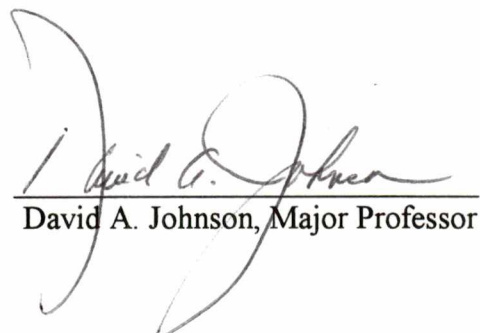


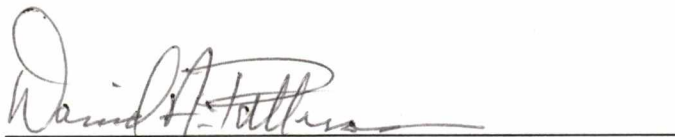
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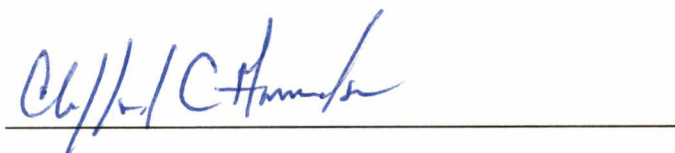
I am submitting herewith a thesis written by A.B.M. Mohiuddin entitled "EIA as a Tool for Sustainable Environmental Planning and Resource Management: Evaluating Jamuna Multipurpose Bridge Project of Bangladesh in Context of a Comparative Assessment of EIA in Some Asian Countries." I have examined the final copy of this thesis for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Master of Science in Planning.



David A. Johnson, Major Professor

We have read this thesis
and recommend its acceptance:





Accepted for the Council:



Associate Vice Chancellor
and Dean of The Graduate School

**EIA AS A TOOL FOR SUSTAINABLE ENVIRONMENTAL
PLANNING AND RESOURCE MANAGEMENT:**

Evaluating Jamuna Multipurpose Bridge Project of Bangladesh in
Context of a Comparative Assessment of EIA in
Some Asian Countries

A Thesis
Presented for the
Master of Science in Planning
Degree
The University of Tennessee, Knoxville

A.B.M. Mohiuddin

August 1998

DEDICATION

*This thesis is dedicated to my lovely wife
Sonia Shahnaz
for her encouragement and devotion
toward my success*

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ABSTRACT

Environmental Impact Assessment (EIA) is a systematic process that examines the environmental consequences of development actions in advance. EIA has been, and remains for the time being, a very important tool of environmental planning and resources management. EIA is one of the tools for predicting and addressing the potential impacts of development policies, plans, projects, and activities. EIA can help responsible governments foresee the environmental repercussions of various development plans, and thereby choose those allowing the most sustainable environment. Strengthening a country's capacity to carry out EIA can significantly improve environmental and resource management. In this research attempt has been made to measure the capacity of the EIA process in some selected Asian countries such as Bangladesh, China, India, Indonesia, and Lao PDR. EIA reports from selected case studies have been analyzed for a comparative assessment. Moreover, the Environmental Action Plan report of Jamuna Multipurpose Bridge of Bangladesh has been evaluated to test its effectiveness for sustainable environmental planning in the context of a comparative assessment of the EIA status of these selected countries.

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LIST OF ACRONYMS

ANDAL	Analisa Dampak Lingkungan (Environment related legislative documents in Indonesia)
BAPEDAL	Badan Pengendalian Dampak Lingkungan (Environmental Impact Management Agency)
DoF	Department of Forestry
DMC	Developing Member Countries
EAP	Environmental Action Plan
EMAP	Environmental Management Action Plan
EMU	Environmental Management Unit
EIA	Environmental Impact Assessment
FPCO	Flood Plan Coordination Organization
IEE	Initial Environmental Examination
IDA	International Development Agency
JMBP	Jamuna Multipurpose Bridge Project
JMBA	Jamuna Multipurpose Bridge Authority
Lao PDR	Lao People's Democratic Republic
LPG	Liquified Petroleum Gas
MOEF	Ministry of Environment and Forest
PAP	Project Affected Person
PRC	People's Republic of China
ROW	Right of Way
SEIA	Summary Environmental Impact Assessment
WCS	Wildlife Conservation Society

CHAPTER ONE

SETTING THE SCENE

Integrating Environmental Impact Assessment (EIA) into Planning and Sustainable Resource Management

OBJECTIVES OF THE RESEARCH

Environmental Impact Assessment (EIA) is a very important tool of environmental planning and resource management. EIA is required, in one form or another, in more than half the nations of the World and EIA is one of the primary tools for predicting and addressing the potential impacts of development policies, plans, projects, and activities. My intention is to measure the capacity of the EIA process in some selected Asian countries such as Bangladesh, China, India, Indonesia, and Lao PDR through analysis of selected case studies.

EIA of projects and programs are already routine for local and national governments in these countries, but has unused potential for helping environmental planners, decision makers, and managers achieve their sustainable development objectives. In my research, I will make a comparative assessment among these nations to investigate the strengths and weaknesses of selected EIA reports. Moreover, I will evaluate Jamuna Multipurpose Bridge Project of Bangladesh in context of the comparative assessment of EIA status in these selected countries.

In the preparation of this thesis, my intention is to investigate the following concerns:

- What are the elements of environmental planning and management?
- What is the need for sustainability and how it can be integrated into natural resource management?

- How can we understand EIA as a planning process and how it can be integrated into decision-making process?
- Is EIA as effective as it should be in these selected countries? How they differ from each other?
- Is the Jamuna Multipurpose Bridge Project sustainable? Does the Environmental Management Action Plan provide necessary mitigation measures to overcome environmental consequences due to the project?

My research is exploratory and integrative in nature. It explores the meanings of sustainable development along with the integration of environmental impact assessment into the planning process. It focuses on the implications of EIA as a tool toward decision-making process and resource management. The study reviews the ongoing strategy of EIA in different nations and draws a comparative assessment of the selected EIA reports.

ENVIRONMENTAL PLANNING AND SUSTAINIBILITY

Typically, planning is defined in terms of its objective. According to Benveniste (1981), planning is the elaboration of a set of related programs designed to achieve certain goals and the planning process is the set of interventions and other actions undertaken during the elaboration of a plan. The planning process is then specified to include both technical aspects of the data gathering, analysis and plan and plan formation, and political dimensions of elaborating goals, assessing feasibility and forming support for implementation. Planning can also be thought of in many other ways. It can be the application of causal knowledge. Planning is a form of political power. Planning is an act of faith. It is often valued not for what it does but for what it symbolizes. This is the view of planning as rationality and the application of reason to social problems (Smith, 1993).

The dominant theory of planning may be referred to as procedure. The procedural model of planning has also been called the "Classical model" of the planning process. It

assumes a definition that planning is the process whereby proposals for the future are devised and assessed (Cayer and Weschler, 1988) and consists of a series of interrelated steps:

- The identification of needs
- The specification of goals and objectives
- The development of alternative means to attain each goal
- The estimation of the costs of each alternative
- The selection of the most promising alternatives

Rather than integrating biophysical concerns into urban and regional planning, a separate discipline and profession seems to have emerged. The separate development of environmental planning is closely linked to environmental impact assessment (Slcombe, 1993), and in the United States to the 1969 National Environmental Policy Act's requirement of environmental impact statements in particular (Caldwell, 1982). Environmental planning envisages the idea of achieving the goals of sustainable development through a system of coordination and control organized through participative democratic processes of government at all levels (Blowers, 1993). Environmental planning is a comprehensive approach to environmental management and has three basic features:

1. It takes account of future uncertainty by a precautionary approach.
2. It reflects the integrated nature of environmental processes and policies.
3. It takes a strategic view of decision-making.

The "Precautionary principles" urges that action should be taken where there are good grounds for judging either that action taken promptly at comparatively low cost may avoid more costly damage later, or that irreversible effects may follow if action is delayed (Blowers, 1993). Therefore, precautionary action may be needed 'even where scientific knowledge is not conclusive.' Responsibility for the future should make us cautious in the present. We also need to develop now those policies for sustainable development that will bear fruit in the medium and longer term.

Environmental problems are both widespread and localized, resulting in social inequalities that are often reflected in the environmental squalor of decaying inner cities or in risks borne by those living near hazardous or polluting industrial plants. In situations, whether global or local, there is an uneasy balance to strike between the continued stability of natural systems, and welfare of communities who depend, directly or indirectly, on the exploitation of resources. As a general principle, economic and community development must work within the constraints set by biophysical systems. The World Conservation Strategy (IUCN, 1980) expressed this in terms of 'resource conservation for sustainable development'. Although the idea of sustainability is a crucial concept, it has proved to be a highly contentious term, posing many difficulties of interpretation (Selman, 1992). The Brundtland report (World Commission on Environment and Development, 1987) captured its essence, by proposing that sustainable development ensured that the needs of present generations were met without compromising the ability of future generations to meet their own needs. Broadly, sustainability arguments tend to stress the need to view environmental protection and continuing economic growth as mutually compatible activities and not necessarily conflicting ones (Serageldin, 1995). Sustainability therefore implies that development programs should be consistent with natural resource base limitations and biospherical waste assimilation capacities (Turner, 1988). At the 1992, U.N. Conference on Environment and Development in Rio (United Nations, 1992), UNCED Principle # 3 characterized sustainable development as "the right to development must be fulfilled so as to equitably meet developmental and environmental needs of present and future generations." UNCED Principle # 4 further states : "in order to achieve sustainable development, environmental protection shall constitute an integral part of the development process and cannot be considered in isolation from it." These two principles, stated as part of the U. N. Conference Agenda 21, have some very profound implications for use and stewardship of natural resources, ecology and environment. Within the statement of sustainable development in Brundtland's report, there are three components that require more precise definition. They are development, needs, and future generations (Schmidheiny, 1996).

“Development” is often confused with “growth.” Growth conveys the idea of physical or quantitative expansion of the economic system. By contrast, development is a qualitative concept incorporating notions of improvement and progress and including cultural and social, as well as economic, dimensions. Sustainable development requires that we have regard to the earth’s regenerative capacity, the ability of its system to recuperate and maintain productivity. Thus the conservation of resources is a strong component of sustainable development (Blower, 1993). The question of ‘needs’ introduces into the definition of sustainable development the issue of the distribution of the resources. Brundtland defines sustainability as meeting the basic needs of all and extending to all the opportunity to satisfy their aspirations for a better life. Greater social equality for both moral and practical reasons is a key issue in achieving sustainable development in both the developed and developing countries (Selman, 1992). A major component of sustainable development is the principle of inter-generational equity. In order to ensure environmental conservation for present and future generations it may be necessary to restrict development of environmental assets such as important habitats, high quality landscape, forests, non-renewable resources and so on. The principle of equity suggests the superiority of communal or common rights over those of the individual or nation-state (Roth, 1993). Sustainable development involves seeking to maintain areas of high environmental quality for the general benefit and, where possible, to enhance environmental quality in areas of deprivation (Blower, 1993). The aim of sustainable development is defined as follows:

To promote development that enhances the natural and built environment in ways that are compatible with:

- The requirement to conserve the stock of natural assets, wherever possible offsetting any unavoidable reduction by a compensating increase so that the total is left undiminished.
- The need to avoid damaging the regenerative capacity of the world’s natural ecosystems.
- The need to achieve greater social equality.

- The avoidance of the imposition of added costs or risks on succeeding generations.

Sustainable development is equitable across socio-economic groups, gender and generations managing for sustainability requires that there is no net reduction in the sum of environmental capital, human resource capital, or human made capital (Goodland, 1992) available to future generations. Sustainable development does not diminish natural resource capital, human capital or human made capital available to future generations (Fig.1). Equitability and sustainability are prerequisites of democratization and improve quality of life (McCormick, 1994). Sustainability can be divided into four degrees weak, intermediate, strong and absurdly strong—depending on how much substitution one thinks there is among types of capital (Daly and Cobb, 1994).

- **Weak Sustainability:** is maintaining total capital intact without regard to the composition of that capital between the different kinds of capital (natural, human-made, social or human). This would imply that the different kinds of capital are perfect substitutes, at least within the boundaries of current levels of economic activity and resource endowment.
- **Intermediate sustainability:** would require that in addition to maintaining the total level of capital intact, some concern should be given to the composition of that capital between natural, human-made, or social. While human-made and natural capital are substitutable over a sometimes significant but limited margin, they are complementary beyond that limited margin (Goodland and Daly, 1994). The full functioning of the system requires at least a mix of the different kinds of capital.
- **Strong sustainability:** requires maintaining different kinds of capital intact separately. This assumes that natural and human-made capital are not really substitutes but complements in most production functions.

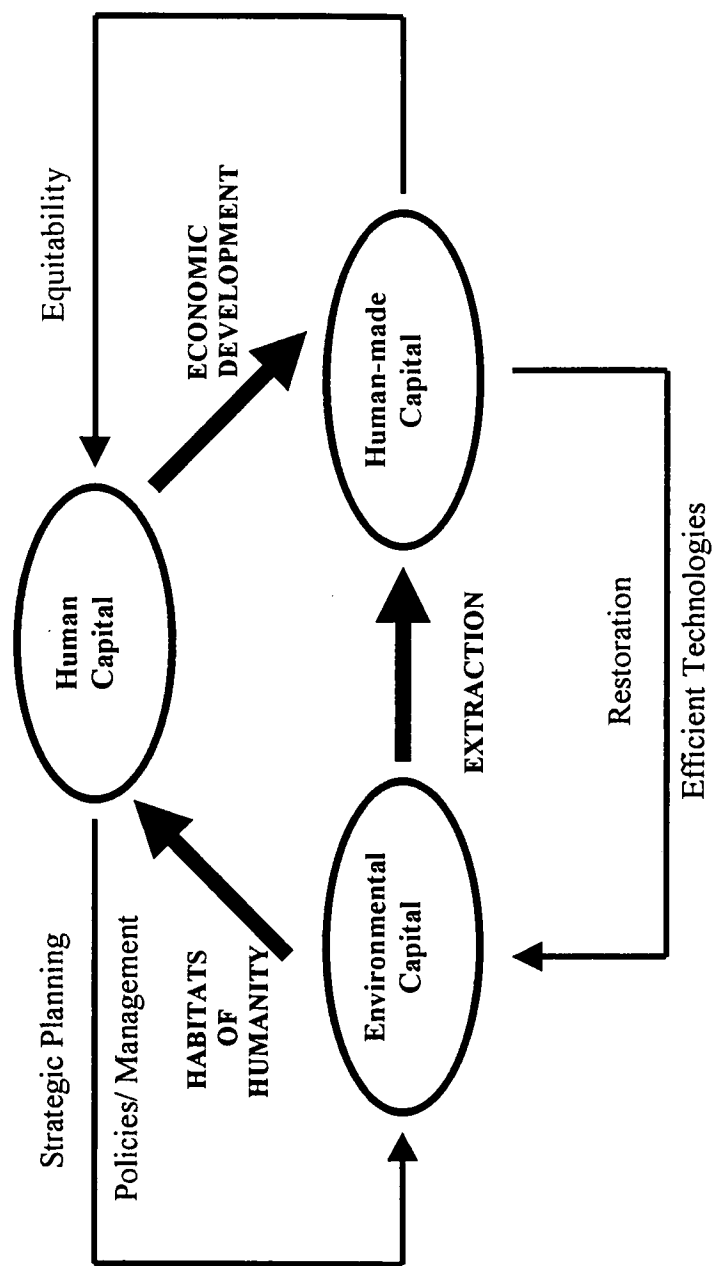


Figure 1: Dynamic Model of Sustainable Development
 Source: McCormick, 1994

- **Absurdly strong sustainability:** would never deplete anything. Non-renewable resources –absurdly could not be used at all; for renewables, only net annual growth rates could be harvested in the form of the overmature portion of the stock.

The decision between intermediate and strong sustainability highlights the tradeoffs between human-made capital and natural capital. Investing in natural capital (non-marked) is essentially infrastructure investment on a grand scale, that is the biophysical infrastructure of the entire human niche. Investment in such “infra-structure” maintains the productivity of all previous economic investments in human-made capital, public or private, by rebuilding the natural capital stocks that have come to be imitative (Goodland and Daly, 1994).

For development to be sustainable, there are five fundamental goals that should guide all decisions concerning future development and in pursuit of which effective policies need to be developed (Smith, 1993).

- **Resource Conservation:** Sustainable development involves the continuing supply of resources for future generations. It means the efficient use of non-renewable energy and mineral resources through higher productivity, recycling, the development of alternative technologies, and substitution where this is possible and not environmentally harmful. It also requires the protection of biological diversity, thereby maintaining the potential species and habitats to assist the development of agriculture, medicine and industry. The goal of resource conservation can be summarized as : to ensure the supply of natural resources for present and future generations through the efficient use of land, less wasteful use of non-renewable resources, their substitution by renewable resources wherever possible, and the maintenance of biological diversity.

- **Built development:** The goal is concerned with the use of physical resources (natural and manufactured) and their impact on the land. Resource conservation requires patterns of development that minimize energy consumption, maintain the productivity of land, and encourage the re-use of buildings. The size, density and location of human settlements that is most appropriate for sustainability will vary in the light of technological developments in energy, building, manufacturing, and transportation. The goal of built development is : to ensure that the development and use of the built environment respects and is in harmony with the natural environment, and that the relationship between the two is designed to be one of balance and mutual enhancement.
- **Environmental quality:** Development must also respect environmental quality. At the very least this means that processes must be avoided which degrade or pollute the environment and thereby reduce its regenerative capacity. Therefore, a third goal is: to prevent or reduce processes that degrade or pollute the environment, to protect the regenerative capacity of ecosystems, and to prevent developments that are detrimental to human health or that diminish the quality of life.
- **Social Equality:** Under present economic arrangements, patterns of trade, aid and investment are largely shaped by the demands of the richer countries. Implicit in these patterns are inequalities that intensify the pressure on the environment through resource exploitation, the destruction of ecosystems, and the creation of pollution. Promoting greater equality will not, of itself, achieve sustainability, since both rich and poor degrade the environment. But the conflicts that arise through inequalities are a major obstacle to co-operation. Sustainability is a moral and social as well as a physical concept and a further goal is , therefore: to prevent any development that increases the gap

between rich and poor and to encourage development that reduces social inequality.

- **Political participation:** Greater equalities means basic changes in patterns of consumption, the allocation of resources and, consequently, life-styles. Contemporary patterns of living in the developed countries based on individualism, competition and conspicuous consumption are simply not sustainable. A shift towards sustainable development will involve a revival of notions of community, collective provision and intervention. A sustainable environment cannot be achieved without the political commitment to make the necessary changes. Fifth goal, therefore, is: to change values, attitudes and behavior by encouraging increased participation in political decision-making and in initiating environmental improvements at all levels from the local community upwards.

Policies for achieving sustainable development which incorporate these five goals will require co-operation and co-ordination through planning , in a broad sense, if they are to be fulfilled. This does not exclude the use of market mechanisms nor does it presuppose particular political and governmental systems, although a participative approach can only prosper within accountable institutions. It does involve the role of law and regulation in appropriate cases, the introduction of inspection, monitoring and enforcement where necessary, and the use of controls over land use, rural and urban.

Sustainable solutions for the development of terrestrial systems fall at the intersection of the spheres that represent the three key ingredients for sustainable development (Fig. 2). Sustainable development occurs only when management goals and actions are simultaneously ecologically viable, economically feasible, and socially desirable; these imply environmental soundness and political acceptability (Muschett, 1997). Sustainable development is not something to be achieved on the margins, as an add-on to current policies, but requires a fundamental and revolutionary change in the

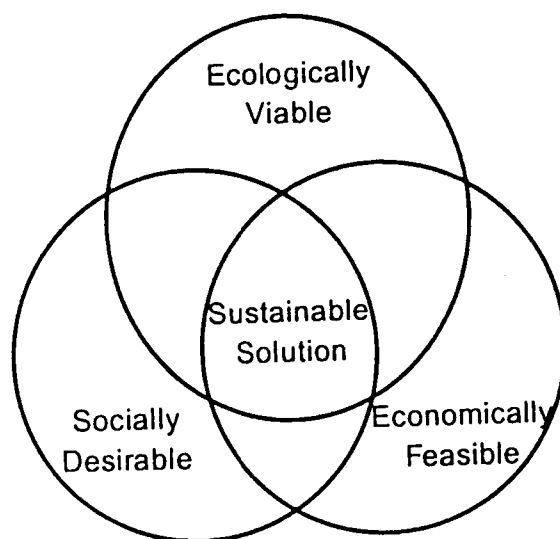


Figure 2: Three Elements of Sustainable Management

Source: Campbell and Lee, 1997

way economies and societies are developed and managed (Blowers, 1993). Sustainable development is an integrating concept, bringing together local and global, short and long term and environment and development. It argues the need for action now to defend the future. Sustainable development is becoming entrenched in policy making at various levels (Runnalls, 1994).

