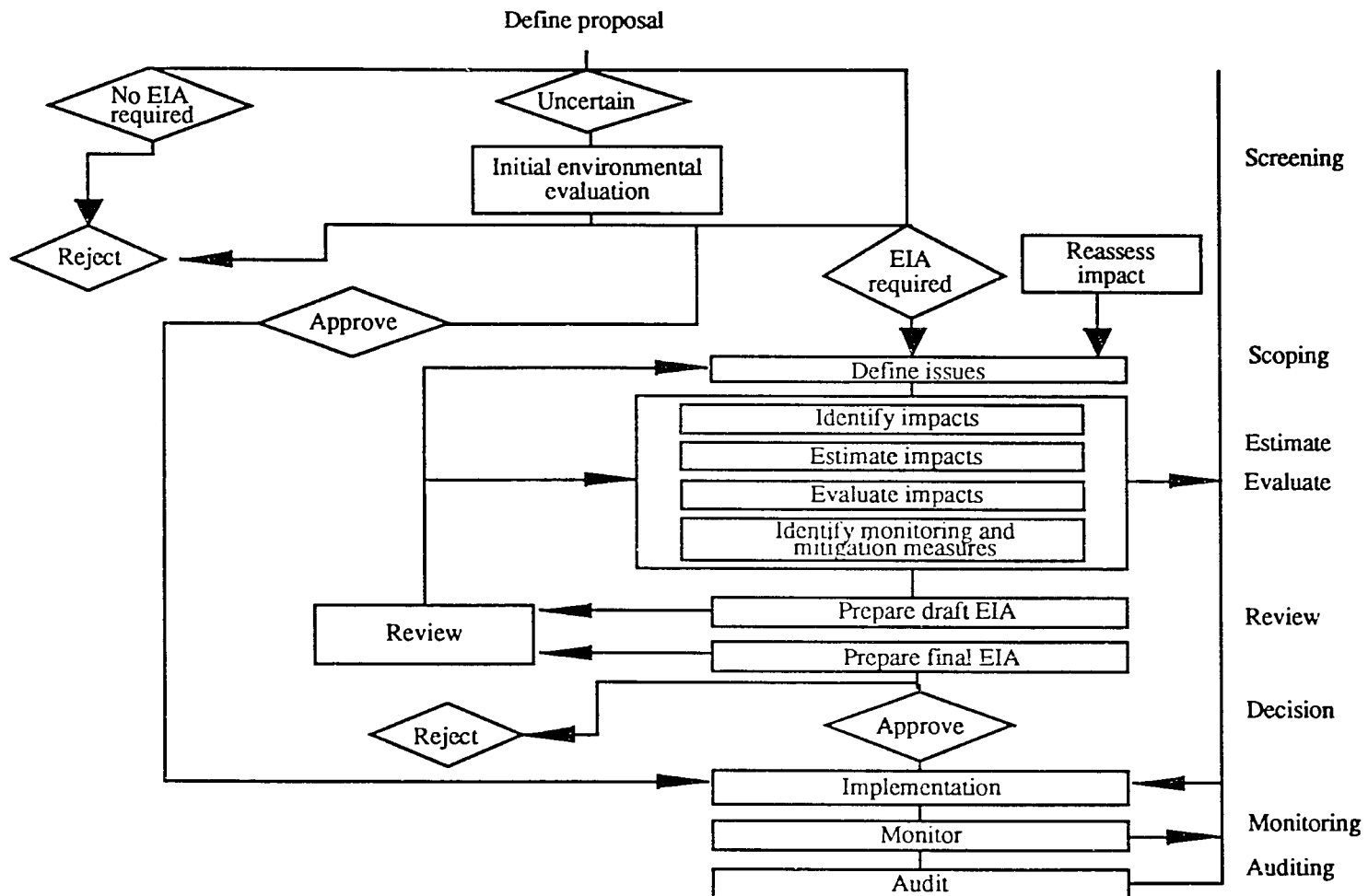
There are at least three perspectives on the IA process. One perspective is held by the person or persons assigned to conducting the impact assessment. The preparer of most IAs is a civil servant in a government agency. However, in respect to projects proposed by the private sector, private consultants or staff members of non-governmental organizations (NGOs) often conduct the IA and prepare an analysis report. A second perspective on IA is that of individuals or institutions who by law or contract are responsible for reviewing impact assessments. This group is often referred to as the 'formal reviewers'. The formal reviewers are usually in government agencies that are external to the agency conducting the assessment (commonly referred to as the lead agency). Frequently, formal reviewers include members of the academic community and organized interest groups such as conservation organizations and trade associations. The third perspective is that of individuals, groups or organizations whose interests may be either adversely affected or benefited by the impacts of the proposed action. This group of informal reviewers may include many representatives who are also in the group of formal reviewers.

The process usually followed in the preparation and review of environmental impact statements is diagrammed by Figure 5.2. Sri Lanka's application of impact assessment to the review of coastal development proposals is illustrated by Figure 5.3. There are only two major differences between the two processes. The impact statement process shown by Figure 5.2 requires the submission of both a draft and a final assessment as well as public review and comment on the draft statement.

Figure 5.1: Relationship between IA Steps and Types of Development Actions

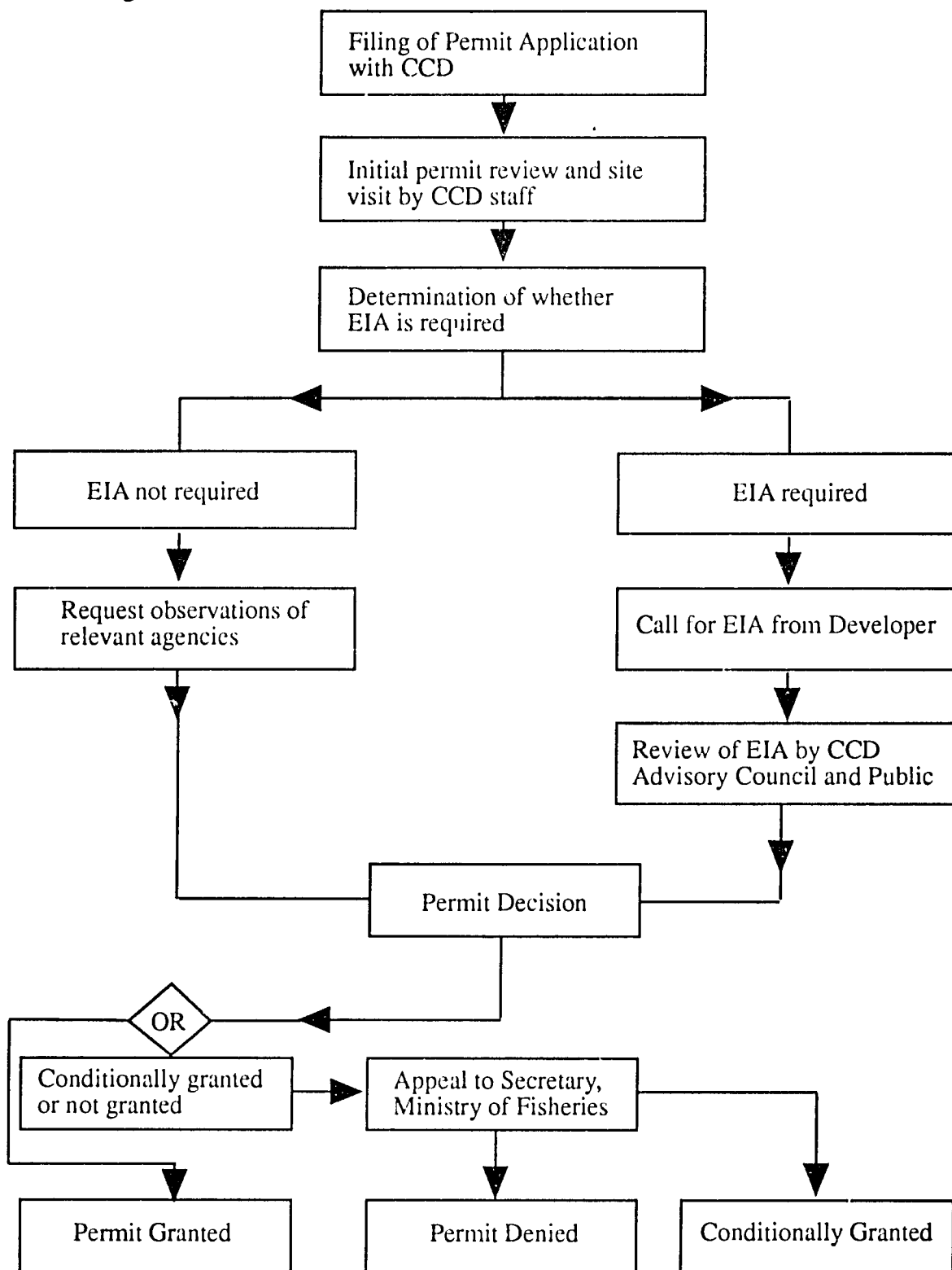
IA STEPS	TYPES OF ACTIONS				
	Overall national plans and programs	Sectoral programs and plans	Regional plans	Large scale project (EIS usually required)	Medium to small scale projects (EIS not usually required)
1. Action Description	X	X	X	X	X
2. Screening	NA	NA	NA	X	X
3. Scoping	X	X	X + PP	X + PP	X
4. Alternatives	I	I	X	X + PP	I
5. Estimation	X	X	X	X	X
6. Evaluation	X	X	X	X	X
7. Review	I	X	X	X + PP	AWR
8. Decision	X	X	X	X	X
9. Auditing	X	X	X	I	I
Key: X = Commonly Occurs I = Infrequently Occurs PP = Public Participation AWR = Agencies with the Legal Responsibility NA = Not Applicable					

Figure 5.2. Flow Diagram Showing the Main Components of an EIS System



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Figure 5.3. Sri Lanka Coast Conservation Department (CCD) Procedure for Reviewing and Issuing Permits



Source: Sri Lanka Coast Conservation Department, Sri Lanka Coastal Zone Management Plan, 1990

5.1 Description of the Proposed Action

The description of the proposed action begins the process of impact assessment. The basic objective of the description is to provide adequate information to conduct the next seven steps of the process.

The proponent or initiator of the action must do the initial description, and in most cases, the proponent or initiator is also responsible for the complete and final description. If the impact assessment is to be prepared by an institution other than the unit that has described the action, it is obvious that the description must provide the information needed to conduct an adequate assessment. The unit of government that conducts the impact assessment and is responsible for issuing the assessment report is usually termed the lead agency.

Similarly, and no less importantly, the description must provide reviewers unfamiliar with the proposed (or completed) action sufficient information to conduct an adequate independent review. This means that the action description has to provide enough information for reviewers to conduct their own impact assessment - if deemed necessary - that is independent from the impact assessment done by the lead agency.

Understandably, the proponents or initiators of a development action usually want to avoid including information in the action description that they perceive may adversely affect their desired outcome, implementation of the proposal. Therefore, guidelines are necessary to specify what must be included in the description of a development action. Guidelines prepared by governments with the longest history of impact assessment include the following five specifications:

A. Purpose

What are the goals and objectives the action is designed to achieve? What socio-economic benefits will the action achieve?

B. Integration with Higher or Co-Lateral Actions

What was the policy-making cycle that led to the action being proposed? How does the action integrate and support the higher or co-lateral levels of plans and programs (see Section 2.2)? Have impact assessments been conducted at the higher or co-lateral levels of plans or programs?

C. Physical Description

Describes the activities that will occur. The activities associated with the entire time span of the action should be included. For example, many projects have four phases including research and exploration, construction, operation, termination and restoration. Are there any activities that may be hazardous to health or safety? Indication of the magnitudes of the project should be given, such as area extent, number of personnel involved, equipment, and required materials.

D. Staging and Future Plans

Are there future additions to the action that can be anticipated? Projects are commonly increased in size and or density several years after they receive initial government approval. Is this proposal just one segment of a larger development plan?

E. Environmental and Socio-Economic Setting

Describes the area's environmental and socio-economic conditions. Maps should be used that indicate the appropriate conditions. Environmental

conditions would normally include geology, soils, hydrology, flora, fauna, and hazards. Socio-economic conditions would normally include present land use, employment, regional income, and demographic characteristics. Unusual or important elements of the existing situation should be pointed out. For example, the existence of rare species, landmarks, and unique social characteristics of a community should be identified.

A second major problem in action description is that the guidelines are often very general - such as the ones listed above. They cover all types of projects, all types of environments and all types of socio-economic settings. However, if the action description is being done by the same institution that is conducting the entire impact assessment process, the generality of the guidelines may not be a problem. When the succeeding steps of the impact assessment process are done, the significant impacts will be determined. Once the significant impacts have been determined, then it is possible to write the action description that contains the information necessary to conduct an impact assessment or impact review. In other words, it is an iterative process.

If the action description is being written by someone who does not know what the full range of significant impacts may be, and the guidelines are very general, then the information is very likely to be inadequate for impact assessment purposes. In such cases, the description will contain much information that is both too detailed and too irrelevant to the significant impacts. Also, the description will fail to include relevant information that is necessary for others to adequately assess impacts. This latter situation assumes that the omission of relevant information is a result of ignorance, not conscious intent to conceal unfavorable aspects of the action.

A common solution to the problem caused by general guidelines on project description is to make them specific to types of projects, or types of environments, or a particular geographic area. Coastal management agencies have prepared guidelines on the types of projects they routinely review, such as houses, subdivisions of land, bulkheads, groins and jetties, docks, hotels, and restaurants. Guidelines have also been written for common types of coastal environments such as wetlands, mangroves, dunes, estuaries, and flood plains. Coastal management programs that have progressed to the implementation stage often have action description guidelines for different geographic areas, such as watersheds, in which estuary water quality impacts are an issue.

5.2 Screening

The second step of the impact assessment process, screening, determines whether an IA is needed. Ideally, this step will quickly and easily identify those actions that should have their impacts assessed and, just as importantly, identify those projects that do not warrant continuing the IA process. In practice, the screening step sorts actions into three categories:

1. those clearly requiring IA;
2. those clearly not requiring IA; and
3. those for which the need for IA is unclear and therefore further analysis is required.

At least six analytical methods have been developed to assist in making screening decisions. They are:

1. positive and negative lists;
2. thresholds;
3. checklists, matrices, and networks;

4. overlay mapping and geographic information systems;
5. sensitive areas; and
6. compliance with an adopted plan.

Positive and Negative Lists

Positive and negative lists appear to be the simplest screening method. Positive lists specify types of development actions which would require an impact assessment. Negative lists indicate the categories of development actions that would normally be exempt from the IA process. The term 'categorical exemption' is frequently applied to actions that comprise the negative list. Table 5.1 is an example of a positive list based on project types.

Some research is required to prepare lists of development actions. Lists are an easy to use system which is readily understood by all concerned. However, gaining acceptance by all institutions on which development actions should be on the lists is usually a time-consuming endeavor.

Positive lists may be compiled by reviewing existing developments and identifying those types of actions that routinely produce adverse impacts. Similarly, actions which seldom generate adverse impacts can be added to the negative list. In the case of those actions for which it is difficult to determine the appropriate list, other screening methods can be applied. For example, the most common problem with lists is that the same type of action can have considerable variation in size, design, and longevity. Also, an action which ordinarily produces no significant impacts may be proposed for a particularly sensitive environment, and therefore should be subject to the IA process. To accommodate these two kinds of problems, the threshold method is frequently applied.