The Rio Conference was an impressive demonstration of global concern about the environment. The declaration of Principles and the two conventions on climate change and biodiversity signed at Rio, together with Agenda 21 (UNCED, 1992), which set out in detail the areas for follow up action, set the agenda. What remains is for the principles to be put into practice and the agenda to be implemented. While the framework for action must be developed at the international level, it will be within countries that the detailed interpretation and implementation of sustainable development will have to be worked out. Much of the impetus and motivation has come not from governments but from environmental groups, non-governmental organizations (NGOs) and local communities working on specific issues in particular places. Environmental planning is necessary to overcome the problems created by the market. Under contemporary economic arrangements, natural environmental resources are depleted rather than conserved. Consequently, some economists argue the case for strong sustainability, with natural and human capital stock being regarded not as substitutable but as separate. Sustainability involves replenishing renewable resources such as soils threatened by erosion, drought or over-cultivation, and conserving non-renewable resources through recycling, increased productivity or product redesign. But sustainability also requires us to avoid overburdening the regenerative capacity of natural systems. To ensure survival it is necessary to avoid the creation of waste and pollution burdens that can result in the deterioration or destruction of the earth's ecosystem.

Whatever occurs within the boundaries of a company determines its profits and loss. Similarly, sovereign states seek to develop their resources of people and materials in order to maximize national wealth. But some of the costs of a company's or a nation's

activities fall outside the boundaries of company ownership or national jurisdiction and are termed “externalities,” strictly speaking, “negative externalities,” since they impose unwanted or unforeseen costs on third parties. It is these to which the quest for sustainability has drawn particular attention. Among the most publicized externalities are the discharge of agricultural fertilizers into watercourses; the emission of sulfur dioxide from power stations creating acid-rain; effluent flowing into sewerage systems; the congestion and noise imposed by traffic; the need for new school places consequent upon housing , and so on. These external costs most often have to be met by other organizations relying upon statutory charges, taxation, or appropriate legislation. The strategies, policies and methods needed to ensure sustainable development will be determined by assumptions about the future (Blowers, 1992). Assumptions have to be made about time-scales, about degrees of uncertainty, about social organization and about values. They require a combination of forecasting, intuitive reasoning and imagination.

ENVIRONMENTAL PLANNING AND SUSTAINABLE RESOURCE MANAGEMENT

The term “environmental planning” may be broadly understood to refer to the process of formulating, evaluating and implementing environmental policy. However, this simple definition serves to conceal a variety of interpretations of environmental planning which may be variously conceived as the technocratic, professional and political views of the process (Hatfield and Evans, 1996). There are, of course, overlaps between each of these interpretations, but each represents a distinctive way of looking at the processes of environmental policy and management.

Technocratic interpretations of environmental planning refer to an understanding of the process which gives precedence to the scientific knowledge deemed necessary to understand and thus manipulate natural biophysical and ecological systems (Hatfield and Evans, 1996).the approach does not deny the importance of the socio-economic

environment within which these processes might be managed or planned, but it does tend to emphasize the importance of technical approaches and solutions. Selman's (1992) book on environmental planning exhibits many of these features. Professional interpretations encapsulate a rather different approach to environmental planning. It refers to the responses of established professional groupings to the rapidly expanding environmental agenda and the associated sources of employment and prestige. The final view of environmental planning is the political interpretation. Here, the long-term objective of sustainability is linked to a policy process of environmental planning. Blowers (1993) argues that the only way of dealing with the complexity of environmental questions is to adopt an integrative, holistic policy approach which transcends established departmental and professional boundaries. This interpretation of environmental planning sees it as a set of arrangements for formulating, organizing and delivering policy with the objective of securing environmental sustainability.

Environmental problems cannot be solved by technical knowledge and statutory procedures alone, and planners must be crucially aware of the broader social and political structures which influence their ability to respond (Selman, 1992). There are several perspectives for sketching the frameworks for environmental planning. The first perspectives center upon the notion of competition for scarce resources. Essentially a geographical framework, it assumes that problems arise because too many interest groups are competing for too few resources, and so it is particularly associated with crowded environments (such as the urban fringe) (Fig.3) or densely populated countries. The effects of crowding and pressure on spatially located resources are seen to cause specific types of damage to vegetation, soils, air and water. These impacts, in turn, are considered to be susceptible to various methods of site management and strategic planning.

A second way of examining the environment, is to consider the "political economy"- the ways in which the operation of the market economy is distorted by government intervention and the actions of various power brokers. Often this adopts a structuralist standpoint, whereby instances of environmental transformations are seen

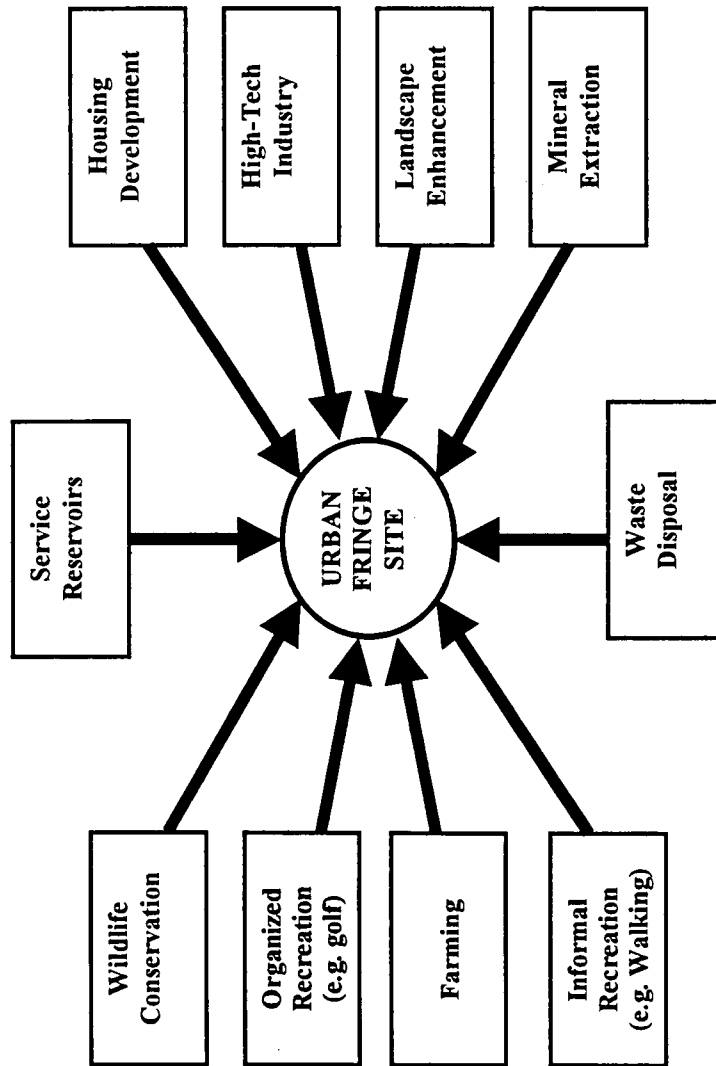


Figure 3: Pressure on Land Use: The Case of the Urban Fringe

Source: Selman, 1992

merely as surface expressions of deep-seated social and economic structures. Change in structural elements tends to lead to the restructuring and reorganization of capital assets and in turn influences the restructuring of urban and rural localities. Within the political economy, therefore, various corporate interests, individuals and their representative organizations, and the state contest the use of the environment. Legislative and land-ownership frameworks are employed to regulate and legitimize transfers between land use activities and sometimes to influence the management of natural and social resources (Selman, 1992).

A third view focuses on the structure of government, and the way in which this influences decisions about the environment. This perspective recognizes that the analysis of scientific or social problems, and our responses to them, have typically been on a reductionist basis, in which fundamental issues are isolated for focused study. The governmental equivalent to this is the functional principle, in which departments are organized according to the primary issue that they are intended to address, such as education or employment. This is an efficient system, enabling problems to be addressed with single-minded vigor, and expertise to be concentrated. It leads to a vertical organizational structure in which each subordinate management tier addresses specific aspects of the overall function (Selman, 1992). That environment can be affected by so many areas of activity requires that an integrated, cross-departmental approach should be taken, involving a horizontal organizational structure. This does not fit in very easily with the normal processes of decision-making, so that environmental action is often poorly co-ordinated, and policies affecting the environment may even be contradictory.

The environment is often viewed in terms of the resources it provides for natural and human ecosystems. A useful way of thinking about natural resources is in terms of their renewability (Selman, 1992) (Fig. 4). Renewable resources are those which can be replenished over time periods of about 10 to 100 years. Non-renewables may only be regenerated over geological timescales, and effectively their stocks are finite; availability depends on the cost of recovering deposits, potential for recycling (impossible for fossil

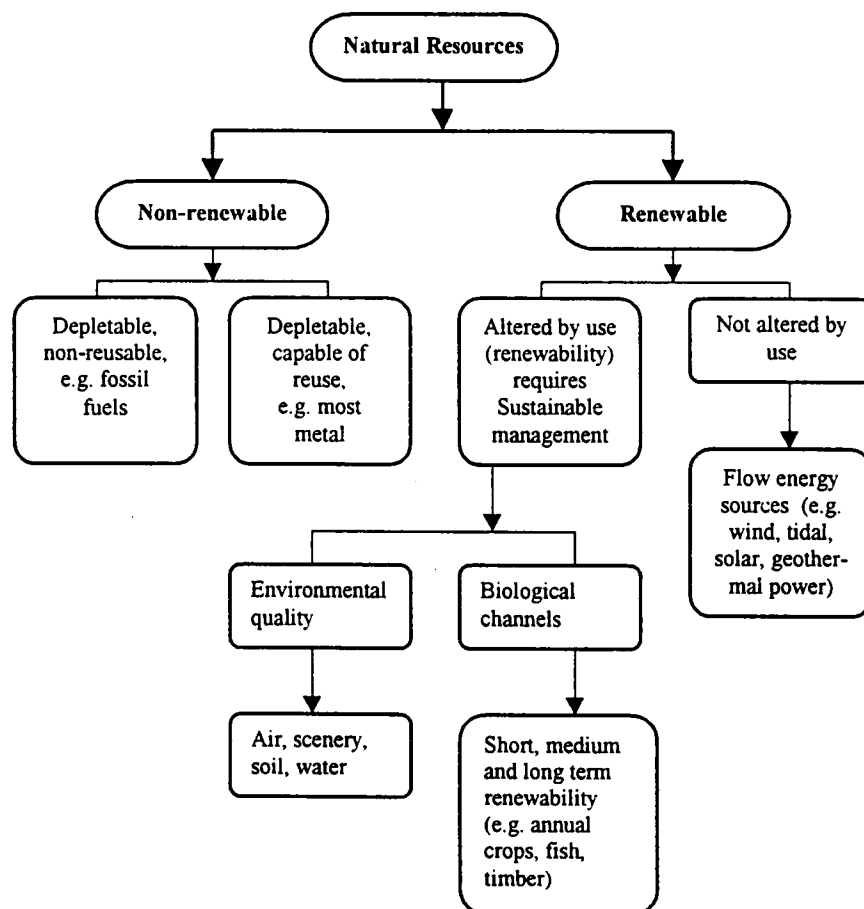


Figure 4: A Classification of Natural resources

Source: Selman, 1992

fuels but technically feasible for most minerals), and development of acceptable substitutes. Equally, excessive exploitation, pollution or visual intrusion may seriously degrade renewable resources.

Globally, many resources are under serious pressure and a summary of some of the more urgent issues is given in Table 1. Although the most serious problems may be global ones, it is essential to recognize that many of them have local origins. This may be because the cumulative impact of individual actions causes positive feedback in environmental systems. An example of this is the emission of CFCs from aerosols which dissociate under high energy radiation in the upper atmosphere and release chlorine atoms, speeding up the breakdown of ozone (O_3) to oxygen gas (O_2). Alternatively it may arise from the 'export' of environmental damage to other countries, for example the clearance of rainforest areas to provide beef for fast food industries (Selman, 1992)

Although many of the more serious environmental problems are associated with accelerated population growth in developing countries, advanced industrial economies may still experience severe pressure on land and other natural resources as a consequence of high rates of household formation, second-home ownership, intensification of rural land use and demand for leisure pursuits. When considering the state of the environment, it is essential to realize that our own local decisions are often intimately linked to, or paralleled by, conditions elsewhere on the earth.

Resource management depicts the idea of actual decisions concerning policy or practice regarding how resources are allocated and under what conditions or arrangements resources may be developed (Mitchell, 1989). The process of resource management is influenced by several elements; such as institutional arrangements for management, interest representation and impact assessment as a process for environmental planning.

Institutional arrangements provide the structure for resource management. Effective planning and decision-making are facilitated when appropriate institutional

Table 1: Critical Pressures on Natural Resources

Population and health

- ⇒ Growth of world population to 8.2 billion by 2025
- ⇒ Accelerating population growth in Africa
- ⇒ Wide disparities in health standards worldwide
- ⇒ Water-related disease in developing countries
- ⇒ Acute and chronic human exposure to pesticides

Human settlements

- ⇒ Rapid growth of urban populations and urban areas
- ⇒ Waste generation from cities
- ⇒ Environmental, social and political pressures engendered by mega cities

Food and agriculture

- ⇒ Despite increasing world food production, levels of hunger and malnutrition are growing
- ⇒ Growth in pesticide-resistant pests
- ⇒ Decreased soil fertility

Forests and farmlands

- ⇒ Clearance of tropical moist forests
- ⇒ Monocultural reforestation in temperate zones, often with non-native softwoods
- ⇒ Soil erosion following logging of closed forests
- ⇒ Degradation of rangelands
- ⇒ Conversion of farmland to other uses

Wildlife and habitats

- ⇒ Species losses with destruction of large areas of wildlife habitat
- ⇒ Illegal trade in endangered and rare species

Energy

- ⇒ Economic dependence on fossil fuels and nuclear power
- ⇒ Production of 'greenhouse' gases and nuclear wastes
- ⇒ Shortage of fuel wood in developing countries.

Freshwater

- ⇒ Very uneven distribution of water availability between countries
- ⇒ Salinisation of water supplies in some arid countries
- ⇒ Pollution from point and non-point sources

Oceans and coasts

- ⇒ Over-exploitation of some fisheries
- ⇒ Pollution from ocean dumping, oil spills, land runoff and atmospheric deposition
- ⇒ Reclamation of coastal wetlands

Atmosphere and climate

- ⇒ Air pollution
- ⇒ Global warming
- ⇒ Ozone depletion
- ⇒ Interactions between pollutants in the atmosphere

Source: Selman, 1992

arrangements are in place. The effectiveness of those arrangements can be modified at a number of leverage points encompassing:

- The context within which management occurs
- The legitimation of relevant management authority, responsibilities and jurisdiction
- The management functions being assigned
- The administrative structures used to provide for management
- The processes and mechanisms used in management
- The culture and attitudes of participants

Resource management should be viewed as a political process that determines the direction of, and the control over, the manner by which resources are developed (Smith, 1993). This process tends to be administered through organizations and agencies that can greatly influence the manner by which policies are both formulated and implemented. Administrative organizations are decision-making entities. Decision processes represent a means for resources to be allocated and conflicts to be solved.

Interest representation seeks to ensure that all of the relevant stakeholders are afforded an opportunity to participate in decision-making. It is a recognition of the need to give people input into the decisions that affect them. The term stakeholders is used to refer to all the parties who have a vested and legitimate interest in participating in the resource management process. Interest representation is necessary within the policy process to ensure political commitment to the implementation of resource management practices such as impact assessment. It also provides stakeholders with an opportunity to influence future planning efforts. Planning can occur at a normative level (with a focus upon policies to guide what ought to be done), at a strategic level (with an emphasis upon the determination of programs to guide what can be done) and at an operational level (with a concern for project implementation and what will be done on practice) (Smith, 1993). At each level, environmental planning should invoke the principles of impact assessment in seeking to provide for improved decision-making, impact mitigation and

conflict resolution. Indeed, impact assessment should be viewed as a process for environmental planning (Selman, 1992). Impact assessment has been integrated into the process of planning but has not been viewed in a broad enough perspective to be seen as a means to achieve management objectives. If impact assessment is to be regarded as a process for environmental planning, the notion of impact assessment solely for project appraisal has to be discarded. This requires that the role of impact assessment within planning be clarified and that the practice of impact assessment recognize the importance of the following activities:

- Scoping
- Prediction
- Significance assessment
- Evaluation
- Monitoring
- Mitigation

The main objective of environmental management is to maintain the environment's carrying capacity on behalf of sustainable development. The carrying capacity of the environment is damaged if the environmental quality can lead to irreversible effects within a generation, such as mortality or morbidity among people, nuisance and damage to well being, the extinction of plant or animal species, the deterioration of ecosystems, damage to water supplies, soil fertility or the cultural heritage, and impediments to physical and economic development (Blower, 1993). Aspiring to sustainability directs resource management efforts towards a balance among societal, economic and environmental objectives. Development, and not just growth, becomes paramount. Human desires are balanced by the necessity to preserve environmental integrity, while pressures for economic growth are balanced by the requirements for societal equity. The purpose of resource management is to supply the basis by which this balance may be achieved. As a goal for resource management, sustainability represents a vision of a desirable future. It is a goal that can guide both the design of future plans and more immediate management of present changes in society, its

economy and the environment (Smith, 1993). Global awareness of environmental issues has never been higher. Translating that awareness into concerted political action requires an easily recognized icon around which to build support for more effective policies and the implementation of integrated resource management practices. Sustainability provides that symbolism (Hatfield and Evans, 1996).

The various components of problem identification, resource management and sustainability can be linked through a integrative framework for sustainable resource management. As shown in Fig. 5, the framework proceeds from a starting-point of problem identification towards the goal of sustainability, with resource management supplying the bridge linking them together. The framework defines a role for resource management procedures and institutions. It involves the translation of values and information into directives for sustainability. Within this paradigm, impact assessment is seen as the process for environmental planning that provides the basis for resource management to achieve the goal of sustainability. Resource management represents the central component of the framework. As shown in Fig. 5, resource management is envisaged as an iterative process, wherein three elements must be integrated:

- Institutional arrangement
- Interest representation
- Impact assessment

Institutional arrangements must be viewed in context and may be assessed on the basis of legitimation, functions, administrative structures, process and mechanisms, and culture and attitudes. Each of these factors represents a potential leverage point for which opportunities exist to alter the institutional arrangements for resource management (Smith, 1993). Within the integrative framework (Fig. 5) the institutional arrangements are viewed as structuring the resource management process.. They determine the role to be played by interest representation and they establish the provisions for impact assessment. Thus, to be effective, the institutional arrangements must provide an

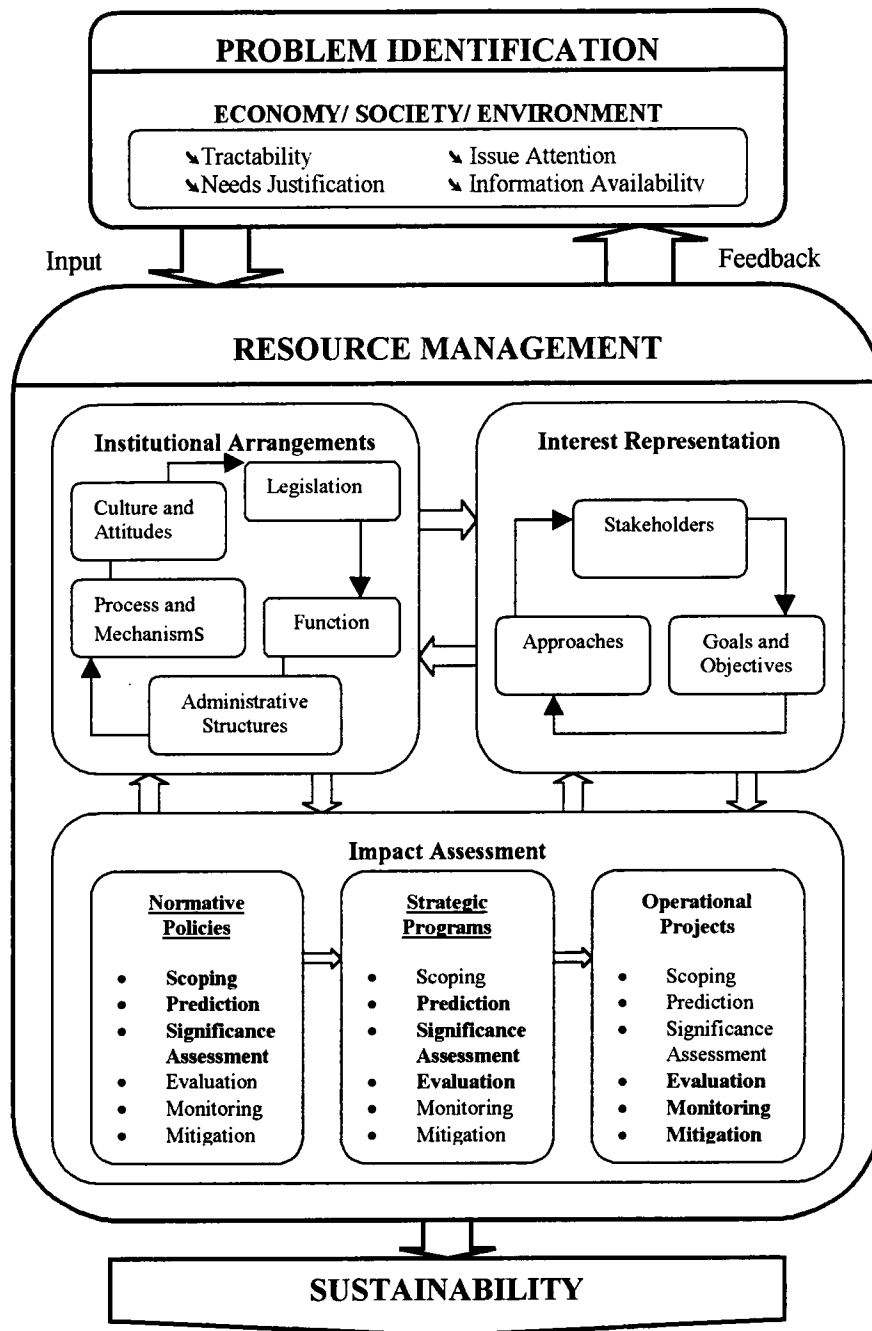


Figure 5: An Integrative Framework for Sustainable Resource Management

Source: Smith, 1993

appropriate basis for the integration of interest representation with the process of impact assessment.

Interest representation is shown in Fig. 5 as a function of the stakeholders involved, their goals and objectives, and the approaches used to make representation within decision-making. In any resource management issue, it is important that full range of stakeholders be identified and approaches to interest representation be adopted that are appropriate to the various goals and objectives of the different stakeholders. It is more pertinent to ensure the representation of all stakeholders within the resource management process than it is to adhere to a distinct method of involvement. Which stakeholders are involved, their views and how they are represented may change several times through the various iterations of the management process. The final component of the integrative framework is that of impact assessment. As shown in Fig. 5, impact assessment is a process for environmental planning. Planning can occur at three different levels, involving the design of normative policies, strategic programs and operational projects. At each level, six activities are seen necessary: scoping, prediction, significance assessment, evaluation, monitoring and mitigation (Smith, 1993). Where planning occurs at all three levels, the iterative sequencing of these activities would involve a shifting emphasis within normative planning stressing scoping, prediction and significance assessment and evaluation, and the final operational planning focused around the activities of evaluation, monitoring and mitigation (Fig. 5).

Thus impact assessment is seen as the engine within the resource management process. Impact assessment operates within the provisions provided by the institutional arrangements and it must incorporate the demands of interest representation. However, it is impact assessment as process that provides the basis for resource management to achieve the goal of sustainability.

EIA AND ROLE OF PLANNING

Environmental impact assessment (EIA) is an integrated component of decisions made every day on proposed projects, plans, and actions (Marriotte, 1997). The term environmental assessment describes a technique and a process by which information about the environmental effects of a project is collected, both by the developer and from other sources, and taken into account by the planning authority in forming their judgement whether the development should go ahead (Glasson, 1995).

Environmental impact assessment (EIA) refers to the evaluation of the effects likely to arise from a major project (or other action) significantly affecting the natural and man-made environment (Therivel *et al*, 1994). Consultation and participation are integral to this evaluation. EIA is a systematic and integrative process, first developed in the United States as a result of the National Environmental Policy Act of 1969 (NEPA), for considering possible impacts prior to a decision being taken on whether or not a proposal should be given approval to proceed (Clark and Canter, 1997). NEPA requires, *inter alia*, the publication of environmental impact statement (EIS) describing in detail the environmental impacts likely to arise from an action. The EIA process should supply decision-makers with an indication of the likely consequences of their actions. Properly used, EIA should lead to informed decisions about potentially significant actions, and to positive benefits to both proponents and to the population at large (Wood, 1995). Other industrialized countries have since implemented EIA procedures. Canada, Australia, the Netherlands, and Japan, for example, adopted legislation in 1973, 1974, 1981, and 1984 respectively (Wathern, 1988), while in July 1985 the European Community (EC) finally adopted a directive making environmental assessment mandatory for certain Categories of projects after nearly a decade of deliberation. Countries in the developed world have not been alone in realizing the potential of EIA. Many developing countries have been quick to appreciate the procedures offer a means of introducing some aspect of environmental planning, often in the absence of any formal land use planning control system (Sankoh, 1996). Colombia became the first Latin American country to institute a system of EIA when procedures were adopted in 1974. In Asia and the Pacific a

significant numbers of countries have established procedures for EIA (Smith and Wansem, 1995). Philippines, Indonesia, Malaysia, and Thailand, for example, strengthen its environmental legislation with governmental decrees and acts in 1977, 1987, 1988, and 1992 respectively (Smith and Wansem, 1995; Gilpin, 1995).

Environmental Impact Assessment: A Process:

EIA is a process, a systematic process that examines the environmental consequences of development actions in advance. The process involves a number of steps (Glasson, 1995), as outlined in figure 6. These are briefly describe below:

- ***Project screening*** narrows the application of EIA to those projects that may have significant environmental impacts.
- ***Scoping*** seeks to identify at an early stage, from all of a project's possible impacts and from all the alternatives that could be addressed, those that are the key, significant issues.
- ***Consideration of alternatives*** seeks to ensure that the proponent has considered other feasible approaches, including alternative project locations, scales, processes, layouts, operating conditions, and the "no action" option.
- ***Description of the project/ development action*** includes a clarification of the purpose and rational of the project, and an understanding of its various characteristics- including stages of development, location and processes.
- ***Description of the environmental baseline*** includes the establishment of both the present and the future state of the environment, in the absence of the project, taking into account changes from natural events and from other human activities.
- ***Identification of key impacts*** brings together the previous steps in the aims of ensuring that all the potentially significant environmental impacts (adverse and beneficial) are identified and taken into account in the process.

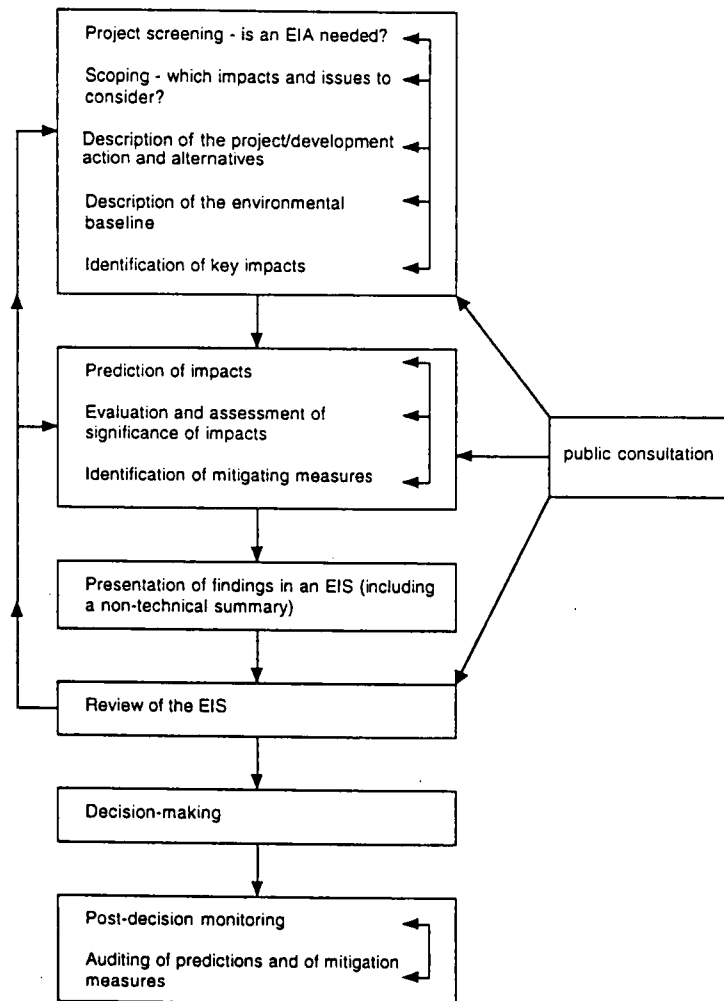


Figure 6: Important Steps in EIA Process

Source: Glasson, 1995

- ***The prediction of impact*** aims to identify the magnitude and other dimensions of identified change in the environment with a project/ action, by comparison with the situation without that project/ action.
- ***Evaluation and assessment of significance*** seeks to assess the relative significance of the predicted impacts to allow a focus on key adverse impacts.
- ***Mitigation*** involves the introduction of measures to avoid, reduce, remedy or compensate for any significant adverse impacts.
- ***Public consultation and participation*** aims to assume the quality, comprehensiveness and effectiveness of the EIA, as well as to ensure that the public's views are adequately taken into consideration in the decision-making process.
- ***EIS presentation*** is a vital step in the process. If done badly, much good work in the EIA may be negated.
- ***Review*** involves a systematic appraisal of the quality of the EIS, as a contribution to the decision-making process.
- ***Decision-making*** on the projects involves a consideration by the relevant authority of the EIS together with other material considerations.
- ***Post-decision monitoring*** involves the recording of outcomes associated with development impacts, after a decision to proceed.
- ***Auditing*** follows from monitoring. It can involve comparing actual outcomes with predicted outcomes, and can be used to assess the quality of predictions and the effectiveness of mitigation.

While not all EIA systems contain every element, the EIA process emanating from NEPA and subsequently diffused around the world can be represented as a series of iterative steps (Wood,1995):

- Consideration of alternative means of achieving objectives
- Designing the selected proposal
- Determine whether an EIA is necessary in a particular case (screening)
- Deciding on the topics to be covered in the EIA (scoping)

- Preparing the EIA report
- Reviewing the EIA report to check its adequacy
- Making a decision on the proposal, using the EIA report and opinions expressed about it
- Monitoring the impacts of the proposal if it is implemented

As indicated by fig 7, which summarizes these steps, the EIA process is cyclical. Thus, the consideration of the environmental effects of alternative means of achieving the proponent's aims and the detailed design of the action are inextricably linked. EIA should be a cyclical process with considerable interaction between the various steps. For example, public participation can be useful at most stages of the process. Monitoring systems should relate to parameters established in the initial project and baseline description (Glasson, 1995). Not every step in the EIA process shown in figure 7 takes place overtly (or indeed, at all) in every EIA system. Scoping and project monitoring were not part of the original conception of EIA in NEPA and are still not required in many EIA systems. Indeed, there is a very considerable diversity of views about the essential elements of an effective EIA system (Wood, 1995).

The environmental impact statement (EIS) provides documentation of the information and estimates of impacts derived from the various steps in the process. Prevention is better than cure; an EIS revealing many significant unavoidable adverse impacts would provide valuable information that could contribute to the abandonment or substantial modification of a proposed developed action (Glasson, 1995). Where adverse impacts can be successfully reduced through mitigation measures, there may be different decision. Table 2 provides an example of the content of an EIS for a project.

The non-technical summary is an important element in the documentation. EIA can be complex and the summary can help to improve communication with the various parties involved. EIA and EIS practice vary from study to study, from country to country, and best practice is constantly evolving. A recent UN study of EIA practice in several

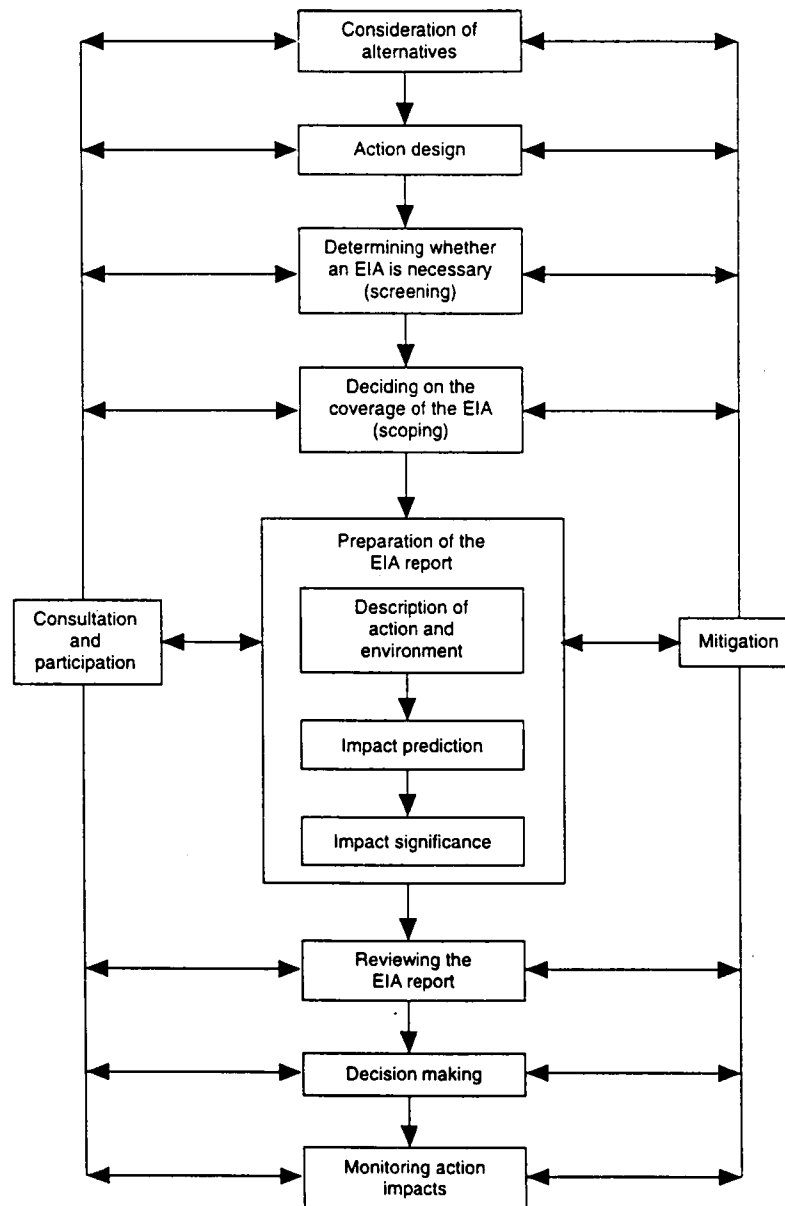


Figure 7: The Environmental Impact Assessment Process

Source: Wood, 1995

Table 2: An EIS for a Project (Example of Contents)

Non-technical Summary
<u>Part 1: Methods and Key Issues</u> ✧ Methods statements ✧ Summary of issues; monitoring program statement <u>Part 2: Background to the proposed development</u> ✧ Preliminary studies: • Need • Planning • Alternatives • Site selection ✧ Site description/ baseline conditions ✧ Description of proposed development ✧ Construction activities and program <u>Part 3: Environmental impact assessment – topic areas</u> ✧ Land use, landscape and visual quality ✧ Geology, topography and soils ✧ Hydrology and water quality ✧ Air quality and climate ✧ Ecology: • Terrestrial • Aquatic ✧ Noise ✧ Transport ✧ Socio-economic ✧ Interrelationships between effects

Source: Glasson, 1995

countries advocate changes in the process and documentation (United Nations Commissions for Europe, 1991). These include giving a greater emphasis to the socio-economic dimension, to public participation, and to “after the decision” activity, such as monitoring.

The main advantages and benefits of EIA:

- Improved project design/siting
- More informed decision-making
- More environmentally sensitive decisions
- Increased accountability and transparency during the development process
- Improved integration of projects into their environmental and social settings
- Reduced environmental damage
- More effective projects in terms of meeting their financial and/or socio-economic objectives
- A positive contribution toward achieving sustainability

Basic Principles of EIA Practice:

A review of selected key recent existing EIA guidelines, handbooks, and sourcebooks and reviews of EIA practice identified common EIA principles (UNEP, 1996). They are outlined below:

General Principles

- EIA is a tool to help achieve sustainable development
- EIA procedure should be integrated, closely, into existing development planning and authorization procedures so that:
 - Minimum disruption is caused to existing institutional arrangements
 - Maximum effectiveness for EIA is achieved by identifying the appropriate time/locations for EIA to be linked up to the existing procedures
- EIA is a management tool to be linked closely to the project life cycle and its decision points to ensure the appropriate environmental information provided

at the correct time. There must be constant interaction and feedback between the EIA team and project designers and proponent to ensure that design/location changes can be implemented to avoid or minimize adverse impacts to the maximum extent possible.

- Projects should be screened to select those needing EIA, and those for which less detailed environmental study is appropriate, using techniques such as:
 - Projects list (with thresholds)
 - Sensitive area criteria
 - Preliminary or initial EIAs, and
 - Combination of these techniques
- EIAs must include an analysis of number of reasonable activities
- Involvement of stakeholders should occur through the EIA process (mechanisms and participants)
 - Scoping
 - Interim reports (if prepared)
 - Draft/final report
 - Decision-making, and
 - Post decision stage
- EIAs must be implemented in a multi- and inter-disciplinary manner
- EIAs must be characterized by integration of social, economic and biophysical environmental impacts to the maximum extent possible

Specific Principles:

- Preparation of TORs (Terms of Reference) for EIAa should be based on the results of scoping activities to specify:
 - Likely significant impacts to be identified, predicted, evaluated, mitigated and monitored
 - Alternative designs/location to be assessed, and
 - Work plan for EIA study and schedule of consultations
- Implementation of EIAs should be according to ToR:

- Baseline studies focused only on impacts being investigated
- Use of a moving baseline to take account of other projects likely to be implemented before the project subject to EIA
- Quantitative predictions of impact magnitude an area/ people affected
- Description of impact characteristics and probability of occurrence
- Evaluation of significance of impacts, from each alternative, based on clear criteria
- Comparison of environmental impacts of each alternative and selection of least environmentally damaging option using agreed sustainability indicators, and
- Preparation of an impact management plan containing mitigation measures, monitoring schemes and, possibly, community liaison committees
- EIA reports (with page limits) should contain:
 - An executive summary
 - Results from EIA implementation
 - Information on data gaps and major sources of uncertainties
 - Technical appendices
 - Visual aids and easy-to-read text
- Review of EIA reports requires:
 - Criteria for review
 - Identification of reviewers
 - Mechanisms for EIA reports to be amended
- EIA reports used in final authorization decision-making should contain:
 - Records of decision
 - Statements of commitment regarding impact management, and
 - Allocation of accountability for post-approval impact management
- Post-design stage and impact management should include:
 - Mitigation

- Monitoring/ auditing of impacts and mitigating measures
- Community liaison, and
- Institutional strengthening and training

Impact Assessment Methods and Methodology:

Various methods for impact assessment were developed because administrative provisions, by themselves, were insufficient to ensure that an impact statement would contain structured information, produced in a “scientific” manner, useful for decision-making (Smith, 1993). Impact assessment must deal with four key problem areas (Bisset, 1987):

- ***Identification***, identifies likely effects and determines the degree of comprehensiveness and specificity to be used in isolating project impacts, their timing and duration. What data are sources are to be employed?
- ***Prediction and measurement***, explicit indicators of impact must be determined and the magnitude of those impacts estimated. Concerns regarding uncertainty and the relative objectivity and subjectivity of the data must be addressed.
- ***Interpretation***, explicit criteria must be used to determine the significance of impacts, to indicate the level of uncertainty and risk involved, and to compare alternatives. Should the impacts be aggregated or disaggregated? Is there to be any public involvement in the interpretation of impacts?
- ***Communication***, results must be communicated effectively to affected parties and should contain a setting description and a summary format. Are the key issues clear? Does the communication satisfy regulatory compliance?

In addressing these considerations, the process for impact assessment involves three steps (Carley and Bustelo, 1984) :

- The establishment of a data base to describe the existing situation
- The development of the means to describe changes related to the project
- The forecasting of changes in the base situation with and without the given project, including both qualitative and quantitative aspects

Five principal types of method have been used to perform the tasks of impact identification and summarization (Bisset, 1987; Thompson, 1990; Wathern, 1988). In order of increasing sophistication, they are:

- Checklists
- Interaction matrices
- Overlay mapping
- Networks
- Simulation Modeling

Checklists:

Checklists are standard lists of features that may be affected by a project. They represent the simplest form of approach to assessing project impacts and were one of the earliest methods for impact assessment to be developed. Checklists aim to promote thinking about impacts, providing a concise summary of the effects of proposals, identifying factors and the trade-off between alternatives. There are several basic formats for checklists (Bissets, 1987), including:

Simple lists: a listing of potentially affected factors.

Descriptive checklists: measurements and predictive techniques for each factor are included in the checklist to provide guidance on the assessment of the impacts identified by the listing.

Scaling checklists: criteria for evaluation are incorporated into the listing, usually in the form of a subjective rating or scaling.