Thresholds

This method establishes size or intensity levels for key features of the action, the environmental setting, or the social setting. If it is anticipated that a threshold will be exceeded, then an IA is required. Positive and negative lists can be simply converted to thresholds by adding size dimensions (for example, hotels with more than 25 rooms require an IA, or all developments with a value in excess of \$250,000 require an IA). Infrastructure requirements, such as water supply demand, have also been used as a threshold. A second means of setting thresholds is location in respect to environmental and social conditions (for example, all substantial development must have an IA if it is within 50 meters inland of the mean high tide, or in a coastal wetland).

Reliance on one threshold may produce incorrect decisions. It is therefore normal practice to link a number of thresholds together, particularly action and environmental thresholds (for example, a hotel with more than 25 units within 500 meters of the mean high tide requires an IA). However, consideration will be needed to prevent a series of thresholds from becoming too cumbersome and time-consuming.

A common problem encountered when using thresholds is development actions that have been designed to barely slip under the minimum levels. For example, if 25 rooms is the threshold level for an IA on a hotel, a common response by hotel developers is to divide a large project into segments of 24 units or less and submit these segments at different points in time, such as one 24-unit proposal each year over a four year period. This ploy is usually called segmentation. In the first step of the IA process, action description, it was recommended that the presentation should include staging and future phases of the project. This requirement is intended to eliminate segmentation. The segmentation ploy is illustrated by Figure 3.5 and Table 3.1. In the example, an impact assessment law was passed in

Table 5.1. List of Those Projects or Activities in Thailand Requiring Preparation of an EIS

Types of Projects or Activities	Sizes
Dam or reservoir	Storage volume greater than 100,000,000 cubic meters or storage surface area greater than 15 square kilometers
Irrigation	Irrigated area greater than 12,800
Commercial airport	All sizes
Hotel or resort facilities in environmentally sensitive areas, such as areas adjacent to rivers and the coast	Greater than 80 rooms
Mass transit system and expressway	All sizes
Mining	All sizes
Industrial estate	All sizes
Commercial port and harbor	With capacity for vessels of greater than 500 tons
Thermal power plant	Capacity greater than 10 MW
Petrochemical industry	Greater than 100 tons/day of raw materials required in production
Oil refinery	All sizes
Natural gas separation or processing	All sizes
Chlor-alkaline industry requiring NaCl as raw material for production of Na_2CO_3 , NaOH, HCl, Cl_2 , NaOCl and bleaching powder	Production capacity of each or combined product greater than 100 tons/day
Iron and/or steel industry	Requiring iron ore and/or scrap iron as raw materials for production greater than 100 tons/day or using furnaces with combined capacity greater than 5 tons/batch
Cement industry	All sizes
Smelting industry other than iron and steel	Production capacity greater than 50 tons/day
Pulp industry	Production capacity greater than 50 tons/day

Source: Sudara, 1984.

1973. The threshold was set at 30 housing units. Table 3.1 shows that, since 1974, 29 units has become the most common size of a housing development project.

Checklists, Matrices and Networks

These three techniques provide a comprehensive framework that can be quickly used to systematically identify potential adverse impacts. Table 5.2 is a checklist based on types of environments and potential impacts. Table 5.3 provides an example of a matrix used for screening. Usually, only one of the three techniques is used to screen actions, since all three produce somewhat the same result. Each have their relative advantages. Normally, checklists, matrices, or networks are not related to specific types of environments and consequently, it is not possible to determine if the adverse impact will be significant or insignificant.

Overlay Mapping and Geographic Information Systems

Overlay mapping has the capability of relating the action to its environmental and social settings. In its simplest form, overlay mapping is a series of single factor maps such as geology, hazards, soils, vegetation, fauna, cultural sites, and landmarks. Figure 5.4 depicts the map overlay process. Overlays of these maps on the site of the proposed development action should identify which of the mapped factors will be affected. The maps and the information they portray should also provide some dimension of the significance of the impact.

During the last ten years, with the advent of small and powerful computers, geographic information systems (GIS) have become a common tool in the field of environmental planning. All geographically referenced information can be digitized and entered into computer storage. Instead of laboriously overlaying maps with different characteristics, a GIS can perform this function. In a GIS, all available types of information pertinent to environmental planning can be referenced to their geographic location. This permits answering questions about potential impacts. For example, a GIS could quickly identify if a proposed development's site and surrounding area contain habitats of rare or endangered species, or include hazard-prone lands, archaeological sites, or erosion prone soils. GISs have been particularly useful in the identification of cumulative or synergistic impacts. In response to a proposal to clear-cut a forest area for agriculture, a GIS could determine the cumulative impacts if all lands in that particular watershed with similar characteristics, such as soil type, slope, forest cover and in private ownership, were also allowable for agriculture development.

There are three major problems with a GIS. Building the system will impose high start-up costs involved in buying the hardware and software, as well as inputting the information. The second problem is the scope, coverage, and quality of relevant information necessary to make the system effective. A staff that is competent to operate, maintain, and update the system is the third problem. A GIS is only cost-effective if it is designed and operated as a long-term investment. With the advent of micro-computers and new software programs, the cost of establishing and maintaining a GIS have been considerably reduced. The micro-computer is relatively cheap in comparison to main frame computers, and it also increases the possibility of establishing or operating a GIS on a local or regional level. At the time of this writing, a combined hardware/software GIS can be obtained for about US \$40,000.

Table 5.2. Potential Impacts of Particular Concern According to Coastal Habitats

Coastal Habitat	Impacts of Particular Concern to the Sri Lanka Coast Conservation Department
1. Coral reefs	Physical damage to coral reefs and collection of reef organisms beyond sustainable limits Increases in freshwater runoff and sediments Introduction of waterborne pollutants
2. Estuaries/lagoons	Encroachment Changes in sedimentation patterns Changes to the salinity regime Introduction of waterborne pollutants Destruction of submerged and fringing vegetation Inlet modifications Loss of fishery habitat
3. Mangroves	Changes in freshwater runoff, salinity regime and tidal flow patterns Excessive siltation Introduction of pollutants Conversion of mangrove habitat and over-harvesting of resources
4. Seagrass beds	Physical alterations Excessive sedimentation of siltation Introduction of excessive nutrients or pesticides
5. Salt marshes (tidal flats)	Degradation of birds habitat or seed fish collection sites Obstruction of storm water runoff
6. Barrier beaches, sand dunes and spits	Sand mining Erosion Dune migration

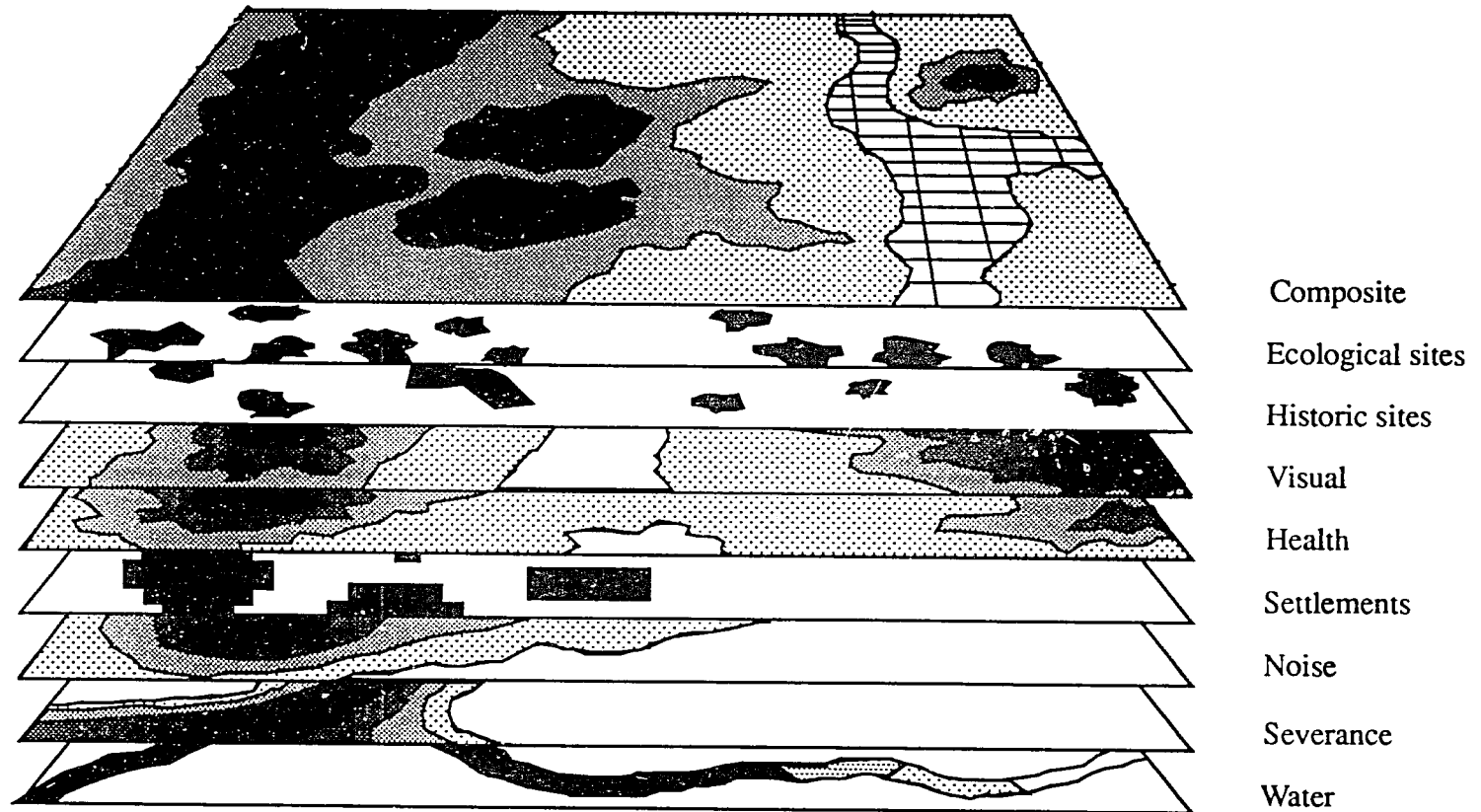
Source: Sri Lanka National Coastal Zone Management Plan, 1990

Table 5.3. Screening Questions

No.	Question	Rating	Score
1	What is the approximate cost of the construction project?	High Medium Low	10 5 0
2	How large is the area affected by the construction project?	High Medium Low	10 5 0
3	Will there be a large, industrial type of project under construction?	Yes No	10 0
4	Will there be a large, water-related construction activity?	Yes No	10 0
5	Will there be a significant waste discharge (in terms of quantity and quality) to natural waters?	Yes No	10 0
6	Will there be a significant disposal of solid waste on land as a result of construction & operation of the project?	Yes No	10 0
7	Will there be significant emissions (quantity and quality) to the air as a result of construction and operation of the project?	Yes No	10 0
8	How large is the affected population?	High Medium Low	10 5 0
9	Will the project affect any unique resources (geological, historical/archeological, cultural, ecological)?	Yes No	10 0
10	Will the construction be on floodplains?	Yes No	10 0
11	Will the construction and operation be incompatible with adjoining land use in terms of aesthetics/noise/odor/general acceptance?	Yes No	10 0
12	Can the existing community infrastructure handle the new demands placed upon it during construction & operation of the project?	No Yes	10 0
			Total: 135

Source: Sudara, 1984.

Figure 5.4. Overlay Mapping Process



The use of overlays to show environmental impacts.

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Sensitive Areas

Since the environmental consequences of an action are a function of both the development action and the setting, the sensitivity of the environmental and socio-economic conditions that characterize the setting provide another means of determining whether an impact assessment is required. A common practice in environmental planning is to map areas with environmental or socio-economic conditions that are particularly sensitive to different types of adverse impacts. 'Critical areas' or 'sensitivity analysis' are other names commonly applied to such a program. The sensitive areas approach has been frequently used to define locations where cumulative impact is an issue. Watershed management, wetlands protection, and hazard-prone areas are three of the more common applications of the sensitive area approach. Sensitive areas can be identified in an overlay mapping or GIS system.

Plan Compliance


If a comprehensive environmental management plan has been adopted for the area proposed for site location, IA may be reduced to simply determining if the action and its impacts will be in compliance with all aspects of the plan. If the action is in compliance with all aspects of the plan, no further impact assessment should be necessary since all the relevant environmental and socio-economic impact analyses were done when the plan was prepared. This point has already been discussed in Section 4 and is illustrated by Figure 5.5. In many nations, impact assessment programs and environmental management programs (which include coastal zone management) have been created by laws or executive orders. It also appears that all impact assessment programs were usually enacted first. Prepared examples include Sri Lanka, Thailand, and the United States. Figure 5.5 illustrates a relationship between the separate enactments of an impact assessment program and an environmental management program. The general evolution is that environmental impact assessment, in the absence of environmental planning, is the major environmental influence on decision-making. As environmental plans are prepared and implemented they replace impact assessment programs as the primary environmental influence on decision-making.

Initial Environmental Examination

The screening step is often made into a formalized procedure by government units that routinely issue or deny permits for proposed development actions. An initial environmental examination (IEE) is the most common name for this formalized screening procedure. The six screening methods just outlined have all been used both individually or in combination to conduct initial environmental evaluations. In most cases, the decision emanating from an IEE is that the potential impacts are not significant enough to warrant an impact assessment. This decision is usually called a negative declaration. The current term in the U.S. is now a 'FONSI' - Findings Of No Significant Impacts. Most projects seeking permits from regulatory agencies are of such a small scale, such as the repair of a bulkhead, that no significant impacts are anticipated. Also, impact assessment is a time- and budget-consuming activity. The more positive declarations there are, the more work there is to be done. Moreover, impact assessment is an attention-attracting process. Many times, the decision to make a positive or negative declaration depends on the government unit's sense of which course of action will generate the least political disturbance among those who have an interest in the proposed development action or its impacts.

Often, the government unit conducting the IEE is required to circulate the notice of a positive or negative declaration to all the governmental and non-governmental units that may have an interest in the impacts of the proposed development, as well as to neighboring

Figure 5.5. Plan Compliance and the Co-Evolution of Impact Assessment and Environmental Management Plans

	Phases of Environmental Planning		
	No Environmental Management Plan	Preparing Environmental Plans	Implementation of Plans
Impact Assessments Required	IA primary means for decision-making	IA done in context with systems impact	IA only done if proposal not consistent with adopted plan
No IA Requirement	Environmental and social impacts not considered in the decision-making process		Environmental management plans are the basis for regulation

residents and property owners. The IEE notice is usually the decision the government unit has made and a brief statement of the reasons supporting the decision. At first, the public notice requirement has the inherent problem of trying to determine who are the affected interests. This problem will be resolved over time as the agency issues more declarations. Most interest groups will be self-identifying as more and more of them react to declarations.

The IEE is usually prepared by the developer of the project, the government agency with primary responsibility for regulating the type of proposed development (such as a power plant), or the agency with responsibility for administering the impact assessment requirement. If the IEE is prepared by the developer, the latter two units of government should conduct their own separate evaluation. The evaluation done by a government unit should include a site visit.

The requirement for public circulation of the declaration serves at least three purposes. It minimizes the tendency of the government to issue negative declarations as a means of avoiding both additional work and political criticism. Secondly, public circulation of declarations gives groups and individuals early notice of an opportunity to become involved in the impact assessment process, particularly in the next step, scoping out the issues. Clearly, IEEs improve both the quality and quantity of public participation. A public notice also decreases the likelihood that the negative declaration will be reversed later in the project cycle, when potentially significant impacts are identified. If the decision is eventually reversed, much of the work done since the declaration will be a wasted effort.

A recent assessment of Sri Lanka's environmental laws and institutions describes the application of IEEs in the implementation of the national law on impact statements.