Multi-attribute utility theory: in an extension of scaling checklists, a subjective measure of relative effect is derived for each of the environmental parameters listed in the checklist.

Interaction Matrices:

Interaction matrices were developed from a desire to link environmental factors with project activities. Matrices are grid diagrams with one set of factors on the horizontal axis and another on the vertical. The interaction between components on the opposing axes is recorded in the cell common to both in either a presentational manner, using algebraic functions (smith, 1993).

The most well known example of an interaction matrix is that developed by Leopold et al (1971). The Leopold matrix is intended to reveal two-dimensional relationships between impacts and actions. It provides a systematic checking of each development activity against a listing of environmental factors. The matrix lists 100 possible project actions within 10 general categories on the horizontal axis and lists 88 environmental factors within 4 general categories on the vertical axis.

Overlay Mapping:

Recognizing the spatial nature of many environmental impacts, overlay mapping was pioneered by McHarg (1969). It is an approach based on the principles of land capability mapping. The method was first used manually. A base map of the area is superimposed upon transparent sheets summarizing each set of features of the existing environment according to value classes connoting high (dark shading), medium (light shading) or low (no shading) quality for that particular element of environment. Impacts are shown through the density of shading that builds up as each attribute is overlaid.

Although simple in its conception and application, the McHarg approach to overlay mapping provides a powerful visual representation of potential impacts wherein the spatial distribution of project effects can be seen and the results easily comprehended by affected publics. It is a method particularly well suited to the assessment of impacts associated with alternative routes for linear facilities such as highways, transmission lines and pipelines.

Networks:

Developed expressly to link secondary and tertiary impacts to primary impacts, networks are directional diagrams designed to trace in two dimensions the higher-order linkages between project actions and environmental factors. A network consists of a number of linked impacts known to have occurred in the past which are then used to trace 'the progression of causes and effects of various project actions' (Smith, 1993).

The strength of networks is their ability to identify and guide analysis to the indirect impacts that may arise from a project. They also have the capability to provide a visually understandable representation of those impacts. Networks do not contain criteria to determine impact significance and they are similar to other impact assessment methods in that they are still 'primarily a tool for identifying impacts, not evaluating them.'

Simulation Modeling:

The logical extension of networks is the application of mathematical and other sciences to the modeling of environmental systems. Certainly, an extensive array of mathematical, natural system and economic models is widely used within impact assessment studies (Basta and Bower, 1982; Biswas et al, 1990;). However, as a distinct methodology for impact assessment, simulation modeling involves the integration of standard modeling approaches in the natural and the social sciences with the increased use and capabilities of computers to provide for different impact scenarios to be

developed, visualized and assessed. Simulation models have three basic characteristics. They are:

- Simplified representations of the systems under investigation
- Explicit assumptions regarding the behavior of those systems
- Open to misinterpretation , especially if used out of context

Models may be used to describe, explain and/or predict characteristics of environmental systems. Their greatest utility is in situations where there are few available data, considerable uncertainty as to the dynamic interrelationships between variables, and the simulation model is employed at an early investigative stage to aid in the conceptualization of the impact assessment study (Munn, 1983).

Role of Environmental law and Institutional Arrangement

Legal provisions for environmental protection, planning and regulation establish the context for impact assessment (Smith, 1993). These provisions vary from country to country and are a product of each nation's distinct political culture. Indeed , as much as the law may be viewed as an instigator of reform, it is itself shaped by new political perspectives (Smith, 1993). As one of the notable products of societal attempts to deal with environmental issues, impact assessment represents a major challenge to the "procedural issues" of environmental and administrative law. Law provides a basis for planning and regulation but it must be viewed, understood, administered and implemented within a wider political context. That is, the implementation of provisions for impact assessment necessitates attention to the institutional arrangements for management (Sheate, 1996).

The wide ranges of definitions applied to institutional arrangements have been well reviewed by Mitchell (1989). The most complete definition is that of Craine (1971) who indicated that the study of institutional arrangements requires:

Special attention to the configuration of relationships

- Established by law between individuals and government
- Involved in economic transactions among individuals and groups
- Developed to articulate legal, financial and administrative relations among public agencies, and
- Motivated by social-psychological stimuli among groups and individuals

Other definitions of institutional arrangements have referred to a “cluster” of customs, norms, and laws; “forms” of governance designed to influence human behavior; and ‘the pattern of agencies, laws, participants, and policies’ that structure resource management (Mitchell, 1989).

Several terms have been used to identify the people and interests seeking representation within institutional arrangements for management. Mitchell (1989) referred to key participants or actors, as ‘those who claim a priority interest in a particular resource’ and are active in the defense of that resource. The term “stakeholders” is used, as it is more inclusive of the full range of participants in a decision environment. Stakeholders include both the effecting interests (resource developers, implementers and regulators) and the affected interests (the beneficiaries, victims, those interested in the plan) capable of exerting influence on the outcome of decision-making (Smith, 1993).

Stating that institutional arrangements refer to ‘a definable system that provides both opportunities for and constraints upon policy making’ may summarize these various aspects. The key aspect is the focus on the interaction of several variables (Mitchell, 1989), most importantly:

- Legislation and regulations
- Policies, guidelines and activities
- Administrative structures
- Economic and financial arrangements
- Political structures and decision processes
- Historical and traditional customs and values

- Stakeholders

Integration of EIA and Plan Making Process

In principle, an environmental impact assessment (EIA) system could apply to all actions likely to have significant environmental impact, irrespective of their type. Thus, the potential scope of a comprehensive EIA system could encompass the approval of policies, plans, programs and projects at all levels of government (Wathern, 1995). Lee and Woods (1978) have suggested a 'tiered' system of EIA applied to a chronological sequence of category of action, as shown in figure 8. There are several advantages associated with an EIA system that is not confined to projects. In particular, higher levels of an action not subject to environmental assessment may generate projects which are misspecified or which lack sufficient alternatives. Similarly, there may be time savings if environmental data are collected when a higher-order action is proposed rather than after an urgent project is suggested or if the assessment of a plan or program obviates the necessity to undertake numerous small projects EIAs.

The plan making process followed in practice varies considerably. While some plan makers seek to produce an enduring blueprint of the desired state of the area at some future date, especially where the area is small, others will expect the desired future state to alter over time in response to changes in external circumstances. Some plan makers rely heavily on a pragmatic approach, based upon the qualitative assessment of likely future situations and of the impact of alternative plans upon them. Others utilize an approach with greater emphasis on quantitative planning techniques. There is, however, some consensus about the nature of plan making. Most plan makers would agree that the plan-making process falls into four main stages (Fig. 9 and Table 3). There are, therefore, a number of common elements in most plan-making procedures relevant to incorporating EIA within the plan-making processes (Wathern, 1988). First, there is a statutory recognition of environmental goals within the broad context of plan making. Secondly, there are provisions for the preparation of planning documents. Background information

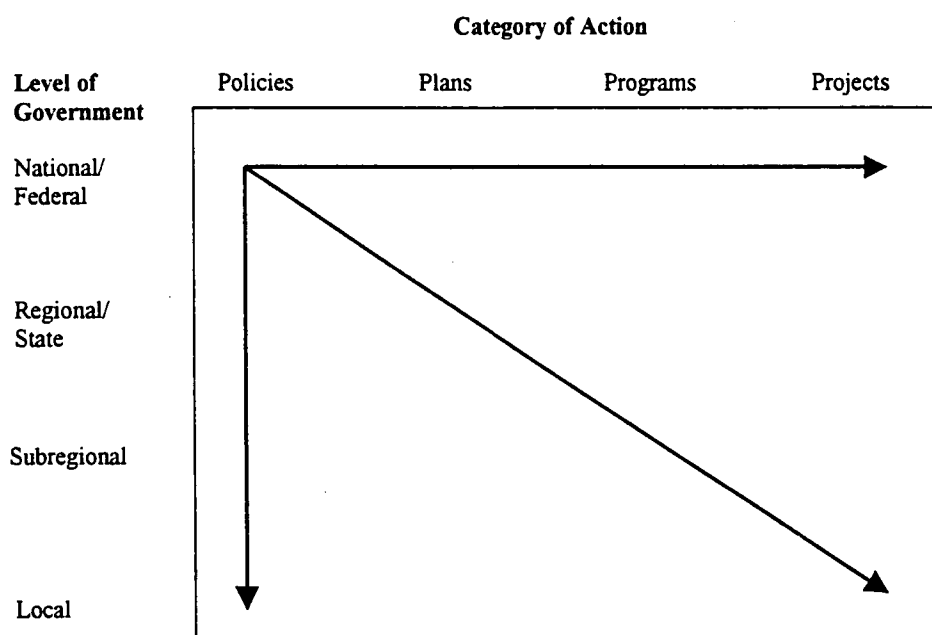


**Figure 8: Categories of Action and Levels of Government
Within a Comprehensive EIA System**

Source: Wathern, 1988

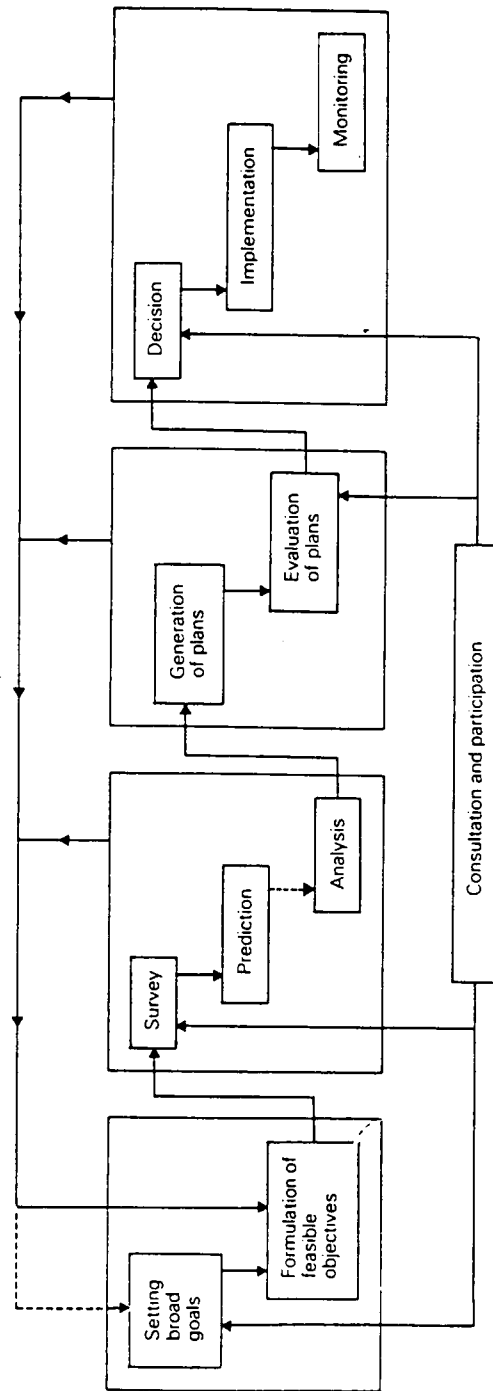


Figure 9: Stages in Physical Planning

Source: Wathern, 1988

Table 3: Characteristics Features of Different Stages in the Physical Planning Process

Formulation of Goals and Objectives Establishment of broad planning goals and more detailed objectives which, at later stages in the planning process, will be refined into more specific operational form
Survey, Prediction and Analysis ✦ Survey of existing conditions ✦ Prediction of future conditions over the planning period (without plan implementation) ✦ Identification of planning problems ✦ Revision of objectives and possibly even goals in the light of these
Generation and Evaluation of Alternative Plans ✦ Development of plans likely to meet agreed goals and objectives ✦ Development and application of evaluation criteria, possible revision of objectives
Decision, Implementation and Monitoring ✦ Plan revision in light of implementation problems and monitoring ✦ Commencing with revision of objectives (and goals)

Source: Wathern, 1988

in the form of a survey of existing (including environmental) conditions, an indication of future prospects and problems as well as sometimes the identification and examination of alternative planning strategies are produced. In addition, the plan itself, which frequently contains policies for improving the environment, is prepared. Finally, there are provisions for consultation and public participation on the basis of these documents and for consequent revision of the plan during subsequent stages in the planning process.

Environmental impact assessment (EIA) is intended not only to ensure that environmental factors are included in decision-making, but also to show how environmental factors have been included both in consideration of alternatives and by the provision of information to the public (Saunders, 1996). The main tasks and activities involved in EIA can be represented in diagrammatic form (Fig. 10). Figure 10 makes it clear that the activities involved in EIA should follow a logical sequence. In practice, however, they represent a series of iterative steps involving feedback as new information is generated, giving rise to an amended proposal. Wathern (1988) has described this integration of the principles of EIA within the design and decision-making process in relation to projects as adaptive environmental impact assessment. It can apply equally to plans. It will be observed from figures 9 and 10 that there are several similarities between the EIA and the plan-making process. Figure 11 in which they are combined, is but one way of expressing the relationship between the plan-making and EIA process (Wathern, 1988).

Thus it is possible to envisage two ways in which the environmental assessment of plans might be carried out. The first is to undertake an EIA of a plan, either during plan making or after it has been prepared, a procedure in which separate documentation presumably would be required. The second is to integrate EIA with the plan making process, in a similar fashion to the adaptive assessment of projects. The principal advantages of undertaking an EIA of a plan is precisely that confusion is removed as a separate document is produced (Wathern, 1995).

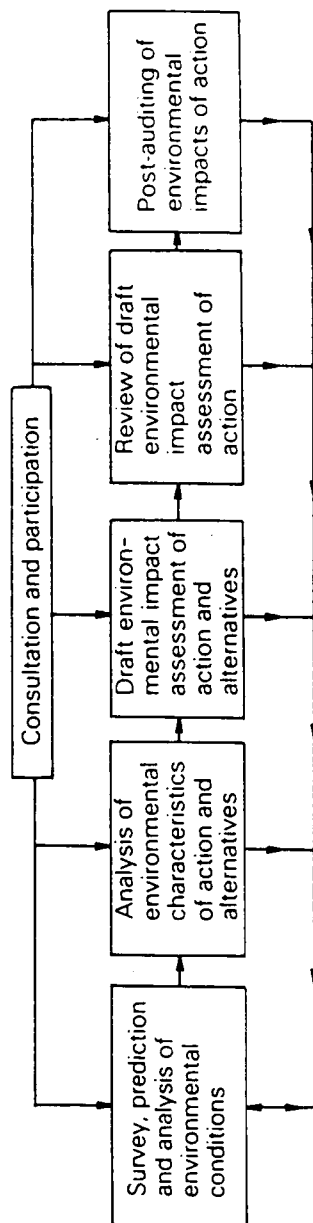


Figure 10: The Main Steps in the EIA Process
Source: Wathern, 1988

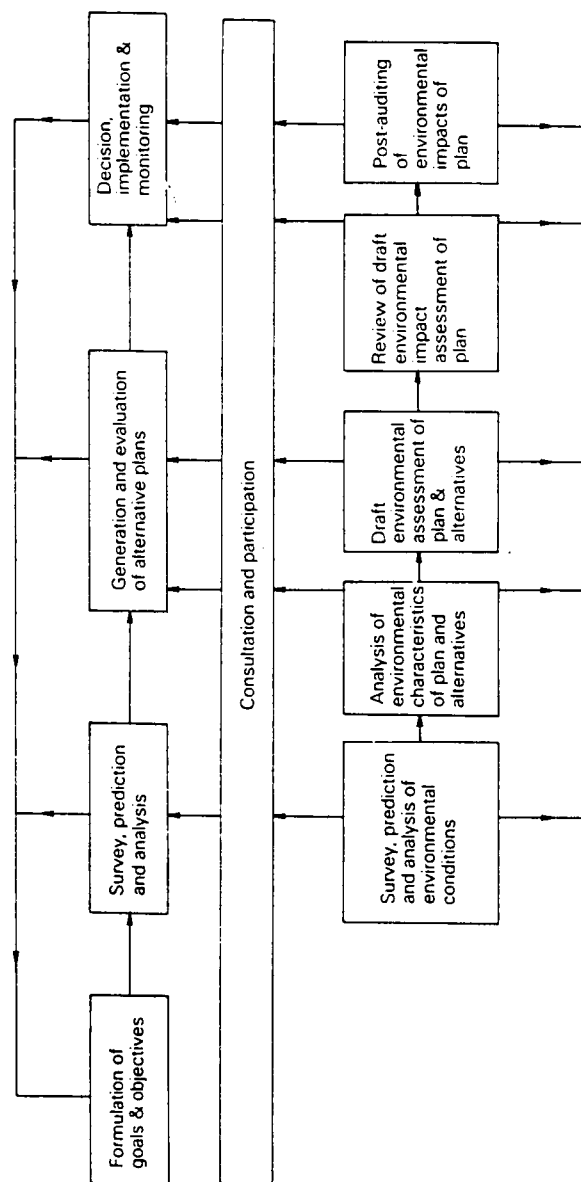


Figure 11: Relationship Between the Plan-Making and EIA

Source: Wathern, 1988

Decision-making Process

Any formal decision-making process (e.g., governmental decision-making with respect to undertaking a proposed project) may be viewed as consisting of several basic components (Erickson, 1994). These components of decision-making include its

- Experimental base
- Prediction system
- Value system
- Selection system

Figure 12 shows the decision-making process as a series of interrelated prediction, value, and selection systems. The experimental base of a decision-making process is the sum of all information, data, and knowledge pertinent to that process. For a governmental agency, this base consists of its legal authorization and all previous actions and experiences as well as protocols previously established in carrying out the mandates of its authorization. This experimental base defines the possible actions that may be undertaken, as well as the goals and objectives that are to be considered appropriate.

From the perspective of decision-making, whether conducted by an individual, a government, or corporations, good decisions are those that do not result in the realization of a selected future; bad decisions are those that do not result in the realization of a selected future (Erickson, 1994). At least some portion of the difference between a good and a bad decision is, therefore, the difference between good and bad prediction system. A valuable prediction system in decision-making is a tool that allows us to relate our present actions accurately to the future consequences of those actions. Values are important factors in human motivation to undertake specific actions, the identification of appropriate values is a complex process in pluralistic societies. Some decision makers, of course, must be concerned with the values of only relatively small number of people (e.g., a corporate board of directors); others have larger constituencies (e.g., a political party). Decision makers involved in environmental decision-making, as defined by legislation or executive orders that mandate environmental impact assessment, must

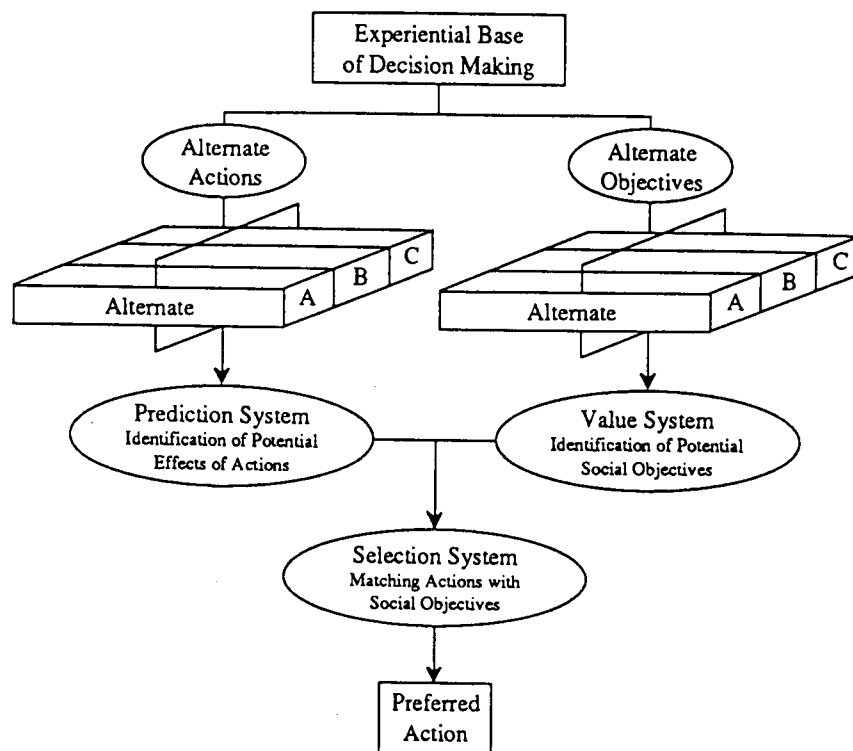


Figure 12: The Decision-Making Process
 Source: Erickson, 1994

interact with very diverse groups, organizations, and agencies and, therefore, with a large number of values (Erickson, 1994).

The manner in which pluralistic values and predicted consequences of actions are integrated, and in which preferred actions and, therefore, alternative futures are selected, constitutes the selection system of decision-making. This phase of decision-making may involve complex institutional and public interaction, such as a referendum or public hearing. The various phases of impact assessment process have their own decision-making requirements. Two phases in which the decisions to be made are of such importance to the overall assessment process must be given particular emphasis. The phases are best known as the 'scoping process' and the 'impact evaluation process.'

The scoping process begins at the very start of the assessment process and, depending on project-specific circumstances, may be extended. The key to a successful scoping process is, of course, the personnel who conduct it. Having identified possible impacts of project development, evaluating those impacts with respect to their significance becomes necessary. Is this impact significant or not? Is it a significant adverse impact? Is it a significant beneficial impact? Performing this evaluation is necessary because decision makers must be informed about issues to which they should pay careful attention. No other task in the assessment process is more difficult (Erickson, 1994). As shown in figure 13, valuation of impacts with respect to negativity or positivity must be done by the assessment team by considering project- and site- specific conditions of the physical and the social environment. Having made that determination, each adverse and beneficial impact must be evaluated for significance; an even more difficult task simply because no universally accepted measure of significance is available. Several criteria that the assessment team should consider in making their determination of significance include,

- Probability of occurrence: Quantitative or qualitative estimate of the likelihood that the impact will occur
- Magnitude: Quantitative or qualitative estimate of size or extent of the impact

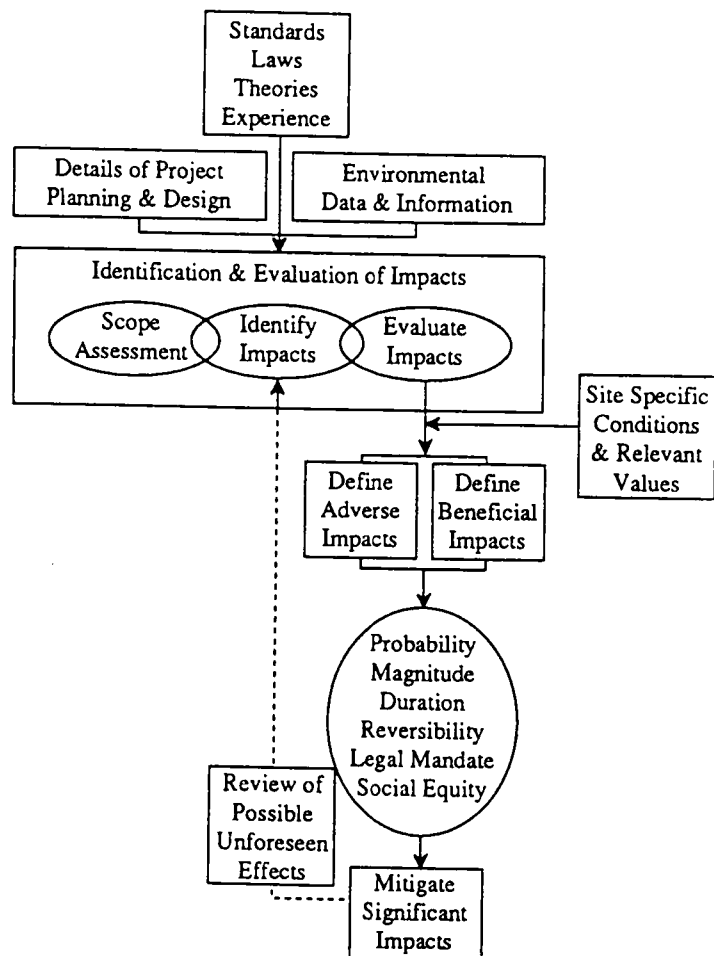


Figure 13: Key Inputs and Outputs Related to the Evaluation of Impact

Source: Erickson, 1994

- Duration: The period of time the impact, if occur, can be expected to last
- Reversibility: Whether the impact can be reversed through human action or naturally
- Relevance to legal mandate: the existence of local or national laws or international treaties that specifically promote or disallow this type of impact
- Social distribution of risks and benefits: Whether this impact contributes to the equitable sharing of environmental risks and benefits.

EIA is a planning tool. However, EIA can be outlined as a plan in the decision-making process (Wood, 1992). Environmental impact assessment is intended not only to ensure that environmental factors are included in the decision-making process, but also to show how environmental factors have been included in consideration of alternatives and provision of information to the public. Chapter two elaborates the EIA procedure and capacity in selected Asian countries such as China, India, Indonesia, and Lao PDR. It further discusses the EIA reports on selected projects of these countries for a comparative assessment.

CHAPTER TWO

EIA IN ASIAN COUNTRIES

Comparative Assessment in China, India, Indonesia, and Lao PDR

INTRODUCTION

Environmental Impact Assessment (EIA) was something new when the United States first mandated it twenty-five years ago, but the concept caught on fast in many other nations. In Asia, the Philippines (Ross, 1993) and Indonesia for example, have been conducting EIAs since the early 1970s (Smith and Wansem, 1995). Like the rest of the developing world, Asian nations now face new demographic and economic realities that require new development approaches. Economic growth is a necessity to meet the basic needs of burgeoning populations, but the conundrum for these nations- as for all others- is how to expand their economies in environmentally sustainable and therefore enduring ways.

Environmental Impact Assessment can help countries foresee the environmental repercussions of various development plans, and thereby choose the most sustainable ones. Strengthening a country's capacity to carry out EIA can significantly improve environmental and natural resource management. Most Asian countries have enacted comprehensive environmental legislation, but laws alone are not enough. Even when clearly set forth in legislation, environmental enforcement is often deficient. A lack of political commitment for pursuing environmental policy goals, a lack of clear regulatory and performance standards, poorly defined permit requirements, a lack of inspection and monitoring activities to identify violators, and inadequate funding of enforcement agencies and tribunals all bedevil enforcement.

At the same time many countries do not have accurate data on rural natural resource use and degradation, and few countries have established viable processing for

consulting with community groups and other private sector interests- essential if an EIA system is to fulfill its potential as a powerful tool in environmental and natural resource management. The last decade has seen tremendous growth in the application of EIA in the region, but levels of sophistication vary. So far, the major focus has been on the techniques and tools of EIA at the project level. Policy, programmatic, and strategic EIAs remain largely untried, and only a few Asian countries have integrated social, cultural, and economic growth aspects into EIAs. In some cases, EIA is a formal mandatory requirement; by law, it must be used during project decision-making. In others, it is seen as a useful but optional component of project review and appraisal. In still other countries in the region, EIA requirements have yet to be adopted. In case studies of China, India, Indonesia, and Laos attempts have been made to foresee the capacity of doing EIAs for their development projects. In this chapter Environmental Impact Assessment Reports (EIAs) from these countries development works have been compared to evaluate the strength of performing EIA on particular projects.

COUNTRY PROFILE

Geography, Government and Legal System:

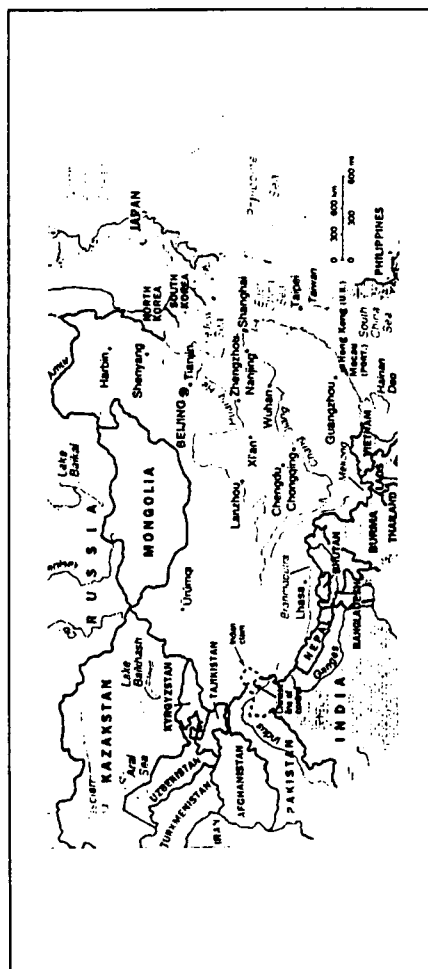
China

China is the world's fourth-largest country based on the size after Russia, Canada, and US (Fig. 14). It has a total population of 1,221,591,778 (July 1997 est.; CIA, 1997) with an average literacy rate of 81.5%. Economically China is getting stronger in Asia with a GDP growth rate of 9.7%. Per capita purchasing power parity in 1996 was US \$ 2,800.

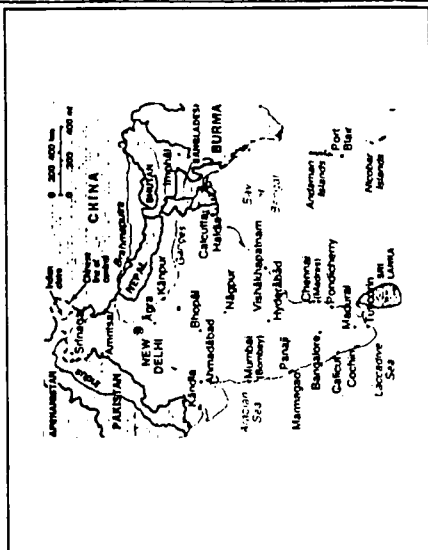
Geography:

Location

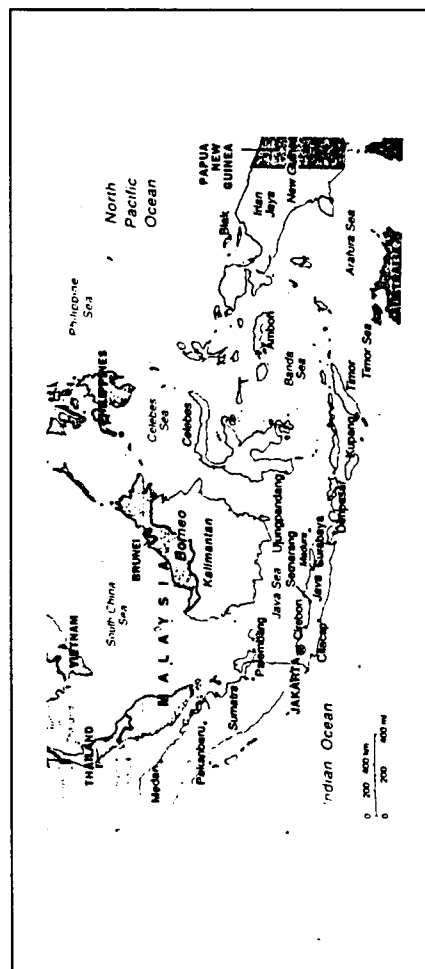
Eastern Asia, Bordering the East China Sea, Korea Bay, Yellow Sea, and South China Sea, between North Korea and Vietnam



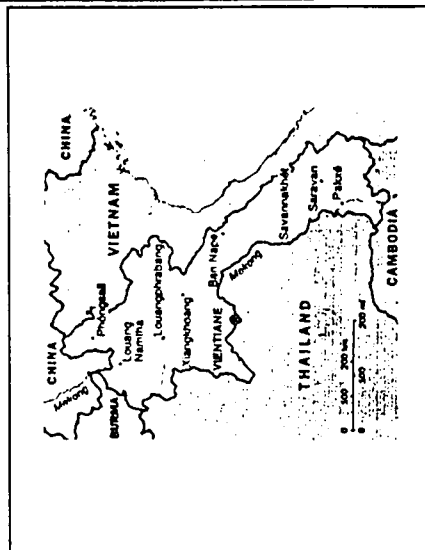
China



India



Indonesia



Laos

Figure 14: Geographical Maps of Selected Asian Countries

Source: CIA, 1997

Area

Total: 9,596,960 sq km

Climate

Extremely diverse; tropical in south to arctic in north.

Natural Resources

Coal, iron ore, petroleum, mercury, tin, tungsten, antimony, manganese, vanadium, magnetite, aluminum, lead, etc. World's largest hydropower potential.

Land Use

Arable Land:	10%
Permanent Crops:	0%
Permanent Pastures:	43%
Forests and woodland:	14%
Other:	33%

1993 est. (CIA, 1997)

Population Density

127 people in per square kilometer

Government:

People's Republic of China is a communist state. The head of the state is a President and a Vice President. Head of the government is Premier and Vice Premier. State Council is appointed by the National people's Congress. President and Vice president are elected by the National People's of Congress while Premier and Vice Premier are nominated by the President, confirmed by the National People's Congress. Chinese Communist Party (CCP) is the ruling party and no meaningful political opposition exists.

Legal System:

A complex amalgam of custom and statute, largely criminal law. Rudimentary civil code is in effect since January 1, 1987. New legal codes is in effect since January 1,

1980 (CIA, 1997). Continuing efforts are being made to improve civil, administrative, criminal, commercial and environmental law.

India

Located in Southern Asia India dominates South Asian subcontinent (Fig. 14). It is near important Indian Ocean trade routes. It has population of 966,783,171 (July 1997 est.; CIA, 1997) with an average literacy rate of 52%. Agriculture(30%), industry(28%), and services(42%) constitute the GDP of the country with a growth rate of 6.5% (1996 est.). Per capita purchasing power parity in 1996 was US \$ 1,600.

Geography

Location

Southern Asia, bordering the Arabic Sea and the Bay of Bengal, between Burma and Pakistan.

Area

Total: 3,287,590 sq km

Climate

Varies from tropical monsoon in south to temperate in north

Natural Resources

Coal (fourth largest reserves in the world), iron ore, manganese, mica, bauxite, titanium ore, chromite, natural gas, diamonds, petroleum, limestone.

Land Use

Arable Land:	56%
Permanent Crops:	1%
Permanent Pastures:	4%
Other:	16%
Forests and woodland:	23%

1993 est. (CIA, 1997)

Population Density

294 persons in per square kilometer.

Government:

The Federal Republic of India is a democratic country. Chief of the state is a President and a Vice President. Head of the government is Prime Minister. President is elected by an electoral college consisting of elected members of both houses of parliament and the legislatures of the states for a five-year term where Vice president is elected by both houses of parliament. Prime minister is elected by parliamentary members of the majority party following legislative elections. There are hundreds of political parties and numerous religious or militant/ chauvinistic organizations in India. Various separatist groups are seeking greater communal and/or regional autonomy.

Legal System:

Based on English common Law. Limited judicial review of legislative acts. Accepts compulsory ICJ jurisdiction with reservations.

Indonesia

Located in Southeast Asia, Indonesia is an archipelago of 17,000 islands (Fig. 14). It is in a strategic location astride or along major sea lanes from Indian Ocean to Pacific Sea. Indonesia has total population of 209,774,138 (July 1997 est.; CIA, 1997) with an average literacy rate of 83.8%. Indonesia's sound macroeconomic management, combined with an emphasis on rapid deregulation and encouragement of private investment resulted in real GDP growth in 1991-96 averaging about 7% (CIA, 1997). Per capita purchasing power parity in 1996 was US \$ 3,770

Geography:

Location

Southeastern Asia, archipelago between the Indian Ocean and Pacific Ocean.

Area

Total: 1,919,440 sq km

Climate

Tropical, hot, and humid. More moderate in highlands

Natural Resources

Petroleum, tin, natural gas, nickel, timber, bauxite, copper, fertile soils, coal, gold, silver

Land Use

Arable Land:	10%
Permanent Crops:	7%
Permanent Pastures:	7%
Forests and woodland:	62%
Other:	14%

1993 est. (CIA, 1997)

Population Density

109 persons in per square kilometers

Government:

Republic of Indonesia is the largest Islamic nation. The President is both the chief of state and head of government. President and Vice President elected by consensus by the People's Consultative Assembly for five-year terms.

Legal System:

Based on Roman-Dutch law, substantially modified by indigenous concepts and by new criminal procedure code. It has not accepted compulsory ICJ jurisdiction.

Lao PDR

Located in Southeast Asia Laos is a 'landlocked' country (Fig 14). It has a total population of 5,116,959 (July 1996 est.; CIA, 1997) with an average literacy rate of 56.6%. Per capita purchasing power parity of Laos is US \$ 1, 120 (1996 est.; CIA, 1997) with a GDP growth rate of 7.5% in 1996.

Geography:

Location

Southeastern Asia, northeast of Thailand. Landlocked by Burma, Cambodia, China, Thailand and Vietnam.

Area

Total: 236,800 sq km

Climate

Tropical monsoon, rainy season (May to November), dry season (December to April).

Natural Resources

Timber, hydropower, gypsum, tin, gold, gemstone.

Land Use

Arable Land:	3%
Permanent Crops:	0%
Permanent Pastures:	3%
Forests and woodland:	54%
Other:	40%

1993 est. (CIA, 1997)

Population Density

22 persons in per square kilometer.

Government:

Lao People's Democratic Republic is one of the few remaining official communist states. Chief of the state is President and Vice President. Head of the government is Prime Minister and Deputy Prime Minister. President is elected by the

National Assembly for a five-year term and Prime Minister is appointed by the president with the approval of the National Assembly for a five-year term. Lao People's Revolutionary Party (LPRP) is the single ruling party. Non communist political groups are proscribed. Most opposition leaders fled the country in 1975 (CIA, 1997).

Legal System:

Based on traditional customs, French legal norms and procedures, and social practice are followed.

Environmental Issues and Trends

China

Natural Hazards:

- Frequent typhoons (about five per year along southern and eastern coasts)
- Damaging Floods
- Tsunamis
- Earth quakes
- Drought

Current Environmental Issues:

- Air pollution from the overwhelming use of high-sulfur coal as fuel.
- Acid rain that is damaging forests.
- Water shortages throughout the country, particularly in urban areas.
- Water pollution from industrial effluents.
- Much of the population does not have access to potable water.
- Less than 10% of sewage receives treatment.
- Deforestation.
- Loss of agricultural land due to soil erosion and economic development.
- Desertification
- Trade in endangered species.

Source: CIA, 1997

India

Natural Hazards:

- Droughts
- Flash floods
- Severe thunderstorms
- Earthquakes

Current Environmental Issues:

- Deforestation
- Soil erosion
- Overgrazing
- Desertification
- Air pollution from industrial effluents and vehicle emissions.
- Water pollution from raw sewage and runoff of agricultural pesticides.
- Tap water is not potable throughout the country.
- Huge and rapidly growing population is overstraining natural resources.

Source: CIA, 1997

Indonesia

Natural Hazards:

- Occasional floods
- Severe droughts
- Tsunamis
- Earthquakes

Current Environmental Issues:

- Deforestation
- Water pollution from industrial wastes, sewage
- Air pollution in urban areas

Source: CIA, 1997

Lao PDR

Natural Hazards:

- Floods
- Droughts
- Blight

Current Environmental Issues:

- Deforestation
- Soil erosion
- A majority of the population does not have access to potable water

Source: CIA, 1997

According to WRI Report (Smith and Wansem, 1995) the key legislation that affects development projects in the four selected Asian countries are presented below.