Only two EIAs have been required since 1984. One often cited reason for the few EIAs is that the requirement has not been sanctioned in law, making The Central Environment Authority (CEA) reluctant to require agencies to carry out expensive studies. IEEs, however, have become far more routine. Most developers send their IEEs to CEA's Environmental Protection Division for approval. CEA has three or four staff available to review the 15-20 IEEs it receives each week and carries out a site inspection for each one. CEA takes about two weeks to reply to the local authorities with their conclusions, but it may take longer because data bases are inadequate and IEEs frequently lack accurate site maps and impact descriptions (Baldwin, 1988).

In 1988 Sri Lanka revised the impact assessment law (Sri Lanka CCD, 1990). One revision involved giving CEA the authority to require an environmental impact assessment, as a condition to be met, before the government decides on the merits of a proposed development action. It will be interesting to see how this new authority significantly affects the ratio of positive and negative declarations.

Summary

The screening method or methods should:

- identify, at the lowest staff costs, the greatest number of actions having significant impacts;
- minimize the number of actions likely to be incorrectly identified as having significant impacts;

- minimize the number of actions exempted from the IA process that, when completed, generate significant unanticipated impacts; and
- identify other actions within the same system that may generate significant adverse impacts, particularly cumulative impacts.

In both the screening and scoping steps it appears that staff experience is one of the most important components of the IA process. After the same person prepares a number of impact assessments, screening and scoping should become much more efficient and effective, particularly if the same individual is responsible for assessing impacts for the same type of actions or for the same type of environment. In the United States, many state level coastal management programs have been implemented for over twelve years. Most of these programs must issue permits for any substantial development in the coastal zone. Each permit submission requires an assessment of potential impacts. Many of the staff analysts have been assessing the impacts of projects for over ten years. The average tenure of a permit analyst on the California Coastal Commission is six years. In Sri Lanka the senior permit analyst in the Coast Conservation Department has held that position for five years.

A person will develop expertise on the various steps in IA to the extent that he or she regularly conducts impact assessments. This is true if the analyst is continuously reviewing the same type of projects, particularly if the same type of projects commonly occur in similar environmental and socio-economic settings. Also, if the permit analyst is assigned to a region, then a regional perspective will be acquired. A regional perspective is particularly valuable in identifying cumulative impacts.

Employee turnover and competence is one of the problems commonly mentioned in the literature on environmental planning in developing nations. Persons assigned to impact assessment are often at the civil service entry level and have no formal education or experience in how to conduct, organize and review an IA. Frequently, when the person becomes competent in IA, the individual moves out of this position, either to a higher civil service level or to the private sector. In addition to the obvious remedies of education, training, and higher salaries, staff should be required to prepare an operations manual so that at least some of the on-the-job impact assessment experience can be passed on to successors.

5.3 Scoping

The scoping step establishes the terms of reference for the impact assessment. The boundary of the scoping step is often difficult to distinguish from both screening and from the two steps that follow it. Many of the same methods used to screen actions can also be used to scope actions. The scoping step should:

- identify the issues that should be addressed by the IA;
- determine what appear to be significant impacts and what appear to be insignificant impacts;
- provide some dimension on the relative importance of the potentially significant impacts so that the depths of analyses can be apportioned;
- identify appropriate measures to mitigate the potentially significant impacts; and
- facilitate an efficient process that saves time and staff resources.

The scoping step is designed to overcome one of the inherent pitfalls in impact assessment—the initial tendency to identify all potential impacts without regard to what is important to decision-making. As Section 4 mentioned, it appears that an impact assessment program goes through an evolutionary phase, when effort is focused on

compiling massive compendia of scientific and technical data, much of which is of marginal relevance to the most significant issues.

One reason that impact assessment is expensive in developing countries is the lack of relevant information. As a result, a large amount of baseline information must often be collected. This is probably the most expensive aspect of the impact assessment process. Scoping is important in preventing the costly collection of information that is not important to the ultimate decisions that have to be made on the proposed development action.

The expenses of IA are closely related to the number of issues selected, the inherent complexity of those issues, the length of the time dimension, and the geographic boundaries of the assessment. Figure 5.6 illustrates the different boundaries that can be selected for determining the region of influence. In the context of coastal management, the ecological and physical boundaries correspond to the concept of coastal systems articulated in Section 2.3. Again, the concern is to identify the potentially significant cumulative impacts.

When mitigation measures are being suggested, it is important to focus the study on workable, acceptable solutions to the problems. It is easy for the study to waste time considering mitigation measures that are impracticable or totally unacceptable to the developer or the government.

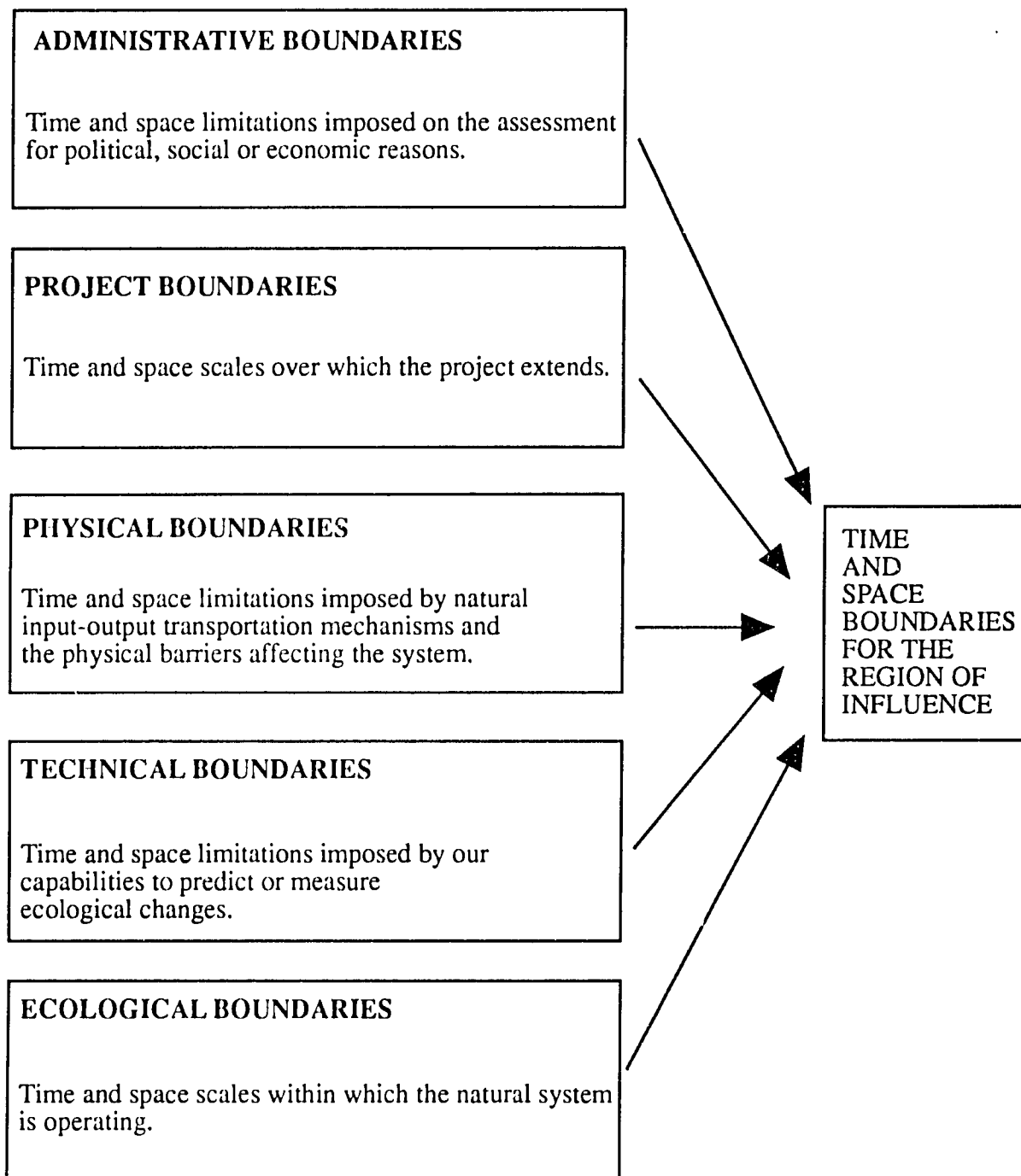
There are a number of factors that influence the scoping process. One basic factor is the legislative framework which mandates the impact assessment process. Laws or guidelines have been used both to explicitly exclude certain issues, such as socio-economic benefits, and to specifically include factors such as the effects on public health and safety.

The most important factor in the scoping step appears to be who participates. It is common for scoping to be done only by the lead agency. This is particularly true of projects that are not large-scale in size or impact.

Impacts from almost any type or scale of action will be multi-disciplinary in nature. If one individual is scoping potential impacts, the impacts identified will likely reflect the individual's professional education and experience. If the assessor is a biologist, the impacts identified will be mostly biological. Many significant impacts outside of the assessor's professional knowledge will likely be missed. In order to prevent this tunnel vision situation from occurring, governments have used a number of arrangements for making scoping a multi-disciplinary process. If the unit of government conducts many impact assessments, it is common for a multi-disciplinary office to be established. Each person in the IA unit has the opportunity to scope the proposed development action from their respective discipline.

A second option for broadening the scoping perspective is to create an ad-hoc team drawn from various units in the agency. This approach is generally used for only large-scale projects. Members of the team reflect the range of impacts of the proposed action. A variation of the second option is to draw members from other government agencies. This inter-governmental variation also has the advantage of drawing in other agencies at the beginning of the impact assessment process. Early involvement of agencies with expertise on the potential impacts of an action is important because these same agencies are often required to participate in the review step of impact assessment, particularly if an environmental impact statement are prepared. Another common observation in the IA literature is that early review and critique are far more effective and efficient than review and critique at the conclusion of the assessment process. At the scoping stage, the options

Figure 5.6. Categories of Boundaries which Determine the Region of Influence to be Studied for Environmental Impact Assessment



Source: An Ecological Framework for Environmental Impact Assessment in Canada, Beanlands and Duinker, 1983. Figure 2, *Categories of Boundaries Which Determine the Region of Influence to be Studied for Environmental Impact Assessment*

should be broader and more flexible, therefore easier to incorporate cost-effective redesign or mitigation measures. In the scoping stage, the responsible agency will also have to decide on the participation of non-government interests that may be affected by the action. This is particularly true of large-scale projects. In many cases public participation in the scoping step is required by law or administrative guidelines. It has been repeatedly demonstrated that public involvement can produce acceptable terms of reference for the impact assessment and reduce the likelihood of controversy once the project commences. However, public involvement as well as interagency involvement has also caused delays and escalated the costs of assessment. It is not possible to specify the extent to which interests outside the lead agency should be involved in scoping because the answer depends on the type and scale of the proposed action as well as the type, range, intensity, and social and geographical distribution of impacts. It is clear that effective scoping depends on the exchange of information and concerns among interested parties, including the public. This will be achieved if the organizational arrangement for scoping is designed to achieve the five objectives of this step.

A number of procedures have been designed to conduct the scoping step as well as the subsequent steps of considering alternatives and estimating impacts. Two procedures that are gaining popular acceptance are joint fact-finding and adaptive environmental assessment. Because of the time and cost involved in setting up these procedures, they have generally been applied to large-scale projects.

In the last ten years two very similar approaches have been developed to resolve conflicts among competing interests. Joint fact-finding and adaptive environmental assessments have been successfully used for assessing the impacts of a large program or project that has a rich information base and involves complex technologies. Adaptive assessment integrates environmental with economic and social understanding at the very beginning of the design process, and in a sequence of steps during the design phase and after implementation (Holling, 1978). Joint fact-finding is one of the initial steps in the conflict resolution process. It involves face-to-face interaction of scientists, decision-makers and interest groups (Susskind and McCreary, 1985). All sides of an issue should be represented in the joint fact-finding process.

5.4 The Identification and Selection of Alternatives

The identification and consideration of alternatives is one of the key aspects of impact assessment. This step provides the means by which the action's assumptions, goals and needs can be examined. A range of alternatives provide the basis for a comparative assessment of the different means to achieve the stated objective of the action. In an assessment of alternatives, decision-makers should be provided with information on how each option compares in respect to the relative costs and benefits for each impact.

One common difference between large-scale and small-scale projects is that large-scale projects usually pose a full range of alternatives. If any alternative is proposed by a small-scale project, it is usually the 'no action' alternative.

The identification and selection of alternatives usually involves three questions:

- How should alternatives be identified?
- What is the reasonable range of alternatives to be considered?
- What level of examination should be applied to each alternative?

Few methods exist to assist in the identification of alternatives. The methods that do exist are associated with types of social objectives such as new transportation corridors or flood control. For example, alternative transportation routes are commonly identified by using a series of overlay maps that portray various environmental and socio-economic factors.

It has been observed that in generating alternatives, there is a series of at least five value judgements that comes into play. Decisions must be made about how many options should be included, and about how much these options should differ from one another (for example, should the impact assessment focus on a small subset of options that sits at one, more politically feasible, end of the continuum?). A decision must also be made about how far into the process new options may be added, and criteria set for including or excluding these new options. Finally, an approach must be chosen for “packaging” hybrid options—for instance, should each highway alternative be packaged with a set of energy conservation measures or should highway options be considered apart from energy conservation measures?

Alternatives can be organized into a number of categories. Governments have at various times required consideration of the following categories:

Demand Alternatives - Tourism and residential development are common demand alternatives for shorelands on a high quality recreational beach;

Activity Alternatives - Impoundments, river channelization, levees, and flood plain zoning are all activity alternatives for reducing the hazards of river floods;

Location Alternatives - On what other sites could the activity occur?

Process Alternatives - Many industrial or public service facilities have a number of alternative design configurations, each of which may have different input, output, and pollution dimensions; and

Mitigation Measures - What alternatives exist to mitigate the adverse impacts identified in the scoping step?

Guidelines on the range of alternatives usually declare that all reasonable options should be considered, including the no action alternative. A reasonable alternative is one that is capable of accomplishing the project objectives within a reasonable period of time, taking into account economic, social, environmental and technological factors. One of the inherent problems of IA is making the distinction between reasonable and unreasonable alternatives. The concern is to assure that time and money will not be wasted on the assessment of alternatives that are not economically or politically realistic.

Identification of the full range of reasonable alternatives often requires a multi-disciplinary perspective. Often, many alternatives are beyond the scope of the proponent of the development action or the lead agency. For example, the proponent of a new power plant usually does not have the authority or the expertise to consider energy conservation or changing charges to power users as alternatives to meeting projected increases in energy demands. Because the identification of alternatives is often best done as a multi-disciplinary exercise, interagency or public participation is often advocated. A number of manuals on impact assessment combine scoping and the identification of alternatives as one step because they can both be facilitated by interagency review and public participation.

There are at least two reasons for ensuring that the full range of reasonable alternatives is identified. One reason is to find the option that ensures that all possible joint gains have

been secured. Impact assessment can be seen as a process for resolving conflicts among institutions or individuals with different interests. Identification of the full range of reasonable alternatives to resolve a conflict among competing interests means that no feasible options for maximizing benefits and minimizing costs have been missed.

The second reason is to prevent costly delays. Failure to include a reasonable alternative often results in a challenge stating that the impact assessment is inadequate. Such a challenge can produce a significant delay, particularly if a supplementary impact assessment must be conducted in order to expand the comparative analysis to include the new alternative.

The range of alternatives is larger at the higher levels of planning (Figure 2.2). By the time the project cycle reaches the project level, there is relatively little flexibility of alternative location, technology types, or the design of the facility.

5.5 Estimation

Once the significant impacts have been determined by the scoping step, an estimation should be made of each impact. Ideally, the estimation would provide qualification of the following dimensions:

Probability of Occurrence - To what extent is impact likely to occur? The probability can range from 1 - absolute certainty that the impact will occur - to an infinitely small percentage such as .0001 for the likelihood of coastal development being destroyed by a tsunami.

Duration - Will the impact occur only during a phase of the proposed action, such as soil erosion during the construction phase, or will the impact be permanent, such as the extinction of a species?

Magnitude - What will be the spatial dimensions of the impact? What will be the intensity of the impact - such as decibels of noise, parts per thousand turbidity, or the number of new employees?

Social Distribution or Incidence - What social groups and interests are positively or negatively affected by the impact?

Making a quantitative or qualitative estimation of impact usually requires data and one or more predictive methods.

5.5.1 Estimation Methods

In 1984, a survey of 140 impact studies drawn from a variety of countries primarily in North America and western Europe, identified 150 different estimation methods (Horberry, 1984). In addition, 200 further estimation methods were identified by the investigation in a subsequent search of environmental evaluation literature. Evidently, the number of estimation methods that might be used in IA is very large. Description of estimation methods has not been included in this manual due to the large number of approaches. However, critical and comparative reviews of estimation methods have been done for different types of development activities (e.g. impoundments, irrigation systems, roads), different types of environments (e.g. mangroves, coral reefs), and different types of impacts such as air or water pollution. Estimation methods are usually classified according to the method of calculation. The three most common types used in IA are statistical models, physical models, and experimental methods.

Statistical Models specify relationships between cause and effect in the form of one or more mathematical functions. They vary greatly in their complexity and information requirements. The simplest describe a fairly straightforward, direct relationship between input and output (e.g. emission and air quality, effluent and water quality) which is based upon the statistical analysis of the direct input-output relationship observed in similar environmental circumstances. More complex models also specify the environmental mechanisms through which inputs are processed and transformed into different impacts (e.g. a dynamic mathematical model of an estuary).

Physical Models are illustrative or working-scale models which have been built to replicate some component of the environment. For example, three-dimensional models have been constructed of rivers, estuaries, and bays to forecast their likely flooding dynamics or sediment impacts. Similarly, wind tunnels and wave chambers are used to help in projecting the impact of pollutant discharges on air and water quality.

Field and Laboratory Experimental Methods are used to determine the number and type of environmental or socio-economic components that may be lost, disturbed, or damaged by a project in circumstances where the magnitude of change in the environment cannot be reliably predicted. The data required to construct these measures may be derived by using either an existing inventory or the findings of a special survey.

Other estimation approaches exist which are less rigorous and formalized than the three types described. Whether or not they are less useful can only be judged in the context in which they are applied. One such approach is to identify similar (or analog) situations to that of the type of development action or environmental type being assessed. Through site visits and/or examination of the relevant literature, one deduces by analogy what the action's impacts may be. Another common means of estimation is expert opinion. It is often used to estimate both the likely scale and significance of an impact. This opinion may be based upon the use of any of the methods already described and, to this extent, is no different from those methods. However, expert opinion may also be in the form of a 'judgment', in which the estimation is not expressed in quantitative terms, nor is its method of derivation revealed. This is sufficiently different to be included as a different type of estimation method.

The surveys of IA practice which have been undertaken suggest that the estimation methods most frequently used are the less formal approaches, notably the use of expert opinion (Horberry, 1984). This is particularly true in developing nations. Even in developed nations, physical models, specially commissioned experiments, and mathematical models are not used frequently in impact assessment, particularly for small- and medium-scale projects.

The apparent lack of sophistication in the use of estimation methods might be interpreted as evidence of serious deficiency in IA practice. However, there may be some justification for this state of affairs, if:

- the requirements of much estimation work, particularly in the early stages of the IA process, can be satisfied using simpler methods; and

- the time and resource constraints imposed upon the operation of the IA process are too severe to enable the data collection, calibration, etc., of the more complex methods to be completed.

The simplest methods are used mainly for purposes such as initial screening, comparison of alternatives where the similarities and differences in impacts are very clear-cut, and preliminary estimation of impacts where limited project description and base-line environmental data are available. By contrast, complex models are used in exceptional circumstances where there is concern by decision-makers that particular activities may have major, irreversible environmental effects.

Section 2.3 and Section 3 described the complexity of coastal systems. Estimating an impact often does not involve only one model, but a set of interconnected models as depicted by Figure 5.7. The more models that are connected to estimate an impact, the greater the margin of error. Each model has an error coefficient, and connecting the models has a cumulative effect on the margin of error. Furthermore, a chain of impact estimation models is only as strong as the weakest link.

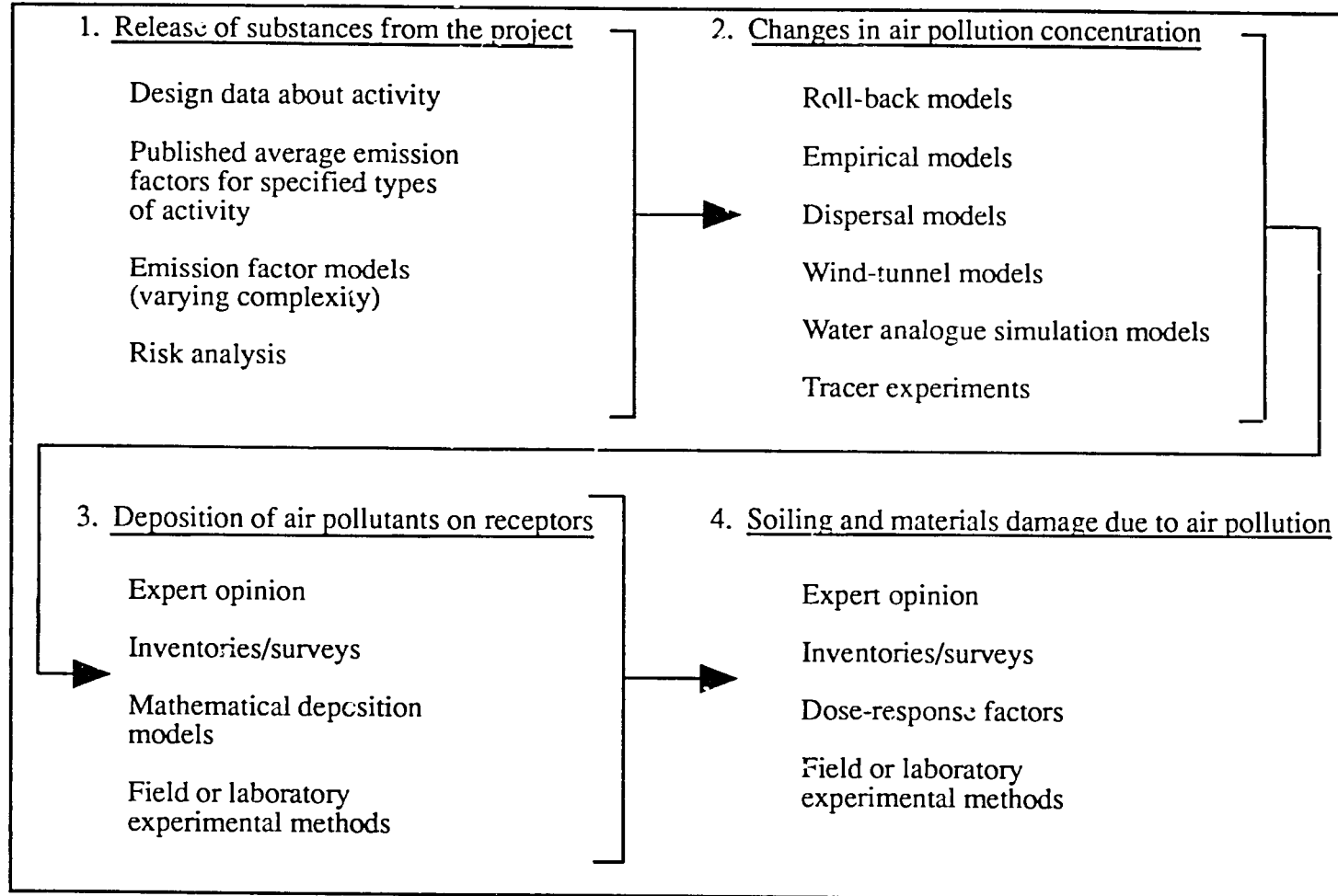
Even simple estimation methods need not (and should not) be used simplistically and uncritically. For example, there are different levels of thoroughness, precision and care with which expert opinion may be used. Determining the most appropriate level for any given estimation situation is an integral component of IA practice. To illustrate:

- A. a single expert may be asked for a brief, qualitative opinion; or
- B. the expert may be asked to justify that opinion by verbal or statistical description of the relationships he or she has taken into account and/or by indicating the empirical evidence which supports that opinion; or
- C. as in (b), except that opinions are also sought from other experts, or
- D. as in (c), except that the experts are also required to reach a common opinion, with supporting reasons and qualifications, etc.; or
- E. as in (d), except that the experts are expected to reach a common opinion using an agreed-upon process of consensus building.

There are a number of general criteria to use when choosing between different estimation methods, including the appropriateness of the task to be undertaken, replication, consistency, and economy in the use of time and other resources. These may be elaborated into a fuller checklist for assessing the suitability of estimation methods.

- Be clear at the outset about the nature of the information which is sought as output from the estimation method. What types of environmental impacts are to be estimated. In what form? For whose use? On what assumptions? For what geographical area? For what duration and at what frequency? To what degree of accuracy?
- Can the method be used to produce the information needed? If not, can it be modified to do this?

Figure 5.7. Interconnected Methods for Estimating Atmospheric Effects



Source: Horberry, J. 1984.

- Can the method be legitimately applied to the particular activity and environment under investigation and is it appropriate to the particular use to which it is applied? Are any limitations of the method, and the assumptions implicit in its use, acceptable if used in this particular context?
- Are the data inputs available which are needed to use the method? If not, can they be collected using the available resources of time, manpower, and equipment?
- Are the resources available to apply the method? For example, computing time, laboratory facilities, field study resources, skilled staff, etc?
- Are the outputs from the use of the method in a suitable form to use as inputs for estimation of higher-order impacts (i.e., socio-economic values that may change)?
- Does the method provide a sufficiently detailed and reliable estimation of the impact for the particular stage in the IA process in which it is being applied?
- Are the outputs from the use of the method likely to be credible and acceptable to decision-makers, as well as to scientists and other users? Can the outputs be presented in a form which is understandable and useful to the different users?

Failure to account for risk and uncertainty is one of the largest pitfalls of most estimation methods. Environmental and social systems are affected by random factors. Usually, it is possible to estimate a range of probabilities for impacts because some key factors may be unknown. In the long run, the range of probabilities can be narrowed through scientific research or experimentation. Unfortunately, impact assessors rarely have the luxury of gathering much original data.

The term 'risk' has been used in many different ways. Confusion can arise when risk is defined as a compound measure of both probability and magnitude. We use risk to indicate an estimated probability.

Uncertainty can never be eliminated because it is a characteristic dynamic of coastal systems. Nevertheless, people commonly make decisions, often without explicitly analyzing their implications. Development decisions, particularly in developed nations, are commonly not completed until cautious scientists are able to reach a workable environment. The best that impact assessment can do about uncertainty is to indicate the ranges of uncertainty about key causal relationships, estimate risks, and include a sensitivity analysis to explore the effects of the alternative assumptions of the estimation method.

5.5.2 Data

All estimation methods require data, and data requirements are particularly needed to operate the complex models that are used to describe or forecast functioning of coastal systems. Baseline models that describe both past and present functions of coastal systems are especially data-intensive. In order to accurately describe the long- and short-term fluctuation of coastal systems, data must be periodically collected over the duration of the fluctuation period. For example, four to five years of rainfall and runoff data are needed to identify areas likely to be inundated during floods.

The task of obtaining data to assess impacts is a particularly difficult challenge in developing countries. The existing data base may be sparse, scattered, or of questionable

validity. Often the data base does not include basic topographic maps or resource inventories such as soil surveys. Maps and aerial photographs may be restricted by military security. The cost of acquiring new data can be prohibitive. A related concern is the set of opportunity costs that may be associated with delaying the project in order to collect time series data. For example, it may not be either socially or economically possible to postpone for several years the construction of a much needed flood control project in order to obtain reliable runoff data for forecasting floods.

It is also important, although understandably difficult, to avoid allowing available data banks to control the design and execution of the assessment. Data can be used to provide a list of environmental characteristics in the vicinity of a proposed development action. But merely a listing of existing flora, fauna, soils, geology, hydrology and land use has limited value to IA. Data should be used more profitably to define impact networks and to validate models of environmental or socio-economic systems. As an example of the later application, models of eutrophication require very specific hydrological, chemical and biological data. It is not easy to use observations collected for other purposes.

In 1987, a book was published on the topic of estimation and environmental decision-making (Culhane et. al., 1987). Culhane's findings were based on analysis of 29 representative projects in the United States. Over 200 estimates in IAs were compared with the data on actual post-project impact (impact auditing). Culhane found two basic patterns of accuracy among the 239 forecast impacts in the field sample.

First, EIS forecasts are not inaccurate. We use this double-negative to highlight our finding that very few impacts in the sample are demonstrably inconsistent with EIS forecasts. Even fewer impacts are unanticipated, and no egregious unanticipated impacts could be identified during the study. On the other hand, only about a third of the forecasts in the study are particularly accurate. The more numerous, middling forecast impacts are either accurate solely by virtue of the vagueness of the forecast, or somewhat inaccurate in various complicated ways.

The logic of environmental assessment in the prescriptive literature on NEPA demands accurate EIS forecasts. A rational analyst must weigh a comprehensive range of consequences of each alternative course of action. This analyst's predicted consequences must be accurate, for otherwise the decision resulting from his or her weighting of those consequences cannot be assumed to be optimum. Impacts rated 'within range of a vague forecast' and other 'grey area' cases clearly fall short of the rationalist ideal of environmental assessment. That is, a forecast that is either unquantifiably vague or quantitatively wrong is not very useful in calculating a project's net benefits and choosing an optimum alternative.

5.6 Evaluation and Presentation

The sixth step of the impact assessment process consists of presenting the estimated impacts in terms that are understandable to both those potentially affected by the impact and the decision-makers. Deciding what action to take involves determining the significance of estimated impacts as well as their socio-economic consequences. Evaluation is also the task of comparing 'apples' and 'alligators', for example, 'biochemical oxygen demand' and 'tax revenue', a task which does not have a simple or well-defined solution.

5.6.1 The Comparison of Alternatives

Once estimates have been made, practitioners are faced with information in all sorts of units of measurement referring to widely different systems. Some effects are easy to quantify, others are inevitably descriptive such as visual quality. The more elaborate the estimation step, the more difficult it is to synthesize the results. This is illustrated by Figure 5.8.

There is an explicit trade-off between keeping estimated impacts in their original units of measure and presenting the information in a form that facilitates the selection among alternatives by decision-makers. A recurring tendency in IA is to aggregate all impacts into composite or unifying measurements such as a number or money. If every impact of each alternative can be added together to produce one number, the selection of alternatives simply becomes an exercise in picking the option with the best number. This process is illustrated by Figure 5.9. To keep it simple, the three alternatives are compared in respect to only three types of impacts: air pollution, noise, and landscape. The Figure indicates the two inherent difficulties in aggregating impacts for comparative analysis: **scoring** and **weighing**.

The earlier step of estimation provides the information for scoring. For example, we shall assume that the air pollution in Figure 5.9 is sulfur dioxide. The parts per thousand of sulfur dioxide for each of the three alternatives must be given a score depending on the relative concentration of the pollutant. Once scores for different kinds of impacts have been standardized into similar numbers they cannot be directly compared with each other. Different types of impact are unlikely to be of the same severity of consequence and importance to decision-making or to those directly affected by the potential changes in environmental or socio-economic conditions.