China

- Constitutional provision: Article 11 1978
- Environmental Protection Law (articles 6 and 7) 1979
- Marine Environmental Protection Law 1982
- Management Guidelines on
Environmental Protection of Construction Projects of the P.R.C. 1986
- Regulations for Engineer Design on
Environmental Protection Construction Projects 1987
- Environmental Protection Law* 1989
- Management Procedure on Environmental Protection Construction projects 1990
- Enforcement Regulations for Law on Prevention of Air Pollution of the PRC* 1991
- Constitutional provision: Articles 9, 10, 22 and 26 1993
- Management Guidelines on Strengthening Loan Projects for EIA

**Anonymous (China Law, 1998)*

India

- Wildlife (Protection) Act 1972*
- Administrative Instructions Established 1973
- Water (Prevention and Control of Pollution) Act 1974*
- Constitutional provision: Articles 48A and 51A(g)
- Water (Prevention and Control of Pollution) Act 1977*
- Forest (Conservation) Act 1980
- Air (Prevention and Control of Pollution) 1981
- Department of Environment (Protection) Act no. 29 1986
- Hazardous Waste Rules 1989
- Public Liability Insurance 1991
- Environmental Impact Assessment Notification: (enacted under the Environment Act of 1986) 1994*
- Specific legislation is planned

**Banham and Brew, 1996; CII, 1995; Valappil et al, 1994*

Indonesia

- Constitutional provision: Article 33(3) 1945, 1973
- Articulation of a National Environmental Policy, as part of the general Guidelines of the State Policy (GBHN) 1978
- Creation of the State Ministry of Population and Environment (KLH) 1982
- Act No. 4 Basic Provisions for the Management of the Living Environment 1982*
- Government Regulation No. 29: required implementation, as of June 1987, of an AMDAL (EIA) system 1987
- Ministerial Decrees Nos. 49-53: General AMDAL guidelines promulgated by KLH 1990
- Government Regulation no. 20: concerning the control of water pollution*
- Government Regulation no. 51: regarding environmental impact assessment 1993*
- Presidential Decree No. 23, creating new agency BAPEDAL 1993

- Government Regulation no. 19: regarding hazardous and toxic waste management 1994*
- Ministerial Decree No. Kep-12: concerning general guidelines for environmental management procedures and environmental monitoring procedures 1994*
- Ministerial Decree No. Kep-14: concerning general guidelines for the preparation of environmental impact assessment 1994*
- Ministerial Decree No. Kep-15: concerning establishment of an environmental impact assessment commission for integrated/ multisectoral activities 1994*
- Ministerial Decree No. Kep-42: regarding general guidelines for the implementation of environment audits 1994*

**Govt. of Indonesia: BAPEDAL (Environmental Impact Management Agency), 1998*

Lao PDR

- Decree No. 99/PM: regarding land acquisition and compensation procedures 1992*
- National Forestry Law (Article 15): concerning compensatory planting for the loss of forest resulting from right of way clearing 1996*
- No EIS legislation to date

**ADB, 1997c*

EIA and Its Capacity:

The origin of environmental impact assessment (EIA) can be traced to the late 1960s when the US National Environmental Policy Act of 1969 (NEPA) was enacted (Clark and Canter 1997). In the two decades since then many countries throughout the world have adopted this basic concept (Hollick, 1986). Among the selected Asian countries, China, India, and Indonesia have progressed significantly. Bangladesh is in the process of adopting this vital process in its development projects. Although Lao PDR does not have any current provision for an EIA, it is also seriously considering the

Table 4: Current Status of EIA in Selected Asian Countries

Countries	EIA	Main oversight Agency	EIA Preparer	Public Participation	Coordination with Local Authority	Penalty for Violation
Bangladesh	No specific EIA legislation, consulted on selected projects	Ministry of Environments and Forest	Project Proponent	Yes	No	Some sanctions under existing legislation unrelated to EIA
China	EIA guidelines for loan projects	National Environmental protection Agency at various level (no committee review)	Project Proponent	Yes, but no public hearings	YES	YES
India	EIA legislation	Department of Environment within the ministry of Environment (utilizes an environmental appraisal committee)	Project Proponent	Limited	Yes	No
Indonesia	EIA legislation	BAPEDAL (Environmental Impact Management Agency) within the ministry of the Environment (utilizes two EIA review commissions)	Project Proponent	Limited	Yes	No
Lao PDR	No EIA legislation to date	If EIS conducted, Ministry of Agriculture and Forestry				

Source: Smith and Wansem, 1995

necessity of this process in its developing projects. Table 4 shows current status of EIA requirements in the selected Asian countries.

Environmental impact assessment (EIA) procedures have been in existence in the People's Republic of China over the last decade due to the environmental protection law of the PRC that was adopted by the Fifth National People's Congress in 1979 (Wenger *et al*, 1991). The EIA process that is administrative and not statutory mandated has been applied primarily to construction projects. The results of the EIA investigation are compiled in an environmental impact statement, which is used as basis for decision-making by personnel in environmental protection division. Figure 15 shows the EIA process in China. Views differ concerning the effectiveness of the EIA program in protecting China's natural, social, and cultural environments. While Some support the EIA program as an added improvement to the environmental protection, critics contend

that the program had little effect in the prevention of pollution (Wenger *et al*, 1991). At present, PRC realizes the significance of the continuation and the improvement of the program. However, it will be more effective to realize the success of the program by placing the evaluation of a particular project in a regional context.

Environmental impact assessment is a recent addition to India's development planning process. The process of EIA in India has been one of parallel evolution with the development of an institutional capacity to coordinate and monitor the environmental policies and procedures going hand-in-hand with the formulation and implementation of the necessary legislation and regulations (Banham and Brew, 1996). The key framework as far as EIA is concerned is the Environment (Protection) Act, 1986 (Valappil, *et al*, 1994). At the time, the regulations introduced under this Act required an EIA (referred to as environmental appraisal in India) and for certain projects it also required to be assessed to ascertain whether an environmental clearance should be obtained from the Central Government, Ministry of Environment and Forestry (MOEF). The number of the rejected projects were decreased to 12% for environmental grounds, while others required more information during the period 1990 to 1994 (Banham and Brew, 1996). The decrease in the number of rejected projects might indicate a gradual improvement in the quality of EIAs. The first full legislative requirements for EIA were contained in the Environmental Impact Assessment Notification, 1994, which was published as a draft in January 1994, reviewed in May 1994, and enacted under the Environment (Protection) Act of 1986. The new legislation was accompanied by changes in the institutional arrangements for EIA within the MOEF. Under this Act, if environmental clearance is required there is a mandatory requirement for an EIA unless the relevant Impact Assessment Wing (IAW) of the MOEF specifically exempts the proposed development. The results of the EIA must be submitted together with an environmental management Plan (EMP). Although the implementation of this legislation is still at an early stage, it has already influenced the development projects in India significantly. Figure 16 shows the EIA process in India.

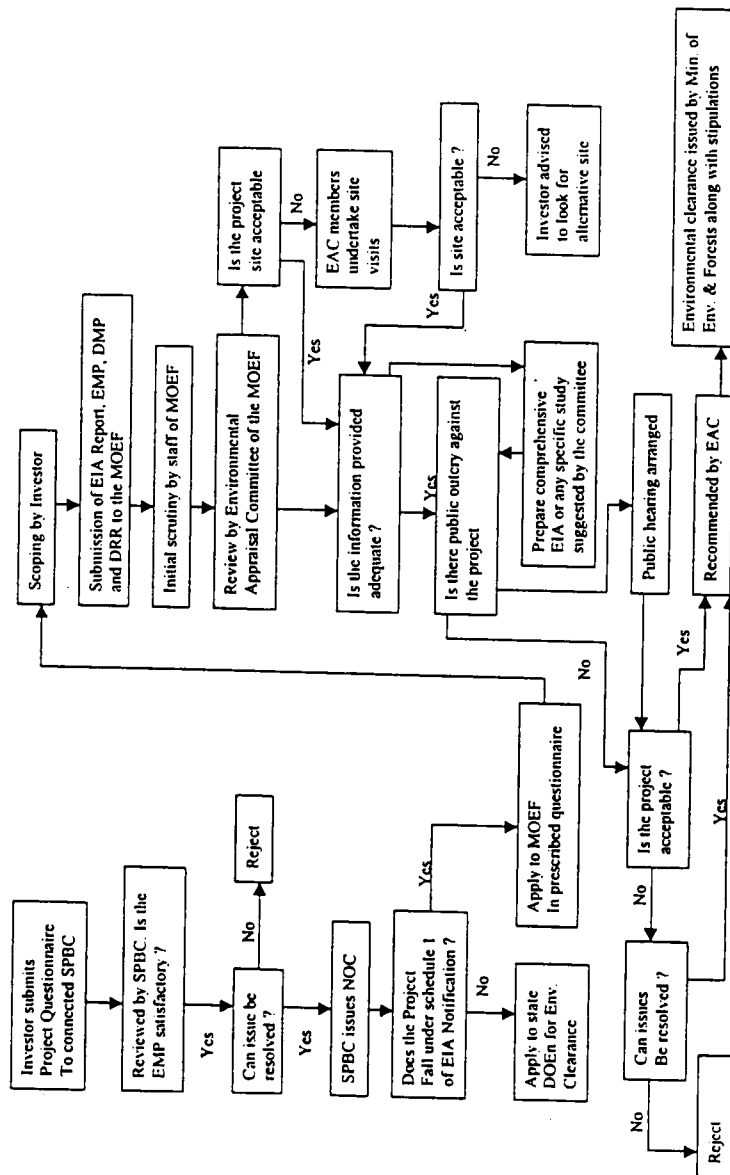


Figure 16: EIA in India
 Source: Benham and Brew, 1996

The use of environmental impact assessments may be one way to help achieve sustainable development in Indonesia (Smith and Wansem, 1995). This tool allows the state to foresee both the negative and positive effects of human activity on the environment and to act as early as possible to mitigate negative effects and provide alternatives for decision-makers. Anticipating sustainable development, Indonesia established the legal basis for AMDAL (Environmental Impact Analysis process or System) in the Environmental Management Act (EMA) of 1982. Guidance for implementation was provided in 1986 by a government regulation and further defined in 1993 (Smith and Wansem, 1995). The objective of environmental impact analyses (AMDAL) is to ensure that potential environmental impacts are predicted and calculated at the earliest stage of development, so that both environmental pollution or deterioration can be prevented and development can proceed in a more sustainable manner. Environmental impact analyses (AMDAL) study allows the project initiator or management to obtain assurance that a project remains profitable and useful to the community without jeopardizing the environment. During the period of 1991 to 1995, the total number of environmental impact analyses (AMDAL) documents under the Environmental Impact Management Agency was 14,046. For the same period volumes of activities on Environmental Impact Evaluation Studies (AMDAL documents evaluated) were 10,630 (Govt. of Indonesia, 1998). In Indonesia, AMDAL has had some positive effects, especially by increasing environmental awareness among bureaucrats and industrialists. However, there are several problems with the AMDAL process in Indonesia. It is not a "transparent" process. Over the last decade many problems have harmed its implementation. "Compliance monitoring is lacking. Sanctions are not applied when compliance does not occur. Consultants and evaluators are not always qualified. Finally, lengthy and convoluted procedures make the process very expensive" (Smith and Wansem, 1995). New regulations issued in 1993 are an attempt to overcome some problems with AMDAL process. Under Government Regulation no. 51, 1993, a new agency BAPEDAL (Environmental Impact Management Agency) was established. The new assessment process has combined the environmental impact analysis and monitoring plans into a single document, and provided "one-stop evaluation" in the Environmental

Impact Management Agency for integrated process. BAPEDAL has developed strategies and programs for the years 1994 to 1998 which aim at:

- the development of the environmental impact management resources
- the strengthening of institutional capacity at both central and local levels
- the development of a partnership with the community (BAPEDAL, 1998).

To strengthen the existing institutional capacity, the organization has been expanded and regionalized as a results of Presidential Decree no. 77, 1994. Ministerial Decree nos. Kep-12, Kep-14, Kep-15, Kep-42 have further strengthened the capacity of ensuring a proper EIA process in Indonesia. Figure 17 shows different steps of EIA process in Indonesia.

There is no EIA legislation in Lao PDR to date. Although a lack of environmental planning, surveys, and legislation diminishes the likelihood of substantial improvement of the environment in the near future, a number of decrees were used to encourage environmental protection. These decrees include general principles for protecting forestland; prohibition on cutting certain tree species; regulation on hunting, fishing, and the use of fire during the dry season; and regulations on the management and protection of forestland, wildlife and fish (Anonymous, 1994). The government's commitment to environmental protection is affirmed in the constitution and in its policy of finding a way to work with environmental management program. In 1991 the Ministry of Agriculture and Forestry established a land use program under the National Forest Resource Conservation and Development Strategies. As far as EIA is concerned, decree no. 99/PM confirms the land acquisition and compensation procedures. Article 15 under National Forestry Law, 1996 also ensures planting for the loss of forest resulting from right of way of clearing (ADB, 1997c).

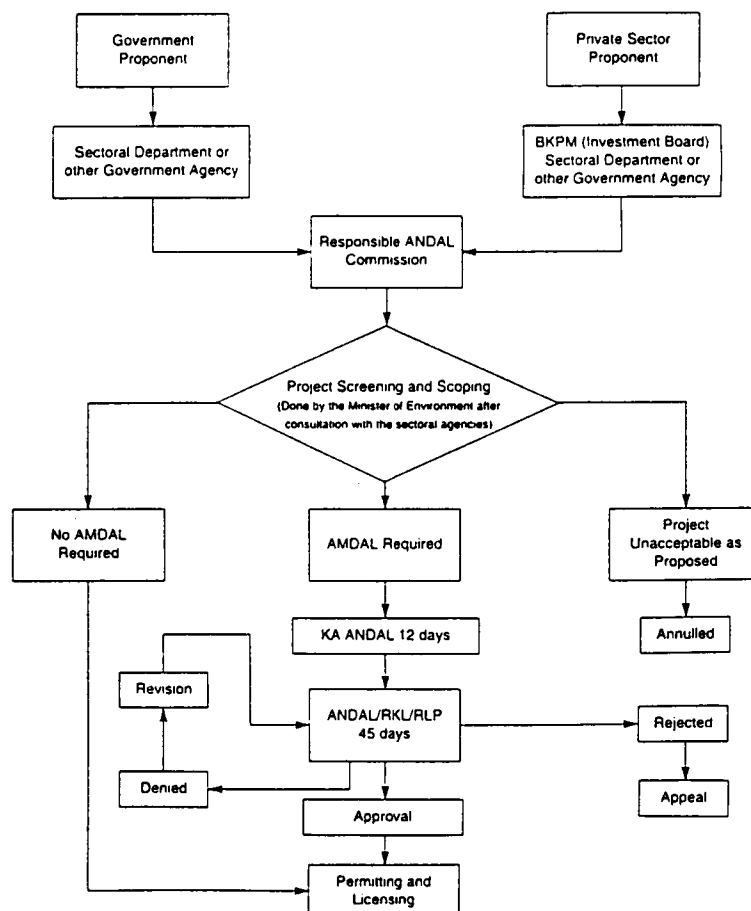


Figure 17: EIA in Indonesia
Source: Smith and Wansem, 1995

CASE STUDIES:

For the current study four EIA summary reports of developmental projects have been selected from Asian countries that are financed by the Asian Development Bank (ADB). Case studies were selected based on the similarities of the projects, similarities in the environmental consequences these projects would imply. Moreover, for an effective comparison in the EIA process, each nation's strength and weakness on EIA procedure have been taken into consideration. In this study China, India, Indonesia, Lao PDR have been selected for a comparative assessment of environmental impact assessment procedure in Asia. A specific development project, Jamuna Multipurpose Bridge Project (JMBP) in Bangladesh has been selected to evaluate the project's EIA capacity in context of these countries' EIA procedure. ADB is also one of the donors for the financial assistance for this project. Chapter three focuses on the comparative analysis of environmental consequences of JMBP and EIA practice in Bangladesh in terms of the environmental protection in an Asian context.

Role of Funding Agency in Environmental Protection:

The traditional role of a funding agency is that of a project financing institution. Its forte is financing physical infrastructure projects. Over time, however, the realization has grown that for projects to be successful, they must be implemented and operated within a proper balance among society, environment, and development. Moreover, the world's financial institutions have been criticized over recent decades for not being concerned about the environmental and social consequences of development projects. Hence, the world's financial institutions such as World Bank are getting more concerned in working more closely with regard to the social and environmental consequences implied by the projects financed by them. Today, environmental assessment is, in one way or another, a requirement by these organization in conjunction with the loans. Financial institutions like the World Bank and the Asian Development Bank (ADB) have further accelerated the process by setting guidelines to predict and mitigate the possible

impacts caused by the projects, and providing research and technical help to the local authority in implementing environmental protection (World Bank, 1998).

Categories of Development Projects in Terms of Environmental Assessment (EA) Requirement:

The World Bank's OD 4.01 "Environmental Assessment" of October 3, 1991 categorizes development projects according to the need to perform an EIA (Anonymous, 1995). Category "A" projects require a full environmental assessment (EA). These projects include most of those having large population displacement impacts. Category "B" projects do not require a full EA but do require some environmental analysis. Category "C" projects do not require environmental analysis.

A full EA is required if a project is likely to have significant adverse impacts that may be sensitive, irreversible, and diverse. The impacts are likely to have adverse impacts that may be sensitive, irreversible, and diverse. The impacts are likely to be comprehensive, Broad, sector-wide, or precedent-setting. Impacts generally result from a major component of the project and affect area as a whole or an entire sector. The following list is illustrative of Category A Projects:

- Dams and reservoirs
- Forestry production projects
- Industrial plants (Large-scale) and industrial estates
- Irrigation, drainage, and flood control (Large-scale)
- Land clearance and leveling
- Mineral development (including oil and gas)
- Port and harbor development
- Reclamation and new land development
- Resettlement and all projects with potentially major impacts on people
- River basin development
- Thermal and hydropower development, and

- Manufacture, transportation, and use of pesticides or other hazardous and/ or toxic materials

Category B projects are ones in which the project may have adverse environmental impacts that are less significant than Category A impacts. The impacts are not as sensitive, numerous, major, or diverse as category A impacts; remedial measures can be more easily designed. Preparation of a mitigation plan suffices for many category B projects. Few category reports would have a separate environmental report; most may be discussed in a separate chapter of the project preparation or feasibility study. Examples of category B projects are:

- Agro-industries (small-scale)
- Electrical transmission
- Aquaculture and mariculture
- Irrigation and drainage (small scale)
- Renewable energy
- Rural electrification
- Tourism
- Rural water supply and sanitation
- Watershed projects (management or rehabilitation), and
- Rehabilitation, maintenance, and upgrading projects (small-scale)

An EA or environmental assessment or analysis is not normally required for category C projects because the project is unlikely to have adverse impacts. Professional judgement finds to have negligible, insignificant, or minimal environmental impacts. Category C projects might be:

- Education
- Family Planning
- Health
- Institutional development
- Technical assistance, and

- Most human resource projects.

Social analysis is a part of the EA process, and resettlement is one of the five topics that the OD 4.01 requires, where they are relevant, be explicitly addressed in an EA. The five topics are: involuntary resettlement, new land settlement, induced development, indigenous peoples, and cultural property.

Role of Asian Development Bank (ADB) in Protection of the Environment

The law and development activities of the ADB are designed to assist its developing member countries (DMCs) with formulation or reform of legal systems in furtherance of their strategic development objectives. These activities are carried out through covenants in project loans, conditions in program in program loans and sector loans, and through the services of experts provided as part of Bank-financed technical assistance (ADB, 1998). Following are some of the Bank's activities in promoting environmental protection:

- For more than a decade, the Bank has promoted protection of the environment through environmental loan covenants and through advice provided under Bank technical assistance. Environment-oriented technical assistance provided by the Bank to its developing member countries (DMCs) has grown from \$350,000 in 1981 to \$16.9 million in 1995. This has often involved the need for legislative reforms.
- Some environmental law development has been promoted in conjunction with the Bank's program loans. Thus, a condition for release of the second tranche of an agriculture program loan required preparation of legislation regulating the use of pesticides.¹⁶ Under another program loan in the agriculture sector, the borrowing country undertook to introduce legislation to control the importation, distribution and use of pesticides in accordance with standards promulgated by the Food and Agriculture Organization (FAO).

- In a national coastal erosion control project, the DMC borrower agreed to require environmental impact assessments for projects which might cause widespread coastal erosion.
- Under industrial sector program loans, borrowing countries have been required to enact industrial pollution monitoring and control laws and regulations and take other environmental protection measures. Establishment of guidelines for environmental impact assessment was also a condition for disbursement in at least one such industrial sector program loan.
- In a forestry sector project, the DMC borrower agreed to adopt revised regulations concerning community forest management, taking into account the need to protect ancestral lands.
- A Bank-financed road transport sector program loan required the DMC borrower, as a condition for release of the second tranche, to help implement a Bank-financed technical assistance grant providing for vehicular emission controls. In response to an interim report prepared under the technical assistance, the borrower issued instructions requiring the country's petroleum companies to reduce the lead content in domestically produced gasoline and diesel fuel.
- The Bank is currently undertaking technical assistance to strengthen environmental impact assessment and environmental legislation in a number of countries.
 - ♦ **TA No. 2531-Bhutan: Strengthening EIA Capability and Preparation of Environmental Regulations.** Assistance in preparation of implementing guidelines for environmental impact assessment (EIA).
 - ♦ **TA No. 2623-Philippines: Evaluation of Environmental Standards for Selected Industry Subsectors.** Assistance to the Philippine Environmental Management Bureau in development of environmental management standards and regulations for industries, including

monitoring and enforcement of compliance with such standards and regulations.

♦ **TA No. 2296-India: Strengthening Environmental Impact Assessment Capacity and Environmental Legislation.** Supporting an intensive effort by the Government of India to improve environmental planning and environmental regulations and to train administrators and environmental specialists.

♦ **TA No. 2090-People's Republic of China: Legislative Reform for Protecting the Environment and Natural Resources.** Bank financed experts proposed draft revisions of the Environmental Protection Law adopted in 1989, and of the laws dealing with water quality, primarily the Water Pollution Prevention and Control Law adopted in 1984. Also included in the technical assistance was an overseas training program for legislative draftspersons from the Environment and Resources Protection Committee of the National People's Congress.

♦ **TA No. 2397-Kyrgyz Republic: Strengthening of Environmental Institutions and Improving Procedures for Environmental Impact Assessment.** The technical assistance was designed to review environmental laws and regulations consistent with the country's environmental development objectives under the National Environmental Action Plan. A nationwide seminar on laws and regulations relating to the environment was also supported by this technical assistance.