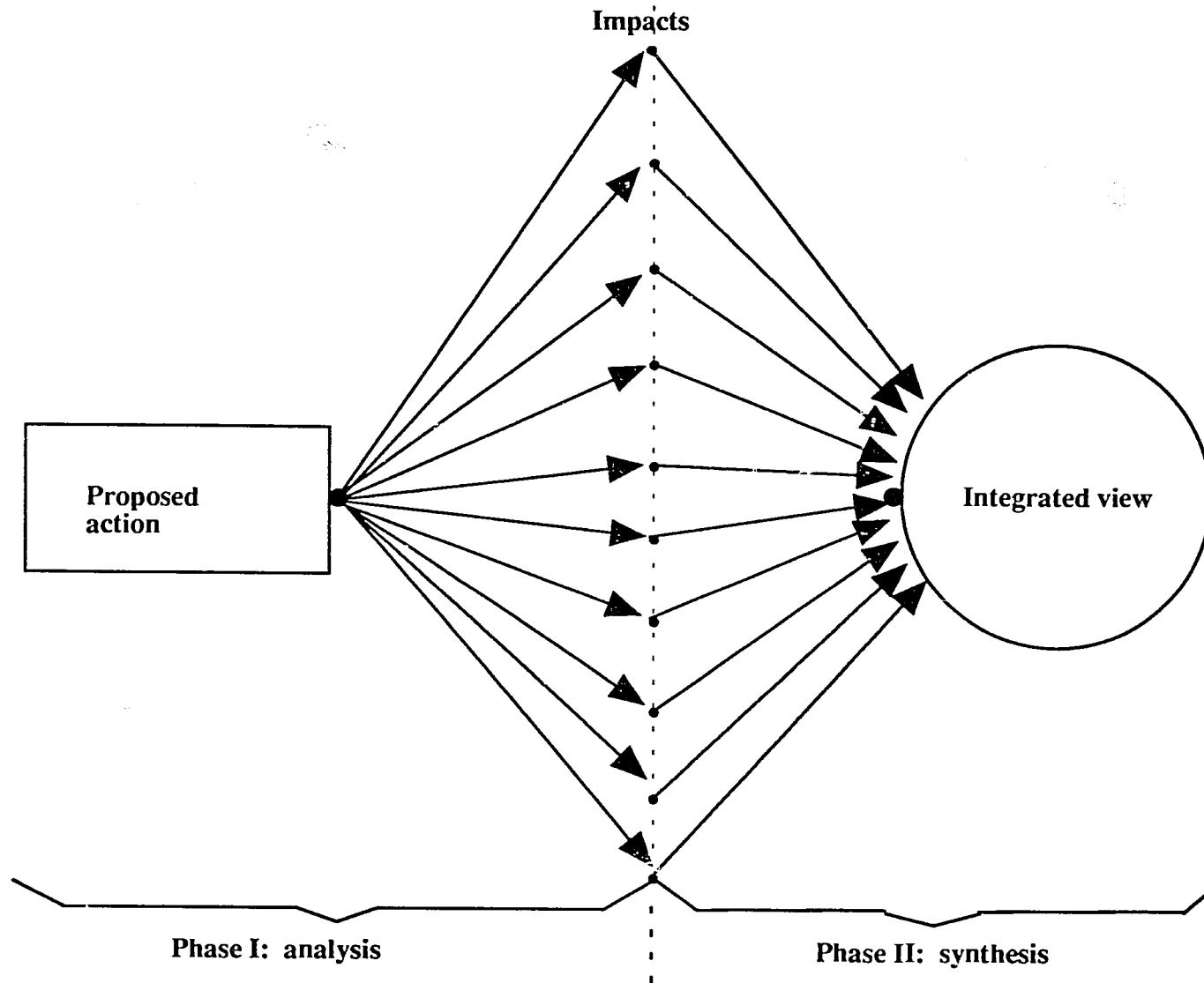
In order to aggregate the scores into a single figure for each alternative, weighing must be placed on each of the impact types according to their relative degree of importance. Figure 5.9 places the highest importance on landscape with a weight of 5, then air pollution at 4 and noise at 1 or, in other words, landscape quality is deemed to be five times more important than noise. It is obvious that weighing is largely an arbitrary exercise that depends on the subjective opinion of the individual or group that sets the weights.

Once the magnitudes of estimated effects are transformed into some unified measure, they tend to lose their practical meaning and the new numbers take on a significance of their own. Generally, reduction of all impacts to a single number usually degrades the information because it calls for subjective judgments about scaling and weighing the impact types. Furthermore, when impacts are transformed into weighted sums, it is tempting to perform statistical operations, regardless of the levels of measurement used in scaling each estimation. These may be invalid and produce an unsound and biased ranking of alternatives.

If impacts are aggregated and the implicit preferences and the judgment are to be valid, the scoring and weighing should represent the preferences of all affected by the action, not just the IA practitioners. Aggregation has been successfully used as a public participation technique. Individuals or groups with different interests can place their own scaling and weighing on the impacts to compare how their aggregation compares with others. It is desirable, but rarely seen, for judgment of impact significance to be expressed in terms of the different vantage points of those affected by the action.

There are a number of methods more sophisticated than the simple aggregation method just described. Most claim to take the subjective judgment out of assessment by developing numerical equivalents for the magnitude and significance of the impact. Others try to

Figure 5.8. Specification and Aggregation of Impacts



Source: Evaluation in Environmental Planning: Assessing Environmental, Social, Economic and Political Trade Offs, by D.M. McAllister, MIT Press, Figure: *Specification and Aggregation of Impacts* ©1980 MIT Press. All rights reserved.

Figure 5.9. A Simplified Scoring-Weighing Comparison of Three Alternatives

Impact Category	Weight	Alternatives					
		A		B		C	
		Score	Score x Weight	Score	Score x Weight	Score	Score x Weight
Air pollution	4	1	4	5	20	10	40
Noise	1	6	6	2	2	10	10
Landscape	5	4	20	4	20	7	35
Total		30		42		85	

establish systematic and reliable methods for incorporating the judgment of experts or interested parties. Much has been written about these methods and their relative attractions or faults. In fact, both the simple and more complex aggregation methods are used rarely and most are impractical for the requirements of project planning and solving environmental and socio-economic problems. When choosing between alternative sites, an aggregation method can be used to structure choice, but rarely is it prudent to convert multi-dimensional impacts into a composite measure.

Matrices without aggregated sums can be useful as ways of displaying information about comparative effects. Indeed, this is the most commonly used method for assembling and relatively comparing impacts for judgment of significance. Figure 5.10 is an example of this method. The impacts are not aggregated, but given excellent, good, fair, poor, and very poor ratings.

In choosing between alternatives or in identifying problems that need attention in project design, it is often just a few key factors that make the difference about the information provided by estimation and evaluation which is needed by decision-makers.









































5.6.2. Comparison of Impacts to Adopted Plans or Standards

A relatively easy means of evaluation is to compare estimated impacts with adopted plans or standards. Plan compliance was previously described as a means of screening development actions. However, the use of adopted plans to evaluate impacts is limited by two factors: the specificity of the plan in respect to the estimated impacts; and, the extent to which there is strong support for the plan. Many environmental plans are based on a set of vague policies. For example, discharges from land uses adjacent to Turtle Bay should not significantly degrade mangrove systems of Turtle Bay. The policy needs to include measurable standards of degradation (for example, effluent discharges into Turtle Bay shall not be in excess of - parts per thousand of phosphorous, - parts per thousand of nitrogen, and - biochemical oxygen demand). Specific impacts cannot be evaluated against vague policies.

Public support is the other problem commonly associated with using plans to evaluate impacts. Many plans are just documents and maps that were created by professional staff without broad based participation from the interest groups that will be affected by implementation of the plan. The interest groups that support the proposed development action often find little or no opposition from supporters of the plan. The development proposal is the real world of tangible socio-economic benefits and the plans are often in the dream world of imagined benefits. In a conflict between benefits predicted in the future world of a plan, and the immediate and tangible beneficial impacts of a proposed development, the benefits of the development proposal usually prevail and the plan is revised to eliminate the conflict.

A more effective process for impact evaluation is to determine if the impacts are in conflict with the standards adopted to protect environmental or social quality. Table 5.4 presents some of the standards adopted by New York state for surface water quality. The main problem with using standards as an evaluation tool is the scientific validity of the levels set. Many times it is difficult to find the scientific rationale that supports the level set by the standard. For example, on Table 5.4, why was the standard for coliform bacteria set at 50 per 100 milliliters. Could the standard be 200 coliform bacteria without producing any significant impact?

Figure 5.10. A Summary Table for Choosing Among Alternatives

Impact Area	Screening Criteria	St. John, Canada	Cross Island, Maine	Sears Island, Maine	Quonset Point, Rhode Island	Melville, Rhode Island
Disruption to other land uses	Size of site. Nature of adjacent uses. Location of major recreational areas.					
Disruption to other shipping activities	Ship traffic.					
Presence of factors affecting safety	Shipping accidents. Channel and berth depths. Channel width Length of approach channel. Configuration of channel. Hazards of obstructions. Ship traffic volume.					
	Accidents at land facility. Seismic conditions Exposure to storm surges and floods.					
Consequences of accidents	Population density. Proximity of incompatible facilities.					
Presence of factors affecting system outage	Exposure to waves. Exposure to winds. Visibility conditions.					
Environmental impact	Critical environmental areas. Pipeline construction dist.					
Economic cost	Dredging volume. Pipeline construction dist. Ship transit time. Ship to tank distribution.					

KEY  Excellent  Good  Fair  Poor  Very poor

Source: Elliot, 1981. "Pulling the Pieces together: Amalgamation in Environmental Impact Assessment in the Caribbean Region." *Environmental Impact Assessment Review*.

Table 5.4. New York State Classification and Standards for Surface Waters

Class and best use	Water Standards				
	Minimum dissolved oxygen ml/liter	Coliform bacteria median no/100 ml	pH	Toxic wastes, deleterious substances, colored wastes, heated liquids, odor-producing substances	Floating solids, settleable solids, oils, and sludge deposits
AA-Source of unfiltered public water supply and any other usage	5.0(trout) 4.0(nontROUT)	Not to exceed 50	6.5 - 8.5	None in sufficient amounts or at such temperatures as to be injurious to fish life or make the waters unsafe or unsuitable.	None attributable to sewage, industrial wastes or other wastes.
A-Source of filtered public water supply and any other usage	5.0(trout) 4.0(nontROUT)	Not to exceed 2400	6.5 - 8.5*		None which are readily visible and attributable to sewage, industrial wastes or other wastes.
B-Bathing and any other usages except as a source of public water supply	5.0(trout) 4.0(nontROUT)	Not to exceed 5000	6.5 - 8.5*		
C-Fishing and any other usages except public water supply and bathing	5.0(trout) 4.0(nontROUT)	Not applicable	6.5 - 8.5*	None in sufficient amounts or at such temperatures as to be injurious to fish life or impair the waters for any other best usage.	

Source: World Bank, 1978

5.6.3 Incidence of Impact

The evaluation step should also determine who gains and who loses as a result of a development action. To put this another way, every physical effect has socio-economic consequences that in themselves are impacts to be concerned about. These social impacts are usually distributed unevenly among groups in the population and thus affect equity. Whether or not one defines IA as incorporating the assessment of socio-economic and cultural effects is hardly important in the end, because it is the consequences for human development, income generation, and long-term productivity that should be key factors considered by decision-makers. The point here is whether the expected socio-economic and distributive consequences are part of the IA process. If they are not, are they taken into consideration in the ultimate decisions about the proposed development action?

Conventional project appraisal is focused on the expected benefits of a project, and sometimes takes into account the distribution of the benefits, applying some preferred social welfare function that may put more weight on benefits to poorer groups. IA often starts from the assumption that in trying to achieve socio-economic benefits, there may be some undesirable distributive effects unless a more comprehensive, systematic appraisal is followed. There is also a presumption that in most cases, the population groups in developing nations most likely to suffer the adverse costs do not control the decision-making process. Usually they have relatively little influence on the public policy-making process.

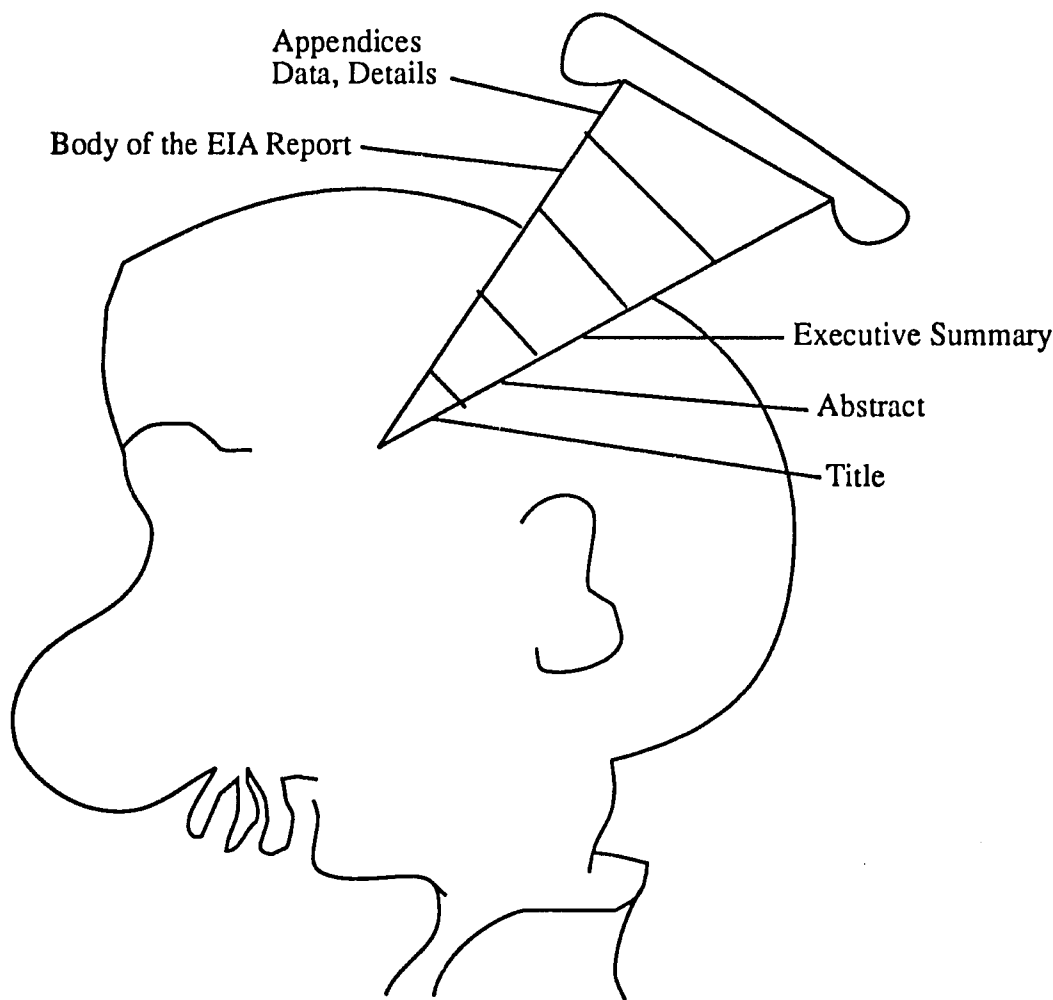
5.6.4 Presentation

The objective of most impact assessments is to ensure that environmental and socio-economic problems are foreseen and addressed by decision-makers. To achieve this, decision-makers must fully understand the IA's conclusions. Lack of sufficient attention to the presentation and communication of findings has been one of the reasons for the limited success of impact assessments and impact statements. Most decision-makers are unlikely to use information, no matter how important it is, unless it is presented in language and formats that are immediately meaningful. Figure 5.11 illustrates the difficulty of getting the full message into the minds of decision-makers. Some ways to improve the presentation are:

- briefly present 'hard' facts and estimations about impacts; comment on the reliability of this information, and summarize the consequences of each of the proposed options;
- write in the terminology and vocabulary that is used by decision-makers and the community affected by the action;
- present the essential findings in a concise document, supported by separate background materials if necessary; and
- make the document easy to use, providing graphics when possible, such as diagrams, tables, photographs, and maps.

Whatever the process of analysis, or the assessment of significance and economic evaluation, decision-makers need to know what the serious problems are, how they can be solved, and how much it will cost. In addition, it should be clear how this information was obtained, what the basis for judgment was, and whose vantage point it represents. Where significant impacts are highlighted, it is preferable to express them in their original units of measurement and to suggest practical measures for mitigation and management.

Figure 5.11. Getting the Message into the Minds of Decision-Makers



Source: Carpenter and Maragos, 1989.

If the action is complex and has a broad array of impacts, the presentation should contain a summary as well as a complete record of the analysis. Pictures, graphs, and maps should be used to simplify and summarize important information. For example, information on the impacts of particular development options can be displayed on a matrix that summarizes relevant information, such as Figure 5.10. More detailed descriptions of likely effects are appended to the summary. Care should be taken not to degrade the information in summarizing it, and to indicate levels of certainty and the differential effects on groups of the population. The crucial factor is to provide the decision-maker with the information needed to select an alternative and approve the proposal.

5.7 Review and Comment

One common distinction between large- and small-scale projects is the requirement for external review of the impact assessment. Almost all legislation or executive orders require that a draft statement be circulated to affected units of government for review and comment. Many EIS procedures in developed countries also require the draft statement to be broadly circulated to members of the public whose interests may be affected by the proposed action. By contrast, impact assessments of development actions that do not require or merit an EIS usually are not circulated outside the lead agency for review and comment, and particularly not to the public. Many or most projects could benefit from external review. In that respect the review steps are very similar to the scoping step since impacts are multi-disciplinary in nature, and the review of an impact assessment should be multi-disciplinary. If the lead agency has multi-disciplinary expertise, then external review might produce little additional information. Also, the review process takes time (usually at least thirty days) and usually imposes additional costs by delaying initiation of a development action.

Assessment teams have typically seen the review process more as an obstacle course rather than as a procedure that can facilitate comprehensive evaluation of impacts. Unfortunately, this perception of the review process is largely based on fact. Agencies that have the responsibility to review the IA of another agency often have used it as an opportunity for making attacks on the lead agency, rather than as an opportunity for offering constructive advice and criticism. Agencies have also sometimes given the responsibility for reviewing IAs to individuals who, by training and experience, are precisely the least qualified to pass judgment on any type of professional study. Sometimes the responsibility has been given to individuals who are so highly trained in one aspect of the environment, they cannot imagine that impacts on anything outside of their own narrow area of expertise are worth considering. The result is often a proliferation of written review comments that are often largely irrelevant to the serious assessment of project impacts on the total environmental and social setting. Unfortunately, it is all too common for review comments to increase the waste of time and money spent in pursuit of irrelevant issues for political reasons, and not to increase either the quality of assessment or the quality of subsequent decisions.

Review of IAs by the public has likewise reinforced assessment teams' perceptions of the review process as a necessary evil. However, unlike the failures of agency review, the failures of public review of IAs are typically exacerbated, if not generated, by the failure of the agency conducting the IA to accept the public as a necessary and desirable component of the decision-making process. A number of procedures are commonly used to constrain public participation. One very common ploy is not to distribute work products in a timely fashion to those whose interests would be adversely affected by the proposed development. Another well-used ploy is to distribute a large and ponderous document that the public will have difficulty reading and understanding, particularly the impacts that adversely affect their interests.

The importance of early liaison between governmental agencies cannot be overemphasized. Not only does early liaison at the scoping stage enhance the potential for coordinated government action on projects affecting the environment, it also enhances the potential for identifying alternative actions which may be undertaken to further the goals and objectives of other environmental legislation.

The lack of early liaison between an agency that is considering a development action and institutions or individuals that have jurisdiction or interest relating to potential impacts is likely to lead to one or more of the following five situations:

- the range of alternative actions will be unduly restricted;
- key environmental data and information that may already be available in one agency will be overlooked and/or duplicated by another agency;
- the assessment of cumulative impacts will be incomplete due to the failure to learn of projects and programs in the same environmental or public service system that are under consideration by other agencies;
- assessments completed by other agencies for similar projects or for projects in the same or similar local areas will be overlooked; and/or
- a reduction or loss in cooperative actions among different agencies with respect to collecting base-line data, monitoring impacts, and designing and implementing ameliorative measures.

Many analysts of impact assessment believe that public review of assessment efforts should begin in the earliest phase of action planning and continue throughout the development phase. These analysts argue that there are two rationales for public participation: efficiency and legitimacy. The efficiency rationale suggests that participation will result in better-designed government services and a greater ability to gain the support of diverse groups in fulfilling policies after their adoption. The legitimacy rationale sees participation as a way to increase people's confidence in officials and make government more stable and accountable. Government administrators usually accept efficiency more readily than legitimacy as a rationale.

On the other hand, lack of public participation often has the following effects:

- increasing alienation among the public at large due to the public's perception of its powerlessness to contribute meaningfully in key phases of environmental decision-making by governmental agencies; and
- increasing alienation among the public as the perception grows that some interest groups and individuals have more influence in decision-making than other groups and individuals.

5.7.1 Revision of the Review Draft

Impact assessment legislation or government guidelines usually require the lead agency to adequately address all substantial issues raised in the review process. This requirement raises at least two problems. One problem is to distinguish substantial issues from trivial or non-substantial issues. This is similar to the scoping challenge of identifying only the salient issues. The second problem is to determine what constitutes 'adequately addressing an issue.' The lead agency will be understandably reluctant to make major revisions in the

review draft if it means a significant increase in costs or political controversy. Common revisions include the addition of new alternatives or the addition of new mitigation measures.

The effectiveness of the scoping step can be measured by the range and magnitude of revisions necessary in the review draft. However, this is only true if all those whose interests may be significantly affected by the development action have had a timely opportunity to review and comment on the impact assessment.

5.8 The Decision

The impact assessment process is designed to improve decision-making. One distinction that can be made among governments that practice IA is the extent to which decision-making is a 'professionalized' process, or an 'interactive' process. Figure 5.12 shows the difference between the two extreme characterizations of the decision-making process. In a 'professionalized' decision-making process, only mid- to high-level bureaucrats with technical expertise (technocrats) analyze problems and make decisions. The participation of top-level bureaucrats and elected officials is limited to getting occasional feedback from decisions made by the technocrats. Non-governmental groups that have a vested interest in the decision are excluded from the process.

The 'interactive' decision-making process has all three groups in communication with each other. The elected officials and top-level bureaucrats make the decisions after consultation with the technocrats and non-government interests. Problems are continuously monitored by all three groups.

One of the major reasons for initiating an impact assessment program is to open up the decision-making process, particularly to those affected by proposed development actions. The 'interactive' decision-making process is usually mandated by laws that establish an EIA requirement.

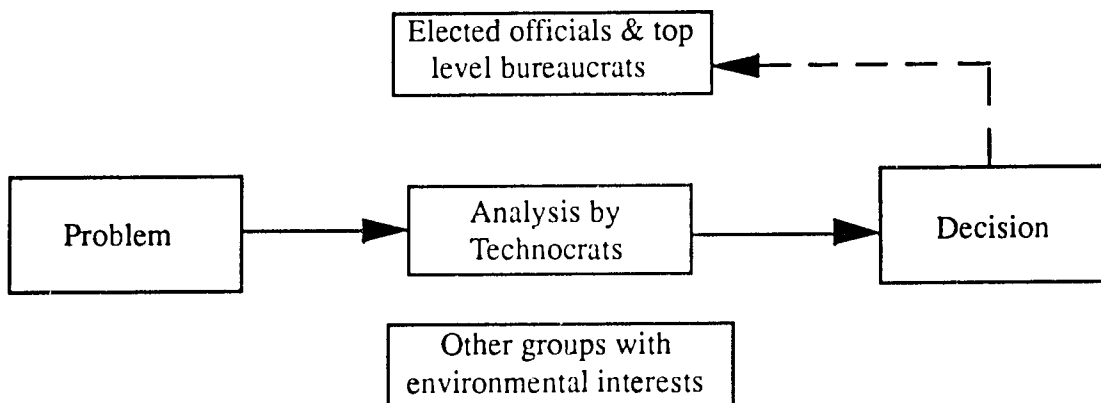
Another distinction among institutions that practice IA is the extent to which the final analysis and recommendations are the decision document. Many governments do not use the impact assessment as the decision document, but as one input to be considered along with other inputs such as benefit-cost analysis, economic feasibility studies, and market analysis.

How the IA affects ultimate decisions depends on at least six factors:

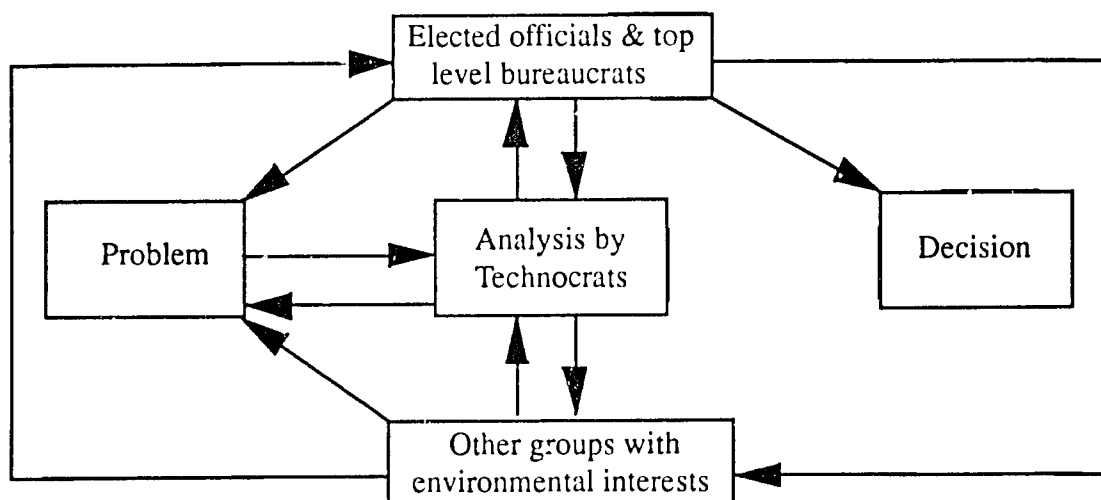
- How well the information is communicated, and whether the decision-maker really understands the IA conclusions and recommendations.
- Are there significant adverse impacts, and if so, can these impacts be adequately mitigated - at least to the satisfaction of those whose interests will be adversely affected by the impact? How politically influential are those whose interests will be adversely affected?
- Are the IA conclusions supported by those who will benefit from the impacts of the action? How politically influential are those who will benefit from the impacts of the action?
- Is there sufficient information to reach conclusions about the probabilities of impact, the degree of uncertainty, and the amount of risk, or is there insufficient information to reach conclusions about critical potential impacts?

Figure 5.12. Two Contrasting Decision Contexts

A 'professionalized' decision-making process



An 'interactive' decision-making process



Source: Multi-Criteria Evaluation for Urban and Regional Planning, Voogd, Henk. 1983. Published by Pion, Ltd., Figure: *Two Contrasting Decision Contexts*

- Is there a consensus among those with expertise on each of the significant impacts that the assessment was based on good data and used the appropriate estimation methods?
- Are the IA conclusions supported by other analysis such as benefit-cost analysis and economic feasibility studies?

To the extent that all of the above factors are positive, the action will probably be approved. Conversely, to the extent that the factors are negative, the action will probably be denied or stringent mitigation measures will be imposed. Of course, decision-makers have a number of options in addition to simple denial or approval. These include:

- deny the action with conditions for reconsideration;
- approve the action with mitigation measures;
- defer decision on the action until further information is obtained;
- defer decision until a better IA is conducted; or
- defer decision until a plan or programmatic IA is prepared.

For most proposed development projects in developing countries, it is not a question of whether the adverse impacts will warrant denial. Rather, the two important questions are: whether mitigation of adverse impacts will be economically feasible; and, can indirect (or secondary) impacts be adequately controlled. On the latter point, in developing nations it is common for IA not to address the indirect or secondary consequences of a development action, such as the changes in land use and land tenure that will result from the construction of a new highway or a new power plant.

Existing conflicts will be mitigated if it can be shown that the mitigation measures will generate more socio-economic benefits than costs. Potential conflicts will be mitigated if the proposed project can support the additional costs. Figure 5.13 summarizes why substantial adverse impacts and conflicts will continue to occur despite the application of impact assessment. Ideally, however, the rate and magnitude of adverse impacts will continue to decrease over time as government agencies become more familiar with systems planning, develop their data bases, and build economies that enable consideration of longer time horizons in policy-making as well as the consideration of non-utilitarian benefits.

The general objective of IA is to move public policy through to level three on Figure 5.13, where anticipated adverse impacts occurred as estimated. At this level, interests may disagree over the ultimate decision to resolve or not to resolve the adverse impact - or the alternative mitigation measures selected - but there is agreement on the range and adequacy of the information upon which the ultimate decisions are based.

5.9 Auditing Impacts

Auditing in the context of IA usually refers to monitoring the actual impacts of the action undertaken. The term 'monitoring' has also been used to describe this step. Moreover, monitoring is sometimes used as a term to mean a critical evaluation of the entire IA program (this is the topic of Section 6).

Government units involved in the IA process should establish an auditing step both to ensure that their decisions are carried out according to the conditions of the decision, and to determine the actual impacts of the action as implemented. In fact, auditing can serve six purposes:

- to ascertain that mitigation measures are being implemented as agreed;

Figure 5.13. Eight Reasons Why Adverse Impacts Will Continue to Occur

Level One: unanticipated adverse impacts

Reason: potential adverse impacts not identified in project design or review stages

Level Two: anticipated adverse impacts, but not of magnitude or distribution expected

Reasons: potential adverse impacts identified and effects not accurately predicted;

or

impacts were greater than predicted;

or

effects not predicted;

or

prediction rejected by decision-makers

Level Three: anticipated adverse impacts occurred as predicted and were not adequately mitigated

Reasons: costs of avoiding or mitigating determined not to be economically feasible;

or

usually insufficient direct benefits to cover the costs of mitigation;

or

prediction rejected by decision-makers;

or

mitigation measure(s) did not work as anticipated

- to warn agencies of unanticipated adverse impacts or sudden changes in impact trends;
- to provide immediate warning whenever a pre-selected impact indicator approaches a pre-selected critical level (This will also be the means to ensure that the legal standards for effluents are not exceeded.);
- to provide information which could be used by agencies to control the timing, location, and level of impacts of a project (Control measures would involve preliminary planning as well as the possible implementation of regulation and enforcement measures. If an intergovernmental monitoring system is used, it would facilitate appropriate response measures.);
- to provide information which could be used for evaluating the effectiveness of implemented mitigation measures; and
- to provide information which could be used to verify estimated impacts and thus validate impact forecasting techniques. (Based on these findings, the techniques, such as statistical models, could be modified or adjusted as appropriate.)