The Bank is also seeking to deepen the skills and awareness levels of educators responsible for training future generations of environmental officials, lawyers and regulators of DMCs by supporting training in environmental law. The Bank is cooperating with the World Conservation Union (IUCN), the National University of

Singapore (NUS) and the United Nations Environmental Program in an initial two year program, with the following elements: (i) an annual six week training course at NUS for law lecturers from the region; (ii) preparation of teaching materials for the training course, and (iii) publication of the teaching materials for use by academics throughout the region. The Bank will finance workshops, training seminars, and preparation and publication of training materials. In addition, the Bank's regional technical assistance has supported subregional environmental training and institution building covering Cambodia, the People's Republic of China, Lao PDR, Myanmar, Thailand and Viet Nam. This technical assistance has included training programs to plan, formulate and implement environmental legislation and programs that are of common significance to these countries (ADB, 1998).

ADB Inspection Policy:

The Asian Development Bank's inspection policy provides a formal channel through which local groups in the Bank's borrowing member countries can raise concerns about the Bank's involvement in certain development projects. The policy is designed to complement other efforts to improve the quality and transparency of the Bank's operations, as well as its accountability. The policy was approved by the Bank's Board of Directors in December 1995 and became effective in October 1996 (ADB, 1998). Under the inspection policy, a local group can request an independent review of a public sector project financed by the bank if the group believes it is being directly and materially harmed because the Bank has not followed its operational policies and procedures in connection with the project. Before requesting an inspection, the local group must bring its complaint to the attention of the Bank's Management. If the group is unsatisfied with Management response, it can make a request for inspection of the project to a standing committee of the Bank's Board of Directors, the Inspection Committee. The Inspection Committee will examine the request and recommend to the Board of Directors whether the project should be reviewed. Any inspection authorized by the board will be carried out by a panel of independent outside experts drawn from a standing roster. This

inspection panel will report its findings to the inspection Committee, which will forward the panel's report and its own recommendations to the Board of Directors.

Case 1

Guizhou Shuibai Project(China):

The Government of the People's Republic of China (PRC) has requested assistance from the Asian Development Bank to finance the construction of the Guizhou-Shuibai Railway Project (ADB, 1997a). The Project railway will be constructed and operated by the Guizhou Shuibai Railway Company (GSRC), which has been established as a joint venture by Guizhou Province, the Ministry of Railways (MOR), and the Ministry of Coal Industry. This Summary Environmental Impact Assessment (SEIA) has been prepared by consultants as an evaluation and summary of an Environmental Impact Assessment (EIA) prepared for the Project, and has been reviewed and update again based on comments received from Bank staff during the Fact-finding Mission (October 1997), including visits to and interviews with people in the Project area. The preparation of the EIA report was carried out by the Second Survey and Design Institute (SSDI) of MOR from June to December 1993 and was approved by the National Environmental Protection Agency (NEPA) on 2 September 1994. The EIA report covers a number of key environmental issues, including spoil disposal, terrestrial ecology, ecology, noise pollution, air pollution, water pollution, electromagnetic interference, solid waste, public safety, land acquisition, resettlement, and induced impacts as well as mitigation measures on the environment, management plan, and monitoring system.

The SEIA has been reviewed and updated based on

- Relevant Project reports, particularly the EIA report; the Project feasibility study report; and the resettlement plan.
- Comments from MOR; the Guizhou Environmental Protection Bureau (GEPB); the Liupanshui Environmental Protection Bureau (LEPB); SSDI; and

various experts from universities, environmental organizations, and other Government organizations.

- Discussions with local residents and field visits in the proposed Project area.
- A survey of affected households carried out from 3 to 7 August 1997.

Description of the Project:

The proposed railway between Liupanshui and Baiguo with a length of approximately 121 kilometers (km) is located within the City of Liupanshui, west of Guizhou Province. With a north-to-south orientation, the line starts at the west end of the south marshaling station of Liupanshui hub; passes through Zhongshan District, Shuicheng County, and Panxian Special District; and ends at Baiguo station on the Panxi Railway. The Project, together with Nanning-Kunming Railway and Neijing-Kunming Railway, makes another new trunk line in the north-to-south network. Construction of the Project is forecast to take about five years, commencing around mid-1998 and finishing by December 2002 to become operational by early 2003 (ADB, 1997a).

The Project is designed as a state trunk line of class I, single track with standard gauge (1.435 meters [m]), and average right-of-way of 30 m. Electric locomotives will be used for the railway operations. The Project includes 13 stations (between Liupanshui and Baiguo on the existing national railway network), 118 bridges with a total length of 20,757 m, and 72 tunnels with a total length of 57,186 m. Freight traffic includes coal, petroleum, steel, metallic and nonmetallic ores, building materials, and some grain. Coal represents a major part of total traffic, and coal transport is the main justification for the Project. The coal traffic forecast is based on a detailed review of actual and planned coal production in the Project area, i.e., 25.31 million tons in 2006 and 28.38 million tons in 2011. Coal production will be stabilized thereafter, estimated at 28.85 million tons in 2022. Freight traffic for coal, transit, and others is forecast at a combined 18.2 million tons in 2006 and 25.26 million tons in 2011, comprising mainly coal. The annual volume of local and transit passengers is forecast to be 1.33 million in 2006 and to increase to

2.13 million by 2011 (ADB, 1997a) . Table 5 shows the Impact and Mitigation Matrix of this project.

Alternatives:

Alternative Mode of Transport

The "no build" scenario was considered as an alternative to the Project. In particular, accommodating the forecast growth in freight and passenger traffic through improvement of the existing highway system was examined. This alternative was found to be less environmentally friendly, less energy efficient and less cost effective, since the class and technical standards of highways are restricted in mountainous areas, and the prime function of the Project will be to transport energy resources, especially coal. It was also noted that highways do not represent a real alternative mode for the transportation of large quantities of bulk commodities such as coal.

Project Alternatives

Alternative alignments at several locations along the route of the Project were considered in the feasibility study. For each alternative, due consideration was given to the potential impacts on

- The natural environment;
- Socioeconomic conditions, especially the magnitude of population displacement;
- Regional development.

Two alternatives, namely the east route and the west route, were examined. The east route was selected for its better geological conditions and to avoid impact on the Wanjiakouzi dam and reservoir. In fact, the presence of the dam renders the west route alignment nonfeasible. Moreover, the west alternative involves a 52 km traverse concentrated in poor geological conditions along the Qingshui River Valley, which could cause difficulties when disposing of the large amounts of spoil during construction. On the east route at the Dayingtou Bridge-Ninadu Tunnel section, a slightly higher cost

Table 5: Impact and Mitigation Matrix – Guizho Shuibai Railway Project (China)

Activity	Potential Impact	Significance	Duration	Mitigation
Potential Impacts due to Design and Location				
Resettlement	Social inequities	Minor	Short	Compensation and resettlement will be undertaken
Historical/Cultural monuments	Loss of values	None	N/A	Avoided through appropriate siting
Interference with wildlife	Endangered species impact	Insignificant	Long	No mitigation required. (The border of the nature reserve and the project railway alignment are separated by a series of mountains)
Development of secondary and tertiary sector based local resources	Induced Impacts	Not determined	Long	Monitoring program implemented and action taken if needed
Potential Impacts During Construction				
Construction of railway line	Generate large amount of spoil	Moderate	Short	i. Buildings of retain walls to available mountainsides to contain the deposits. ii. Spoil could be used to develop level areas near villages.
Uncontrolled erosion/runoff	Soil loss/downstream siltation, landslides, mudflow	Significant	Short	i. Revegetating, reforesting exposed areas upon completion of the earthwork. ii. Building ditches and culverts dimensioned and judiciously located iii. Building retaining wall to prevent landslides
Emission of hazardous materials	Dust , emission from broiler	Minor	Short	Dust control and use of desulfurization devices
Interference with river courses	Diversion of water ways	Insignificant	Short	No irreversible impacts are predicted. River course will be restored to the original state upon completion of the construction
Nuisance to nearby properties	Noise and Vibration	Minor	Short	i. Equipment with low noise and vibration. ii. Noisy operation will be avoided near school at school hour and near residential areas at night
Land acquisition	Social inequities	Minor	Short	Compensation
Interference with wild life	Endangered species impact	Insignificant	Short	Explosion will be minimized in the vicinity of the reserve

Table 5: (continued)

Activity	Potential Impact	Significance	Duration	Mitigation
Potential Impacts during Operation				
Escape of polluting materials	Fly ash from coal	Minor	Long	Will be controlled by water spraying and providing covers as appropriate
Waste water discharge	Deterioration of quality	Minor	Long	Waste water will be treated before discharge
Nuisance to nearby properties	Noise and vibration	Minor	Long	Green belt or sound barrier will be established
Solid waste	Health and ecological hazard	Insignificant	Long	No major interference
Electromagnetic interference	Interference with TV receivers	Insignificant	Long	No major interference
Health and Safety	Sickness/accidents	Insignificant	Long	Railway safety education campaign. Culverts with pedestrian walkways

Adapted from the information of EIA report; Guighou Shuibai Railway Project (ADB, 1997a)

alternative was chosen to bypass Ninadu Village, thus avoiding greater population displacement and noise impacts. At the Sanjiazhai section, the Baiguo Tunnel (length: 1,020 m) alternative was selected in order to bypass the Sanjiazhai coal-washing factory and to minimize farm land and population displacement (ADB, 1997a).

Institutional Arrangements and Environmental Monitoring and Management:

NEPA and its local bureaus in the provinces, cities, and counties have principal responsibility for monitoring and managing the quality of the environment. In addition, MOR and its local offices have their own requirements for environmental protection relating to the construction and operation of railways. For the Project railway, environmental monitoring will be undertaken by a suitably qualified agency with adequate experience, which will be contracted by GSRC before the beginning of construction work.

During the construction phase of the Project, actual field environmental monitoring of air, water quality, and noise parameters will be carried out regularly on a seasonal basis by the contracted entity. While the mitigation measures for spoil disposal, protection of terrestrial ecology, soil erosion control, and methane gas checking will be implemented by the contractors, their regular supervision and random checking will be conducted by both the engineering supervisors and the contracted environmental entity, to ensure compliance. GEPB will review the data submitted by the monitoring entity as quality control of the results before submission to GSRC and the Bank. Land acquisition and resettlement will be carried out by GSRC with assistance from the Liupanshui local government and representatives from counties and townships. GSSA will be contracted by GSRC and be responsible for monitoring the resettlement and social aspects of Project implementation.

During operations, the contracted environmental entity and GSSA will continue their monitoring work until one year after the completion of railway construction. GSRC

will take over the job afterwards and will be responsible for the implementation of all environmental management and regular monitoring activities. Specific staff of GSRC will be devoted to such tasks. LEPB and its Environmental Monitoring Station will continue to conduct regular environmental monitoring for both the Project line and other potential pollution sources in the area. LEPB has been part of the national integrated monitoring and information system network for acid rain air emission, and the data base has been adequately updated.

Monitoring results during the construction and operation of the Project, after their quality control by GEPB, will be reported to GSRC. Assistance will be sought from NEPA and the Environmental Protection Office of MOR when needed. GSRC will report the results of environmental monitoring through quarterly progress reports and annual reports on environmental monitoring of the Project through the Project construction period; and a final report one year after Project completion, prepared by the selected environmental monitoring entity, will be submitted to the Bank.

Major environmental factors to be monitored will include spoil disposal, terrestrial ecology, soil erosion, electromagnetic interference, air quality, water quality, noise and vibration, solid waste, public safety, and population resettlement and compensation. Environmental monitoring will be done regularly (ADB, 1997a).

Case 2

LPG Pipeline Project of India:

The Environmental Impact Assessment (EIA) study of the LPG Pipeline Project in India was carried out by Engineers India Ltd. (EIL), New Delhi for the project sponsor, Gas Authority of India Ltd. (GAIL).

The base—line studies had been carried out by experts from the

- National Remote Sensing Agency to determine land use patterns within one kilometer (km) on either side of the pipeline route;

- Salim Ali Center for Ornithology and for Natural History — to evaluate the project's impact on flora and fauna using the recognizance and quadratic method;
- Industrial Toxicological Research Center— to assess quality of the air, water, and soil along the pipeline route; and to gather population statistics;
- Indira Gandhi Institute of Development Research — for socioeconomic impact assessment. From 23 February to 7 March 1997, a Bank's environment specialist visited critical areas of the project identified in the EIA.

The EIA has been submitted to the Ministry of Environment and Forest (MOEF) and has been taken up by its Appraisal Committee; a No-Objection certificate is expected before the third quarter of 1997 (ADB, 1997b). The original EIA was done in conformity with MOEF's requirement, which assumes a project's impact area at a 25-km radius regardless of the size and type. A risk analysis was carried out by EIL, which showed that the project's impact is limited to a maximum of 200 meters (m) on both sides of 400 millimeter (mm) diameter pipe, and 100 m for 150-mm pipe. The Bank has requested GAIL to prepare a more detailed investigation of the critical areas identified by the risk analysis and to include it as an addendum to the main EIA report. The Bank has classified the Project under category A, a project with potential significant environmental impact if proper mitigation measures are not included in the design, construction, operation, and abandonment procedures. Under the Bank's Environmental Assessment Requirements and Review Procedure, this Summary Environmental Impact Assessment (SEIA) is circulated to the Bank's Board of Directors 120 days prior to their consideration of the loan proposal. The main EIA report and addendum are available at the project office on request. The EIA and this SEIA were prepared by GAIL and have not been evaluated by the Bank. The Bank's assessment and evaluation of the report and environmental impacts related to the project will be included in the documentation when the project is considered by the Board (ADB, 1997b).

Description of the Project:

Liquefied petroleum gas (LPG) is used for domestic fuel in India, where the demand is concentrated in the northern, central, and western regions. Locally, LPG is produced by GAIL, Oil India Limited, Oil and Natural Gas Corporation, and India Oil Corporation from natural gas and oil refineries. At present, demand for LPG is higher than local supply, and the deficit is projected to increase further, especially in the northern region in areas close to Delhi. The deficit is filled by imports from the Gulf States. Imported LPG is landed in Kandla and Okha ports in Gujarat and transported by truck to the northern, and western regions. At present, 2.0 million metric tons per annum (MMTPA) of LPG is imported; 1.8 MMTPA is transported by truck and 0.2 MMTPA by rail from Kandla and Okha, which are both approximately 1000 km from Delhi (ADB, 1997b).

The need to transport LPG by truck and rail has already put tremendous pressure on the railway and highway networks. LPG has to be transported in pressurized tanks. It is heavier than air, and leaks could spread on the ground up to 200 m before it is diluted by air below its explosive and flammable concentrations. Kandla and Okha ports are the major ones in western India and are also used for shipment of fertilizer, steel, cement, oil, salt, and other industrial and commercial produce. The transport of LPG not only results in congestion of highways but also poses a serious threat to drivers and communities along the route in case of accident. Accordingly, the development of an LPG pipeline starting from Kandla and Okha ports up to Loni, some 30 km north of Delhi, has been given high priority by GAIL to facilitate transportation of imported LPG — and of LPG locally produced at Hazira, Gandhar, and Jannagar — to the northern region.

The pipeline will consist of

- 1,708 km of 150-mm and 400-mm steel pipeline
- Five dispatch terminals at Kandla, Okha, Jannagar, Hazira, and Gandhar
- Seven tap-off stations at Haryala, Palanpur, Ajmer, Jaipur, Piyala, Madanpurkhadar, and Loni

- Three intermediate booster stations at Samakhiali, Palanpur, and Ajmer plus one between Palanpur and Ajmer. At the dispatch terminals at Kandla, Okha/Sikka, Hazira, Gandhar, and Jannagar the following facilities will be provided:
 - Booster pumps to mainline pumps
 - Two electric motor-driven booster pumps, one operating and one standby, to be provided upstream of the mainline pumps.
 - Mainline pumps and intermediate booster station pumps.
 - Basket strainer.
 - Storage facilities.
 - Metering system.

At each tap-off station, the facilities such as pig receiver/launcher, metering, pressure reduction control valves, basket strainers, and density meter will be provided. For adequate control and for safe pipeline operation, a supervisory control and data acquisition (SCADA) system will be provided at Pyala terminal. Initially, the pipeline will have a capacity of 2.6 MMTPA. By 2007 (Phase II), the pipeline capacity will be increased to 3.7 MMTPA with the addition of pumping facilities at Okha and additional pipelines from Okha to Jamnagar. GAIL has requested Bank financing for Phase I (ADB, 1997b).

The land along the right of way (ROW) will be cleared of vegetation and debris in a strip 10-m wide on both sides of the pipeline, which will be reduced to 5.5 m near the 0.5-km stretch of mangrove swamp on the Hazira-Patan route. The pipe will be buried at least 1.0 m underground. The trench for laying the pipe will be dug to a suitable width and about 2 m deep using mechanical trenchers. In agricultural areas, the top 0.25 m of soil will be retained and replaced; on replacement it will expand to 0.3 m. The pipe sections will be placed end to end and welded together to form a string. The string will be subjected to radiography to determine weak points. The pipe string will then be lowered into the trench over a bed of 15-centimeter (cm) thick fine sand and will be hydrotested

for leaks. The fine sand layer will cushion the pipe and facilitate alignment of the pipe segments. Thereafter, soil and fine sand will be used as filler up to a height of 15 cm above the pipe crown. If the excavated soil is free of rocks and stones, the pipeline will be laid directly on the soil; the 15 cm of sand underneath it will not be required. The trench will be backfilled with the excavated soil. Except for the top 0.2 m, the excavated soil will be backfilled, levelled, and compacted in layers of 0.2 m to prevent subsidence and stress on the buried pipe. In the top 0.2 m, the excavated topsoil will be used for backfilling up to a height 0.1 m above the natural ground. The topsoil will not be compacted mechanically.

The pipe ROW may not be used for planting trees, for house construction, or for any permanent structure. The land may be used for wheat, vegetables, oil crops, and other plants. Shows the schematic of the various activities to be undertaken during pipeline construction. The ROW will be 20 m. Pipeline construction across small rivers will be done by the open cut method. All the small rivers along the pipeline route are seasonal, and construction will be done during the dry season. The open cut method is similar to the trenching method previously described except that embankments are provided to prevent flooding of the trenches in case of off-season floods. In all the major rivers, the horizontal directional drilling method will be used: A tunnel will be drilled under the river and the pipe will be pushed into the tunnel as the drilling progresses. The pipelaying operation will not interfere with the river flow, nor with the river ecosystem (ADB, 1997b).

Markers will be placed at each stream or river crossing and turning point. Kilometer markers will be placed every 1 km, and aerial markers every 5 km. The marker post will be approximately 0.05 m in diameter, while the signboard will be approximately 0.3 m in diameter. The aerial markers will normally be laid horizontal to the ground to facilitate identification of the pipeline from the air. Table 6 shows the Impact and Mitigation Matrix for this project.

Table 6: Impact and Mitigation Matrix
LPG Pipeline Project (India)

Activity	Potential Impact	Significance	Duration	Mitigation
Potential Impacts due to Design and Location				
Resettlement	Social inequities	None	N/A	No resettlement required. Appropriate siting to avoid densely populated areas
Historical	Loss of values	None	N/A	Avoided through appropriate siting
Potential Impacts During Construction				
Movement and storage of operational equipment	Losses in neighboring land uses	Minor	Short	No mitigation required
Movement of heavy equipment	Soil compactness, low productivity	Minor	Long	Deep plowing, addition of compost and fertilizer, suitable alternative crops.
Nuisance to neighboring properties	Pollution, noise	Minor	Short	Water spraying to suppress dust, noisy equipment will be operated during daytime near farmhouses.
Interference with river courses	Blockage of river flow/ sedimentation	Insignificant	Short	i. Avoiding rainy season to lessen soil erosion. ii. River banks will be reinforced with concrete iii. Major river will be crossed using horizontal drilling techniques
Land acquisition	Social inequities	Minor	Short	Compensation
Cleared of shrubs, undergrowth, and trees	Deforestation, loss of ecological value	Minor	Short	Two plants will be planted for every tree cut
Pipe lying operation	Crop loss	Minor	Short	Compensation
Potential Impacts During Operation				
Land value changes and population movement	Social inequities	None	N/A	No monitoring required
Nuisance to nearby properties	Noise	Minor	Long	Soundproofing the compressor
Escape of hazardous materials	Damage to environment, people	Minor	Long	Appropriate equipment used. Monitoring, Health and Safety Plan
Inadequate environmental monitoring and operation, and maintenance skill	Damage to ecological and social values	Minor	Long	Training and monitoring will be provided by GAIL
Health and Safety	Sickness/ accidents	Moderate	Long	Health and Safety Plan

Adapted from the information of EIA report; LPG Pipeline Project (ADB, 1997b)

Alternatives:

In February 1995, GAIL carried out an optimization study for transport of LPG to the western and northern regions by rail, road, and pipeline. The study recommended pipeline transportation of LPG as the most economical mode (ADB, 1997b). The advantages of the pipeline are:

- lesser direct contact with the populace, thereby reducing hazardous impact during an accident as well as providing better overall security;
- lower traffic congestion of the highways/railways, thus facilitating the transport of other materials requiring that infrastructure;
- uninterrupted supply of LPG ensured as compared with the otherwise intermittent and discrete supplies resulting from traffic congestion and non-availability/shortage of road/rail tankers and other infrastructure;
- the unit cost of transportation of LPG by pipeline being the lowest among various modes of transportation (e.g., rail/road);
- reduction in LPG delivered cost; and (vi) more efficient utilization of energy, resulting in lower pollution load. The energy requirement for the pipeline is 35 kilo calorie/ton-kilometer (kcal/ton-km), while for trucking it is 430 kcal/ton-km, although the cost difference is not as apparent because of the very high subsidy currently in place for diesel fuel.