Despite the six purposes that can be served by auditing impacts, most IA programs do not include this step as a routine procedure. Usually, the IA administrative agency can not afford to bear the costs and provide the expertise needed to conduct audits. Therefore, little new knowledge is added to the practice of impact assessment, and many of the required mitigation measures are either not taken or inadequately executed. One of the strongest conclusions of the Culhane study was the future prospect for auditing:

Our results make us less than sanguine about the prospects for routine post-auditing as a capstone to the NEPA process. Most lead agencies show little or no interest in their projects' actual consequences. Max Weber, the German sociologist, noted that one of the principal characteristics of a bureaucracy was that it keeps its important information in the files. Since we could find so little systematic data on forecast impacts in lead agencies' files, we conclude that information was not important to those bureaucracies. Rather, the conventional wisdom suggests capital project and natural resources agencies reward a manager for planning a project, building a coalition supporting decisions favoring the project, and implementing that project. What happens thereafter is immaterial, since the manager is building her or his next project.

6. PROGRAM EVALUATION

Evaluation is the term more commonly used to assess the effectiveness and efficiency of IA programs. The term 'evaluation' was also used to describe the sixth step of the IA process. As a step in the IA process the term is either 'evaluation of impacts' or 'impact evaluation.' A critical analysis of the IA process or the institutional arrangement is usually referred to as 'program evaluation.'

Many nations have over eighteen years of experience in conducting environmental impact assessments and preparing statements (EIS). An appropriate topic for consideration by governments that have practiced IA for several years is the relative costs and benefits of the program. Over the years three basic questions usually emerge to shape an evaluation of IA programs:

- Are the benefits of doing environmental impact assessments greater than the costs?
- What benefits can be identified from conducting IAs, and which of those benefits can be economically quantified?
- What costs are associated with IA and what are representative costs for conducting the study?

Different viewpoints exist on the benefits and costs of environmental impact studies, particularly with reference to establishing monetary values. One viewpoint is that unless the identified economic benefits of doing environmental impact studies exceed their costs, then the entire concept should be dropped from the planning process. Individuals opposed to the environmental impact process can easily give the greatest attention to cost information and conclude that the process is expensive and not justifiable from a benefit-cost perspective. The contrary viewpoint is the proposition that the environmental impact process was initiated as an alternative to traditional benefit-cost analyses. No consideration should be given to the costs because all the benefits can not be quantified. A compromise viewpoint would be to give consideration to both costs and benefits, and attempt to quantify these in a systematic fashion. However, with only quantitative information on costs, a valid conclusion cannot be made on whether the benefits of the IA process exceed the costs.

There are numerous costs associated with the IA process. The most commonly calculated costs are the amount spent on the study and the extra expenditures incurred by time delays and litigation. The literature that addresses the costs of IA estimates that the process costs between 1 to 2 % of the total capital costs. In very few cases have IA studies' costs exceeded 5% of the project capital cost. Even at 5%, the portion of the budget spent on the EIS is very small in comparison to the overall costs of project planning and development.

According to Horberry (1984), a study was done in 1982 on the application of IA in Association of Southeast Asian Nations (ASEAN) Countries (Brunei, Indonesia, Malaysia, Philippines, Singapore, and Thailand). The report was not very conclusive, but asserts that costs and delays do not pose significant problems for proponents of projects required to conduct IA. However, it seems that there is a problem in influencing the implementation of projects on the basis of the impact assessment results.

While benefits of IA can be qualitatively enumerated, such as saving rare and endangered species, there is comparatively little quantitative information. Examples such as the savings of 6 million dollars in project costs cited in Section 2.2 are few and far between.

7. INSTITUTIONAL ARRANGEMENTS FOR IMPACT ASSESSMENT

The institutional arrangement for IA is a composite of the laws, policies and governance structure that determines what the process will be and who will be the participants. It is difficult to draw the line between the institutional arrangement and the process. Each influences the other. A common finding in the impact assessment literature is that the problems encountered in IA are far more attributable to the institutional arrangement of IA than to the IA process. To be sure, there are problems with the IA process, such as the lack of good, cost-effective models and inadequate data, but these are minor in comparison to institutional impediments, such as inadequate authority and insufficient budget.

One means of determining how institutional arrangements affect the IA process is to compare the various administrative structures governments have established. Figure 7.1 portrays the relationship between the steps of the process and the various types of institutions that are usually involved in the process. The arrangements depicted are for nations or provinces that have impact assessment laws, usually requiring the preparation of an impact statement. Almost all the literature on IA addresses the topic in context with environmental impact statements. There is very little literature on regulatory units using impact assessment for the routine process of granting development permits, as is commonly done for coastal management programs.

Almost all - if not all - laws that create an impact assessment process identify one unit of government as the administrative focus. This agency - at the very least - has two responsibilities. One mandate is to issue the guidelines that establish and control the IA process. The other mandate is to review and comment on both the adequacy of a particular impact assessment, and how government decisions should be influenced by the assessment of impacts.

The proponent of a development activity can be either a government agency or a private sector institution. For example, the proponent of a tourism resort complex could be either the Tourism Ministry or the corporation that will own the complex. The government proponent of a development activity often has a direct financial interest in the proposal and therefore has a strong bias for having it approved. Even if the government proponent does not have a direct financial stake in a proposed action, it is very sympathetic to the industry with which it is associated and is usually biased in favor of the industry's interests.

One aspect that is common to most countries is the division of responsibility for managing the environment and natural resources among many agencies. In the United States, for example, over 41 federal agencies have some responsibility for managing various aspects of the coastal zone. (Gammann and McCreary, 1988.) Figure 7.1 has a column for agencies that manage environmental quality or natural resources. This category consists of the agencies that routinely have to give permits for development activities, such as a wastewater discharge permit or an air effluent permit.

A number of governments have organized an interagency task force or council for the review or preparation of impact statements. The task force could be a permanent arrangement or it could operate only on an ad hoc basis. It appears that such an interagency arrangement works best on an ad hoc basis only for the lifetime of a very large project or regional development plan. Permanent interagency arrangements tend to weaken over time.

Figure 7.1: Institutional Arrangements for Administering the Impact Assessment Process

STEP	Proponent Institution	Agency with Responsibility for Administration of IA Process	Agencies with Responsibility for Managing Environmental Quality and Natural Resources	Multi-Interest Task Force	Private Consultant	Private Interest Affected
Issue Guidelines		x	x			
Notification of Proposed Action	x	x				
Action Description	x	x		x	x	
Screening	x	x	x		x	
Scoping	x	x	x	x	x	x
Alternatives	x	x	x	x	x	x
Estimation	x	x	x	x	x	
Evaluation	x	x	x	x	x	
Review		x	x	x		x
Decision	x	x	x	x		
Monitoring & Enforcement	x	x	x	x	x	

Agencies lose interest in the IA process as it becomes a routine operation. Also, because no one agency has responsibility for the success or failure of the IA process, none of the participants are usually willing to contribute adequate time or budget to the assessments.

The effectiveness and efficiency of an IA program appears to depend more on the amount of authority and resources given to the administrative agency than to any other single factor. Generally, the more steps listed by Figure 7.1 that are under the control of the administrative agency for IA, the stronger the IA program. Conversely, the fewer the steps that are under the control of the administrative agency, the weaker the program. The relative strength and weakness of the IA process as a function of its institutional arrangement is summarized by Table 7.1.

In the weakest type of program, the IA administrative agency only has two authorities: to issue guidelines on how the process should be conducted; and, to review and make advisory comments on the IA document. The U.S. Council on Environmental Quality (CEQ) is an example of the weakest arrangement. The Council administers the National Environmental Policy Act, the law that requires federal agencies to prepare impact statements. Since CEQ's creation in 1970, many have argued that its powers should be increased in order to fully implement the law.

Most governments are dominated by pro-development agencies and their respective interest groups. This is particularly true in developing countries. Impact assessment is viewed by most pro-development agencies and their interest groups as both a burdensome task and a threat to achieving their development objectives. Development agencies usually do not see that impact assessment could actually help them achieve their mission by designing plans and projects that do not have fatal defects. Accordingly, the development agencies and their interest groups will usually fight against enactment of a strong IA law. If a law is enacted, they will then work to constrain program implementation by withholding adequate staff and budget resources.

Table 7.1 is a useful means of determining if a government is really serious about achieving the objectives of impact assessment. Most impact assessment laws establish a weak institutional arrangement. Weak laws can give the appearance that the government is doing something about protecting and enhancing environmental and social qualities. Weak laws can also allay the environmental and social concerns of international assistance institutions. However, weak laws are largely self-defeating and the impact assessments that are conducted will not adequately influence public policy formulation and decision-making.

The proponent of the development action almost invariably initiates the IA process by notifying other institutions of its intention. This initiative can be in the form of a simple notice of intent, or it could be an in-depth description of the proposed action. A simple notice of intent is a means of preventing the proponent of the development action from incurring the costs of submitting a full description and then finding out that an IA is not required.

The IA law often specifies which development actions must conduct an assessment and what actions are exempt. One of the most common weaknesses in many IA laws is the types of development activity exempted from the process, or conversely, limiting the types of development action that have to conduct an IA. It is common for the IA process to only be applied to the public sector. The development actions of the private sector are exempt from IA requirements. A rigorous impact assessment program should include all development actions that could have significant adverse impacts on environmental or social qualities. Making the distinction between public and private actions makes no sense since they both can produce the same impacts.

Table 7.1. The Relative Strengths of the IA Process as a Function of the Institutional Arrangement

Step	Weak	Strong
Guidelines	Administrative guidelines are only advisory.	Administrative guidelines have mandatory compliance.
Notification of proposed development action	No notice given or only given to the administrative agency.	Ninety day notice circulated to all interests that could be affected by the action.
Development action requiring an IA	Only certain types of large public actions. IA at discretion of the administrative agency.	All public and private development that may have a significant impact on the environment. The administrative agency has little discretion in the selection of IAs.
Scoping	Only the lead agency is involved.	Government and non-government units are involved.
Scoping, Alternatives, Estimation, Evaluation	The IA is prepared by the proponent of the development action.	The IA is prepared by a non-biased institution that has no vested interest in the outcome.
Decision	The administrative agency does not have the powers to deny the action or to impose mitigation measures. The agency with decision powers does not have to justify why adverse impacts were not adequately mitigated.	The administrative agency does have the powers to deny the action and impose mitigation measures. The agencies with decision powers have to demonstrate that appropriate mitigation measures were taken.
Auditing	The auditing is conducted by the proponent.	The auditing is conducted by a non-biased institution.

In the screening step the administrative agency should have the authority to determine whether an impact assessment is necessary. Guidelines should be written both to inform the development community of whether an IA will have to be done, and to minimize the amount of discretion the government has in deciding if an IA is necessary. This latter point is particularly important if the administrative agency is not supportive of the impact assessment process but rather regards IA as a burdensome requirement.

Generally, the proponent of the development action does the action description. The proponent should know the most about all aspects of the proposed development action. However, as Figure 7.1 indicates, the administrative agency or a private consultant could write the project description. Section 5.1 mentions that the proponent of the project will tend to bias the description to suit their interests, particularly omitting information that may be unfavorable to the proposal.

The control of bias is the main reason why the administrative agency should control all the steps involved in preparing the impact assessment. This would include: project description, screening, scoping, alternatives, estimation and evaluation. However, most governments with an IA requirement allow the proponent to prepare the impact statement. It is to be expected that impact assessments prepared by the proponent of the development action usually have many inadequacies and are biased presentations to suit the proponent's interests.

The solution to the bias problem is the requirement that an impact assessment be conducted by an organization or individual who has no vested interest in the outcome of the development proposal. For example, local governments in California who seriously use the impact assessment process for growth management require the development proponent to retain an independent consultant from a list provided by the local government. The consultant is paid by the project proponent through a three party contract. Once the fee and scope of work for the consultant is agreed upon, funds are deposited in an escrow account held by the government. As the consultant adequately completes each phase of work, money is released by the government. In this way, the government controls the content and quality of the consultant's work. This helps to ensure that the assessment is not biased either for or against the proposed development action. If the consultant produces biased work, the firm or individual may be dropped from the government's list and deprived of future IA contracts. Gamman and McCreary (1988) observe that the three party contract approach greatly improves the quality of information generated during the IA process.

Government units that are not supporters of development, such as the administrative agency of the IA program or a university institute, have assumed the role of the non-biased preparer of the impact assessment. A charge could be made for the cost of the assessment, provided that the exchange of money does not undermine the institution's independence and bias the process and the products. The cost reimbursement arrangement is also a means of increasing the size and quality of the staff in the IA administrative agency.

The effectiveness and efficiency of the review and decision steps are largely a function of two factors: (1) the powers that the IA administrative agency has over development actions; and (2) requirements for the participation by those who may be affected by the proposed action. The quality of the impact assessment will be measurably improved if the administrative agency has the power to prevent the development action from occurring and the power to force adoption of mitigation measures. The basis for denial would be either the inadequacy of the impact assessment or the finding that the proposal's adverse impacts outweigh its beneficial impacts.

It appears that in many, if not most IA institutional arrangements, the administrative agency can only make recommendations to other agencies on what the decision should be. It must depend on other agencies either to deny the proposed action or to impose appropriate conditions to mitigate adverse impacts or maximize beneficial impacts. For example, in the U.S., the CEQ can only make recommendations and must depend on other agencies such as the Environmental Protection Agency or the federal courts to carry them out. If the CEQ determines that an impact statement is inadequate, this finding can be used by the court to compel the preparation of an adequate statement. The U.S. Environmental Protection Agency (EPA) has powers to deny or force modifications of proposed federal actions. The CEQ's advisory recommendations are commonly incorporated by EPA and transformed into denials or mandatory mitigation measures. The opinions of the EPA and the CEQ on the adequacy of the EIS are given great weight by courts in the likely event that NGOs will take the lead agency into litigation.

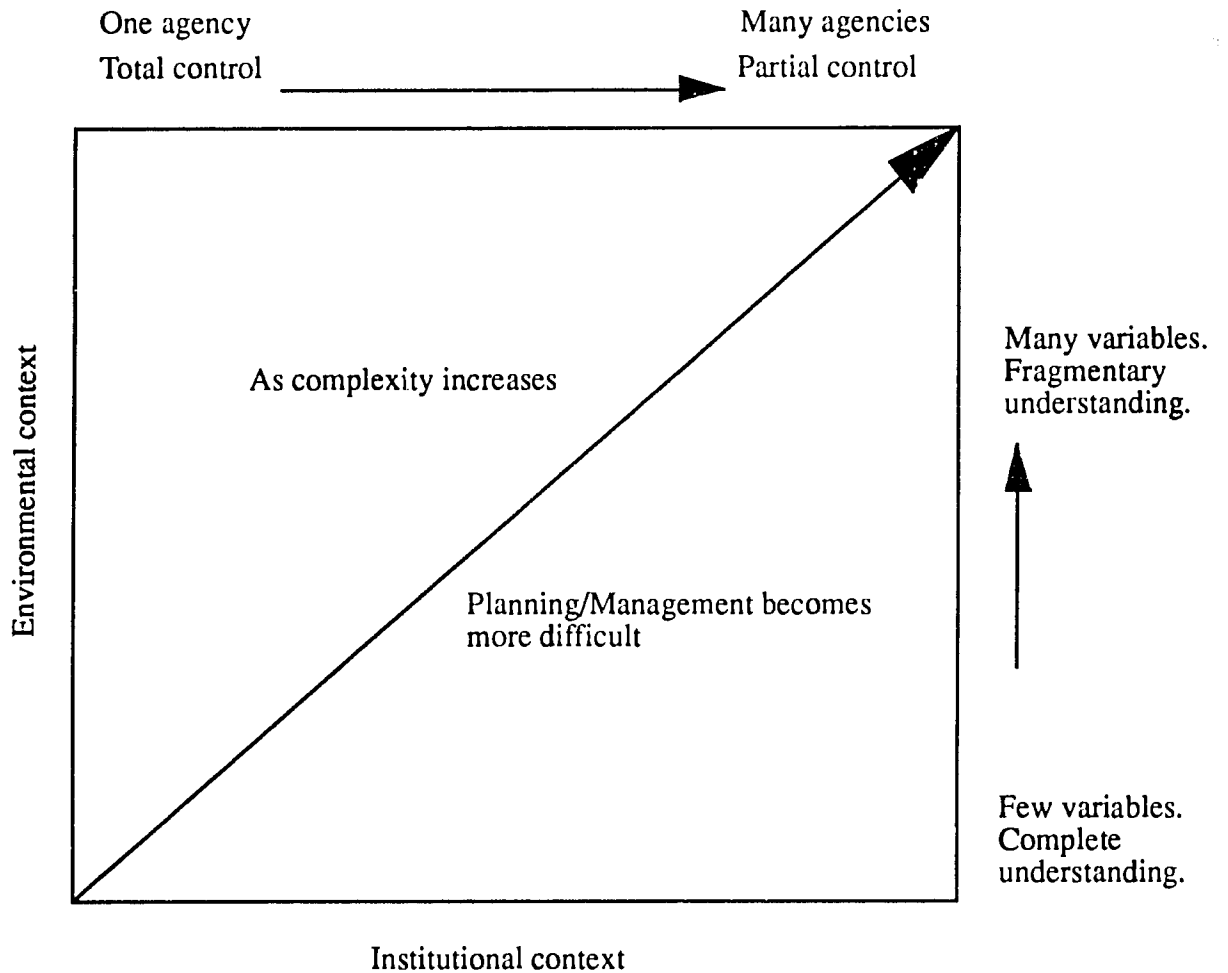
The IA process can be strengthened by requiring that those agencies with decision-making powers demonstrate that appropriate regard was taken to preventing or minimizing the potentially adverse environmental and social impacts. In the U.S., for example, judges have found that agencies have to show that the ultimate decision reflected a balancing of the potential benefits against the potential costs. Also, explanation needs to be given if any feasible mitigation measures were not employed. The U.S. courts have declared that impact assessment cannot be conducted as a paper exercise. Government decisions must rationally consider the conclusions of the IA process.

Figure 7.1 indicates that all six institutions listed can be involved in auditing the actual effects of the development action. The most important aspect of an auditing program is that it be planned and executed without bias. In this respect, auditing is similar to the preparation of an impact assessment. Often the institution that is the proponent of the development action is assigned the responsibility of monitoring the impacts that actually do occur. This may put the proponent in a conflict of interest situation. The proponent has the incentive to minimize the actual adverse impacts. This can be simply done by biasing the data collection and interpretation program. In order to keep auditing unbiased, the agency administering the IA process should either collect and interpret the data or assign this task to an independent institution. The three party contract arrangement that is appropriate for the preparation of the impact assessment would also be an appropriate arrangement for an auditing program.

The relation between the complexity of the environment being assessed and the number of institutions involved in the IA process is depicted by Figure 7.2. Generally, impact assessment becomes more costly and time consuming with each increase in the number of institutions that can exercise some control in the IA process. If one agency has total control of the IA process there should be minimal costs associated with inter-institutional relations. However, a minimum cost for conducting the IA process is probably not a desirable objective. For example, if the agency that has total control of the IA process is biased toward development, the assessments would also have the same bias. A number of agencies, each with partial control of the IA process, will create a system of checks and balances that will improve both the scope and quality of information. This is another illustration of the adage that it is better to be on a slow train moving in the right direction than on a fast train moving in the wrong direction.

Figure 7.2 also illustrates that IA becomes more difficult with increases in the complexity of the environment under assessment. Assessing impacts of development is comparatively difficult because of both the number of variables and the scientific understanding of the relationships among the variables. By contrast, the effect of ground water withdrawal from an aquifer is relatively easy to assess because of the simplicity of the system under study.

Figure 7.2. Relationship between the Environmental and the Institutional Context



Source: Environmental Planning Resourcebook, prepared for the Lands Directorate, Environment Canada by Lang, R. and Armour, Audrey, 1980. Figure: *Relation Between the Environmental and Institutional Context*

7.1 Public Participation

IA programs can be placed along a spectrum in terms of the degree to which they involve the public in the impact assessment process. The term 'public' is commonly used to denote non-governmental institutions, groups, and individuals. At one end of the spectrum are a number of developing countries that have no requirements for participation either by other government agencies or by the public. Next along the spectrum are IA programs that limit participation to the review step and circulate an IA to only a few government agencies with direct connection to the proposed action. At this end of the spectrum, non-governmental representatives do not participate in the IA process. At the other end of the spectrum are governments, such as the federal government of the United States, that require broad public participation at several steps in the IA process. The guidelines on the U.S. program declare that the public should include all institutions and individuals whose interests may be directly adversely affected to a significant degree by the proposed development action.

Public participation in policy-making is frequently analyzed from four perspectives, including: why participation should occur; who participates; when the participation occurs; and how participation occurs. Table 7.2 presents six sets of objectives for public participation in the IA process. Without a clear and well-defined set of objectives, attempts at public participation often result in a useless waste of resources on counter-productive public meetings. Also, the objectives selected will largely determine who participates, when they participate, and how they participate. Figure 7.4 illustrates the relationship between the six objectives and appropriate public participation techniques, of which there are many.

The text of Section 5 includes several references to public participation in context to the steps in which it may occur. These steps are: notification of the proposed action; scoping; alternatives; evaluation; and review. Governments commonly confine public participation to just the review step. Limiting public participation to the review step will not only preclude reaping many of the potential benefits listed in Table 7.2, but can also be a counter-productive exercise. For example, public participation in the review step may identify important issues and reasonable alternatives that were not considered by the earlier steps. Such a revelation may not only force the lead agency to conduct another impact assessment, but will also likely diminish the agency's credibility.

The need for public participation usually increases in relation to the amount of controversy that may be generated by the potentially adverse impacts of the development proposal. This relationship is well-illustrated by the Tantalum riot in Phuket, Thailand. This incident is described in Figure 7.3. The real and potential impacts were highly controversial and there was no meaningful public participation in the decision-making process. The impact assessment was also a paper exercise that was conducted after project construction.

There is a good argument that impact statements actually tend to work against the objectives of public participation. The federal government and many state governments make available to the public reams of information about impacts associated with major development actions. Notwithstanding these efforts, actors in the siting process still commonly complain that they lack access to the 'right' information. They criticize impact statements for being too long, unreadable, late, and not responsive to the needs of information consumers. When impact statements are read, they are often not believed. Charges of bias are common.

By assembling 'all the information' into one massive document, an impact statement tells each person a lot about aspects of a project that affect him or her very little. And since an impact statement generally is not written to respond to the needs of any particular group, it often does not provide enough information to satisfy the needs of one individual. Impact statement writers respond to the demands of courts (instead of persons potentially affected

by the project). Thus we wind up with long, boring, unreadable documents whose organization reflects the requirements of the law that mandated their production. (O'Hare, Bacow and Sanderson, 1983). According to O'Hare, the impact report provides wrong information to the wrong people in the wrong form at the wrong time.

In general, most of the criticisms of meaningful participation in IA can be resolved by structuring the process as a joint fact-finding arrangement. This means that the focus is not on a product, such as an impact statement, but rather on the resolution of conflict among competing interests. The institutional arrangement needs to be designed to be a process for conflict resolution, not as a generator of documents. Many governments have made impact assessment out to be the ends and not the means of conflict resolution. The sections of this manual on scoping (5.3), selection of alternatives (5.4), evaluation (5.6), and review (5.7) outline arrangements for providing the right information to the right people, in the right form, at the right time.

Figure 7.3. The Tantalum Riot: Some Lessons Learned

THE TANTALUM RIOT: SOME LESSONS LEARNED

It would have been one of only five tantalum processing plants in the world, and the only one in Asia. Designed to produce 600,000 pounds of tantalum pentoxide (Ta_2O_5) a year, or approximately a quarter of the current world demand of 2.5 million pounds, it would also have produced an equivalent quantity of niobium pentoxide. The entire production of tantalum would have been exported, earning an estimated 1,100 million baht a year. Claimed to incorporate the latest pollution control technology, the plant was shortly to open. But then, on 23 June 1986, a mob broke in and burned the 600 million baht plant virtually to the ground. What had gone wrong?

The first problem was that the authorities had badly underestimated how far the public might go to stop a project with which it was not in sympathy. In retrospect, the planning of the project had not been sufficiently sensitive to public feelings at a time when the reverberations of the Bhopal disaster were still being felt and the Chernobyl disaster was headline news. Among their worst fears: the hydrofluoric acid used by the plant might leak, causing another Bhopal, or the sheer environmental impact of normal operations would undermine the booming local tourism industry.

The residents of Phuket first began to voice their concern in May of 1986, culminating in mass demonstrations by about 50,000 people in June. Local community leaders were threatening to boycott the national election on 27 July, but the real surprise was the mass break-in on 23 June, the day that a public hearing was meant to begin, with the Minister of Industry present.

On the surface, things seemed to be going well. The Thailand Tantalum Industry Corporation (TTIC) had received considerable support from the Board of Investment, with the bulk of the project's financing coming from a US \$53.5 million package arranged by the International Finance Corporation (IFC), the World Bank's investment arm. The project's original proponent, S.A. Minerals, was the largest investor, holding 45 percent of the equity, with the IFC, three Thai banks, the quasi-governmental Industrial Finance Corporation of Thailand and local tin-mining families holding the rest.

Tantalum is very much a high technology metal, exploited for its high tensile strength and heat resistance. It is used to make capacitors, special alloys, aerospace components and nuclear reactor equipment. It is normally derived either from tantalite ore or from tin slag, the major source in Thailand. The tin slags have a tantalum content varying from 2.5 percent of Ta_2O_5 in low grade ores to 14 percent in high grade ores. The original plan for the Phuket tantalum plant called for two components: an enrichment plant to produce slag with a 20-30 percent Ta_2O_5 content (later deferred because of falling tantalum prices), and an extraction plant using hydrofluoric acid, to dissolve the tantalum in the ground ore or slag, and methyl isobutyl ketone, a common solvent, to extract the tantalum-rich material.

The wastes from the plant would have included 380 cubic meters per day of acidic and wastewater. The plan was that the acidic wastewater and ammoniacal digestion residues would be neutralized with lime, and the resulting 48 tons per day of waste would be filtered and the solids landfilled. The treated wastewater would be discharged to a canal in the rainy season, and to an abandoned mine during the dry season. Air pollutants, it has been promised, would be collected and treated.

One problem, however, was that an Environmental Impact Assessment (EIA) was only prepared late in the day, and then somewhat reluctantly, following government pressure on TTIC. The EIA was completed shortly before the plant was burnt down, and was not used as a means of promoting public participation. The TTIC plant was also approved before the World Bank issued its post-Bhopal guidelines for assessing the major hazards associated with industrial development projects in developing countries. The TTIC plant would now come within those guidelines, since they cover any plant handling more than 10 tons of hydrogen fluoride. Such assessments are not a legal requirement under Thai law, but the lack of such an assessment can leave the door open for rumour and speculation.

The plant was located on the northern outskirts of the city, just a few hundred meters from a teacher training college. The site was apparently chosen because of its proximity to the tin smelter that produces the tantalum-rich slags, but the siting of such plants in residential areas is questionable at the best of times. Even if local people have read and understood the EIA report which concluded that the plant could be run safely (if sufficient effort was devoted to making sure that it was), the lack of effective enforcement of pollution control standards in Thailand would have raised question marks over the apparently satisfactory picture painted in the EIA.

The tantalum riot, reprehensible though it may have been, underscored a number of points about the planning requirements for such projects. The local public remained grossly ignorant throughout the project of what was likely to be involved. But the facts that did percolate through, for example that tantalum is used in nuclear warheads, simply fanned the flames. The fact that the public could be gradually swayed into staging a riot should be a lesson to us all.

Given that there were probably other, deeper-rooted political forces at work, too, it is impossible to guarantee that a developer who does his homework, basing it on a thorough environmental assessment of the major hazard potential involved, and who does his best to ensure that the local community is involved in the decision-making process, will succeed. But TTIC's experience confirms that if he does not do these things, he will certainly increase his chances of failure.

Table 7.2. Public Participation Objectives

1. Information, education and liaison.
 - a. Educate citizenry on the EIA purpose and process, and how they can participate.
 - b. Disseminate information on study progress and findings.
 - c. Disclose data on environmental impacts.
2. Identification of problems, needs, and important values.
 - a. Identify "environmental resources" important to public in the area.
 - b. Define areas of environmental problems and needs and relation to problems and needs for which project is under study.
3. Idea generation and problem solving.
 - a. Identify alternatives which haven't been considered.
 - b. Brainstorm ideas for mitigating measures for adverse environmental effects.
4. Reaction and feedback on proposals.
 - a. Assess impacts of actions deemed important by public.
 - b. Probe perception of action and resource interrelations.
5. Evaluation of alternatives.
 - a. Provide "value" information about the significance of "presently unquantified environmental amenities" as well as those that are quantified.
 - b. React to value tradeoffs in selection among alternatives.
6. Conflict resolution and consensus.
 - a. Mediate difference between interests.
 - b. Develop mechanisms for compensation.
 - c. Avoid unnecessary and costly litigation.
 - d. Work toward consensus on preferred action.

Source: Public Participation in Environmental Impact Assessment, in **Environmental Impact Assessment**, by Bishop, B. (edited by Blisset, M.), 1975. Engineering Foundation, Table: *Public Participation Objectives*

Figure 7.4. Capabilities of Public Participation

Communication Characteristics			Participation	Impact Assessment Objectives Problems/Values					
Level of Public Contact Achieved	Ability to Handle Specific Interest	Degree of 2-way Communication	Public Participation Techniques	Inform/Educate	Identify	Get Ideas/Solve Problems	Feedback	Evaluate	Resolve Conflict/Consensus
M	L	L	Public Hearings		X		X		
M	L	M	Public Meetings	X	X		X		
L	M	H	Informal Small Group Meetings	X	X	X	X	X	X
M	L	M	General Public Information Meetings	X					
L	M	M	Presentations to Community Organizations	X	X		X		
L	H	H	Information Coordination Seminars	X			X		
L	M	L	Operating Field Offices		X	X	X	X	
L	H	H	Local Planning Visits		X	X	X	X	
L	H	L	Planning Brochures and Workbooks	X		X	X	X	
M	M	L	Information Brochures and Pamphlets	X					
L	H	H	Field Trips and Site Visits	X	X				
H	L	M	Public Displays	X		X	X		
M	L	M	Model Demonstration Projects	X			X	X	X
H	L	L	Material for Mass Media	X					
L	H	M	Response to Public Inquiries	X					
H	L	L	Press Releases Inviting Comments	X			X		
L	H	L	Letter Requests for Comments			X	X		
L	H	H	Workshops		X	X	X	X	X
L	H	H	Charettes			X		X	X
L	H	H	Advisory Committees		X	X	X	X	
L	H	H	Task Forces		X	X		X	
L	H	H	Employment of Community Residents		X	X			X
L	H	H	Community Interest Advocates			X		X	X
L	H	H	Ombudsman or Public Representative		X	X	X	X	X

L-Low M-Medium H-High

Source: Public Participation in Environmental Impact Assessment, in Environmental Impact Assessment, by Bishop, B. (edited by Blisset, M.), 1975. Engineering Foundation, Figure: *Capabilities of Public Participation*

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