The pipeline route for the selection criteria were based on

- proximity to existing pipelines operated by GAIL to facilitate mobilization of resources during an emergency;
- minimal number of houses or people affected;
- geologic stability of the area;
- proximity to LPG producers, import storage facilities, and bottling plants.

The routes selected were primarily salt pans, deserts, and agricultural lands. In passing through agricultural lands, the preferred pipeline route follows the ROW for irrigation canal maintenance (ADB, 1997b).

Institutional Requirements and Environmental Monitoring Program:

GAIL has an Environment and Safety Unit headed by a Senior Manager and assisted by qualified personnel with backgrounds in environment, safety, and firefighting. The environment and safety unit reports directly to the General Manager for Operation and Maintenance. The functions of the unit are to train personnel in firefighting, safety and fire drills, fire prevention, and regular checking of safety devices. The unit prepares annual reports for management on the environmental and safety concerns for all GAIL installations, specifically pipelines, industrial plants, and transport facilities. The unit also coordinates compliance of the facilities with the state pollution control boards of Gujarat, Rajasthan, Haryana, and Uttar Pradesh. Periodically, reports on environmental monitoring around the pipeline facilities such as booster stations are submitted to MOEF and the state pollution control boards depending on the conditions imposed in the environmental clearance. Once a year, the environment and safety unit will collate and submit to the Bank the monitoring results; copies of environmental and safety licenses, clearances, and permits; and highlights of any event of concern to the safe and environmentally sound management of the facilities. If within the year the project has been cited for violation of any environmental or safety regulation by any of the state pollution control boards, MOEF, or other relevant Government authorities, the report of the environment and safety unit will include a certification for the Government authorities that the defect has been corrected or an acceptable plan has been submitted and will be implemented (ADB, 1997b).

The conditions of the pipeline will be monitored automatically by a SCADA unit, which will give an indication on the rate of corrosion or break in the protective coating. This is an advance warning to prepare corrective action works. The difference in mass balance between the LPG supplied and delivered will also be calculated daily to determine losses in the system. In addition to the SCADA, a monthly aerial survey will be carried out to detect any unusual conditions in the pipeline route that might not be detected on the ground. Regular foot patrolling will be carried out four times a year and more frequently in sensitive areas.

In the dispatch, takeoff, and pumping stations, the air quality will be measured once every six months. The air quality samples will be analyzed for SO₂, CO, HCs, and NO_x. Noise will be measured outside the buildings' housing the compressors and pumps as well as at the boundary of the installation. Noise will be measured at noon and at midnight once a week for the first six months after project commissioning and on a monthly basis thereafter (ADB, 1997b).

Case 3

North Java Road Improvement Project (NJRIP) of Indonesia:

The NJRIP has been prepared under the North Java Transport Corridor Study (NJTCS). The Study was undertaken by a team of consultants during 1991-1994 and was funded in part under the Bank-financed TA No. 1193-INO and Loan No. 966-INO (ADB, 1994). The Study was divided into different phases. The feasibility work was carried out in Phase I, while the first part of the second phase, i.e. Phase IIA, was concerned with reviewing and updating the feasibility study and undertaking and costing the preliminary engineering design of the proposed road improvements. Phase IIB covered the detailed design of the improvements in the selected road links and the final economic evaluation. In Indonesia, the environmental review process is known as AMDAL (Analisa Mengenai Dampak Lingkungan or Environmental Impact Assessment). According to the Indonesian legislation, the relevant documents include the Analisa Dampak Lingkungan (ANDAL), the Rencana Pengelolaan Lingkungan (RKL), and the Rencana Pemantauan Lingkungan (RPL). The ANDAL is a study of the effects of a Project on the environment. It analyzes the project activities, describes the existing environmental conditions and finally assesses the potential impacts. The RKL is an Environmental Management Plan, while the RPL is an Environmental Monitoring Plan. All these reports have been prepared during Phase IIB of the NJTCS (ADB, 1994).

The scope of work for the EIA included:

- Determination of existing noise and atmospheric pollution conditions within the proposed corridor

- Prediction of post construction noise and atmospheric pollution levels
- Determination of current social and economic development within the corridor
- Prediction of impacts on social development and quality of life including resettlement and the potential separative effects of the expressway:
 - Assessment of impacts on flora and fauna
 - Proposed mitigation measures for all potential impacts
 - Proposals for long-term habitat rehabilitation
 - Emergency response proposals for accidents resulting in hazardous material releases and other environmentally threatening road accidents
 - Potential impacts on cultural minorities; and
 - Construction and post construction monitoring proposals.

This SEIA presents a synopsis of baseline data and field methods used in the preparation of the environmental impact assessment (EIA). It incorporates the results and conclusions of the EIA along with comments by local agencies (ADB, 1994).

Description of the Project:

On the basis of the studies and analyses undertaken, an improvement to four-lane standard of nine links, about 210 kilometers (km), of the northern national road between Jakarta and Surabaya is recommended. Four links are located in the West Java Province, three in Central Java Province and two in East Java Province (ADB, 1994).

Almost all the improvements under the proposed Project are along the alignment of the existing national road. The proposed improvements range from minor action, such as resurfacing existing road sections, to road widening, including the construction of bypasses. The final design consists of a combination of works that can be summarized as follows:

- Resurfacing or other minor improvements where existing sections have already been widened to four lanes. This could consist of any action, except major widening or rerouting, such as strengthening of pavement and subsurface, placing of a median, improving drainage, paving and widening shoulders, and transporting materials and equipment.
- Widening along existing alignments where the existing sections have less than four lanes. This consists of the activities mentioned above plus action related to the widening, such as demolitions, clearing, cut and fill, transporting materials and equipment, and so on.
- Two bypasses have been included where the widening of the existing road would involve higher impacts.

The improvements ultimately depend on road conditions and on the conditions in the areas. Generally speaking, considerable variations in road configuration exist over the length of the links. The most common situation is a two-lane carriageway with narrow, unpaved shoulders. In central urban areas, the road often expands up to four lanes, sometimes divided, with raised concrete footpaths on one or both sides beyond paved shoulders and narrow concrete-lined drainage.

The construction costs are estimated at about \$240 million in mid-1995 base costs, including about \$46 million for land acquisition, resettlement, and environmental mitigation measures. The current implementation schedule envisages that construction will start in the second quarter of 1996 and be completed in early 1999 (ADB, 1994). Table 7 shows the Impact and Mitigation Matrix of this project.

Alternatives

The principal route for road traffic traveling between Jakarta and Surabaya is currently the road along the north coast via Semarang and Tuban. However, other routes

Table 7: Impact and Mitigation Matrix, North Java Road Project (Indonesia)

Activity	Potential Impact	Significance	Duration	Mitigation
Potential Impacts due to Design and Location				
Resettlement	Social inequities	Minor	Short	Less than 5% of the total no. of households is affected by the project. Compensation and resettlement will be done
Historical/ Cultural monuments	Loss of values	None	N/A	Avoided through appropriate siting
Development into ecologically sensitive areas and forests	Loss of values	Minor	Short	Siting avoids ecologically sensitive areas
Potential impacts due to Construction				
Clearing of Trees, Clearing of Crop-field	Deforestation Loss of ecological value, Crop loss	Moderate	Short	Trees will be planted Compensation
Cut and Fill	Soil erosion Ground water pollution	Insignificant	Short	No mitigation required
Quarrying	Impact on soil stability and soil loss	Moderate	Short	Terraces and suitable drainage system will be established Seeding grass cover, replanted bushes and trees
Quarrying	Water pollution due to sedimentation	Insignificant	Short	No mitigation required
Bridge works Clearing River Bank	Impacts on flora and fauna Potential landslides	Minor	Short	Replanting on the river bank will be carried out immediately
Pavement	Soil loss due to sheet erosion from lateral ditches Water pollution	Negligible	Short	No mitigation required. Suitable clauses will be included in the construction contracts
Land acquisition	Social inequities	Moderate	Short	Compensation
Impact due to Operation and Management				
Traffic Movement	Air pollution	Insignificant	Long	No mitigation required
Traffic Movement	Noise	Minor	Long	Mitigation measures are needed
Health and Safety	Accidents	Moderate	Long	2 m wide central median will divide two traffic flow Two-lane carriageway will separate the traffic according to the speeds Suitable footpaths will be provided in the urban areas
Escape of Hazardous Materials during transportation	Damage to environment, people	Minor	Long	Suitable barriers on bridges and along the roads when they parallel water courses

Adapted from the information of EIA report, North Java Road Improvement Project (ADB, 1994)

are available that traffic can and does use. Four alternative routes have been reviewed under the NJTCS:

1. Alternative A - the northern or north coast route from Jakarta to Semarang via Karawang, Cirebon; and from Semarang via Tuban to Surabaya;
2. Alternative B - the northern plus a middle route (from Jakarta to Semarang via the same route as in Alternative A; from Semarang via Purwodadi to Surabaya).
3. Alternative C - the northern plus southern route (from Jakarta to Semarang via the same route as Alternative A; from Semarang via Surakarta to Surabaya).
4. Alternative D - the southern route (from Jakarta to Surakarta via Bandung and Yogyakarta and then to Surabaya via the same route as Alternative C).

The analysis of the three alternative routes between Semarang and Surabaya, from an environment viewpoint, (route D was not considered as an investment alternative), indicates that one route is not better or worse than another route. However, Route C has a greater impact on religious and culturally valuable areas and Route B passes through substantial areas of Jati forest. Considering the lengths of the alternative routes and the studies performed in Phase I, route A was selected as the alternative that would have the lowest impact on environment in the area it crosses (ADB, 1994).

Institutional Requirements and Environmental Monitoring Program:

The implementation of environmental management requires the joint activities of several agencies, mostly public, at both the national and the local levels. At the national level, the Directorate General of Highways of the Ministry of Public Works formulates a project. If the project is approved, and financial resources are available from national or international sources, the Ministry of Finance provides the necessary budget to the

Ministry of Public Works. Part of this budget is transferred to the public works departments in the provinces covered by the project. The provincial public works departments appoint project managers who will be responsible for the implementation of the project. The governors in the province ensure that the specialized provincial services such as environmental office, socioeconomic office, and office of land affairs cooperate with the provincial public works department in the implementation of the project.

- Preconstruction Phase

In the preconstruction phase, land acquisition and relocation/resettlement are the main problems. The governor is responsible for these activities in the province. According to the Presidential Decree No. 55/1993, the governor is responsible for establishing a land acquisition committee in every district or municipality. The chairman of the land acquisition committee is the district head (Bupati) and he cooperates closely with the project managers, especially in announcing and giving information on the project, measuring the affected land, buildings and plants and organizing meetings to negotiate compensation between the project managers and the affected people. The role of the land acquisition committee in the meetings is to ensure the adequacy of land acquisition compensation. Community and informal leaders can also be involved in the compensation negotiations to ensure the objectivity and fairness of compensation. In case a serious problem arises, the National Human Rights Commission and the local people's representative may be requested by the affected people to help them in getting fair treatment (ADB, 1994).

- Construction Phase

In the construction phase, an environmental management unit (EMU) will be established to carry out specific activities related to the environmental management and monitoring. This technical unit is composed of representatives from the provincial public works department and the provincial environmental office. Environmental managers and technicians from third parties may also be included on the Board of the EMU. The day to day environmental management and monitoring activities are carried out by an

environmental supervisor in coordination with EMU. The construction contract documents are important in the implementation of projects. Issues that arise about the contracts will be handled by the project managers together with the contract administration representatives and the contractors. The project managers and the subproject managers are responsible for day-to-day implementation. They have to monitor the contracts for the road widening and ensure the contractors fulfill the terms of the contract. If serious problems arise, the project managers will report to the governor who will call a meeting of the concerned parties. The environmental procedures are planned in EMU meetings and in consultation with local authorities and the governor. (ADB, 1994).

- Operation and Maintenance

The provincial public works departments will be responsible for the operation and maintenance of the roads after construction. The first year operation is covered by the guarantee of the contractor who has to undertake all the activities concerning the maintenance of the road. An independent environmental supervisor will be employed to control the environmental management during this phase. A maintenance manager in charge of the maintenance of the road may also be appointed by the provincial public works department (ADB, 1994).

Case 4

Power Transmission and Distribution Project of Lao PDR:

The Power Transmission and Distribution Project is designed to supply electricity to selected areas of northern Lao People's Democratic Republic (Lao PDR) (ADB, 1997c). These areas have been targeted by the Government for special development assistance because they are at a lower level of economic development than other parts of the country. They include parts of the provinces of Xieng Khouang, Xayaburi, and Xanakham; the special region of Xaysomboon; and parts of the Vientiane Plain. The Project follows on previous Bank assistance to electrify the Vientiane Plain and provide

power supply to Luang Prabang and surrounding areas, and complements previous and ongoing World Bank assistance for rural electrification in the central and southern parts of the country.

An initial environmental examination (IEE) was undertaken by Electrowatt Engineering for the Government of Lao PDR during 1996-1997 as part of the Project feasibility study. Following the loan Fact-finding Mission in March 1997, the Bank supported further field investigations during April and May 1997 to fill gaps in the IEE report, particularly concerning compensation issues, and to broaden stakeholder consultations. Several organizations shared information and made results available from recent investigations. These included the World Conservation Union (IUCN); Center for Protected Areas and Watershed Management (CPAWM) of the Department of Forestry; Wildlife Conservation Society (WCS); Nam Ngum Watershed and Conservation Project; and Milsearch (mines advisory group) (ADB, 1997c).

Description of the Project:

The Project aims to improve rural access to power supply and increase the electrification ratio as a means of promoting economic growth. The principal objectives are to supply electricity to about 37,500 rural households and other consumers in some 350 villages and provincial towns, and to improve the operational efficiency of Electricité du Laos (EdL) by rehabilitating old power system facilities in Vientiane. The long-term objective is to provide the necessary infrastructure to meet the power demand of approximately 88,000 consumers in outlying villages by 2015. Project implementation is scheduled to start in early 1998 and to be completed in late 2001 at a cost of approximately \$62.65 million (ADB, 1997c).

Macroeconomic benefits of the Project will be achieved by:

- Facilitating economic development through agro-based and other industries.
- Stimulating entrepreneurial development.

- Promoting balanced regional development
- Displacing the use of imported kerosene and diesel fuels.

The market for the Project will initially consist of residential and commercial consumers totaling about 9,000 in the Xieng Khouang-Xaysomboon area, 7,300 in Xayaburi and enroute, and 6,400 in Xanakham. In addition, the Project will provide 24-hour electricity supply to households in Xieng Khouang, Xayaburi, and Xanakham that are now supplied by Government-owned diesel generators for a few hours each day. Shieldwire will be used to supply power to villages along the transmission line route. Two wood processing factories located in Hinheup and Xanakham will also be consumers (ADB, 1997c).

The Project will include the following components:

- 158 kilometers (km) of 115-kilovolt (kV) transmission line from Nam Leuk Hydropower Station to Xieng Khouang, extension of the Nam Leuk switchyard, construction of a 115/22-kV substation at Xieng Khouang, shieldwire distribution along the transmission line, and conventional distribution in Xieng Khouang and Mouang Cha towns and surrounding areas;
- 73 km of 115-kV transmission line from Xieng Ngeun to Xayaburi, construction of a 115-kV switching station at Xieng Ngeun, construction of a 115/22-kV substation at Xayaburi, shieldwire distribution along the 115-kV line, and conventional distribution in Xayaburi town and surrounding areas.
- 94 km of 115-kV transmission line from Nam Ngum via Hinheup to Nonhai, construction of 115/22-kV substations at Hinheup and Nonhai, shieldwire distribution along the line, conventional distribution in Hinheup and Nonhai, 22-kV connection from Nonhai to Xanakham, and construction of a substation at Xanakham;
- About 380 km of 22-kV distribution lines, 120 distribution transformer substations, and about 10,500 low voltage connections in the Vientiane Plain.

- Rehabilitation of Vientiane city power distribution facilities, including replacement of overloaded conductors, deteriorated wood poles, and old distribution panels; installation of power factor-correction capacitors and switchgear; and provision of maintenance equipment.

Table 8 shows the Impact and Mitigation Matrix of this project.

Alternatives:

In addition to the proposed Project design, three principal alternatives were considered but rejected. These included:

1. A "do nothing" alternative;
2. Expansion of existing diesel power stations in Xieng Khouang, Xayaburi, and Xanakham;
3. For Xanakhm, connection to Thailand

The first two For Xanakham, connection to Thailand. The first two alternatives would have resulted in continuing heavy reliance on indigenous fuelwood and imported hydrocarbons, predominantly diesel and kerosene. They are unsustainable in the long term and incompatible with Government policies directed at reducing the use of fuelwood and minimizing reliance on imported petroleum products. They would provide limited or no electrification to rural areas. The third alternative would have required construction of a 70 km 115-kV transmission line through densely populated land to reach the nearest substation in Thailand. Also considered but rejected on economic grounds were alternative energy sources such as wind power and solar power (ADB, 1997c).

Table 8: Impact and Mitigation Matrix
Power Transmission and Distribution Projects (Lao PDR)

Activity	Potential Impact	Significance	Duration	Mitigation
Potential Impacts due to Design and Location				
Resettlement	Social inequities	None	N/A	No resettlement required
Historical/ Cultural monuments	Loss of values	None	N/A	Avoided through appropriate siting
Encroachment into ecologically sensitive areas and forests	Loss of values	Minor	Short	Siting avoids ecologically sensitive areas; monitoring to prohibit illegal tree falling
Interference with utilities/traffic	Disruption of services	Insignificant	N/A	No major interference
Impairment of aesthetic	Loss of environmental beauty	Minor	Long	Lines sited along roads; alignment modified to avoid impairment of aesthetics near cultural site; lattice towers
Potential Impacts during Construction				
Uncontrolled erosion/silt runoff	Soil loss/downstream siltation	Minor	Short	Revegetate and stabilize soil around towers
Maintenance of rights of way	Health and ecological hazard	Insignificant	Long	Little or no use of herbicides
Nuisance to nearby properties	Losses in neighboring land uses/values	Minor	Short	Compensation for temporary use of land
Blockage of Wildlife passage/ hunting	Species Impacts	Minor	Short	No blockage; strict enforcement of rules against firearms and wildlife trapping
Interference with drainage pattern	Flooding	Insignificant	N/A	No new roads to be constructed
Inadequate disposition of borrow sites	Loss of land values	None	N/A	No borrow pits
Land acquisition	Social inequities	Minor	Short	Compensation
Health and Safety	Sickness/accident	Minor	Short	Health and Safety Plan
Potential Impacts during Operation				
Land value changes and population movements	Social inequities	Moderate	Long	Monitoring Program implemented and action taken if needed
Increase in affluent/ Poor income gap	Social imbalances	Minor	Long	Monitoring
Escape of polluting materials and fires	Damage to environment and property	Minor	Long	Appropriate equipment purchased; monitoring, Health and Safety Plan
Health and Safety	Sickness/ Accidents	Minor	Long	Training to be provided by Edl; monitoring by independent party
Inadequate environmental monitoring and Operations and maintenance skills	Damage to ecological and social values	Minor	Long	Training to be provided by Edl; monitoring by independent party

Adapted from the information of EIA report, Power Transmission and Distribution Project (ADB, 1997c)

Institutional Requirements and Environmental Monitoring Program:

- Institutional Responsibility and Capacity

EdL will bear full responsibility for ensuring that the Project complies with best environmental practices and meets the mitigation and monitoring requirements described in the IEE report. The program includes both environmental and social parameters. The major social issues to be monitored during the Project will be

- any pressures on existing communities resulting from speculative activity or influx of settlers from outside areas as a consequence of the Project;
- any difficulties, grievances or impairment of households' abilities to maintain a livelihood as a consequence of temporary or permanent loss of agricultural land or crops. Special attention will be given to ethnic minority households.

Training in assessment and monitoring provided by the Project will include collection of baseline data and monitoring of beneficial and/or adverse impacts that may not become apparent until 5-10 years after the completion of construction. An independent third party with experience in environmental assessment and monitoring of infrastructure projects will assist EdL in coordinating and overseeing implementation of the monitoring plan. This is expected to be a Lao-based international nongovernmental organization, of which several have the capability to provide such a service. The selected institution will be required to periodically audit implementation of the monitoring plan to assist in strengthening EdL's environmental capacity, and to undertake public participation, information dissemination, and village-level liaison. Environmental management reports will be prepared by the contractor on a monthly basis as part of the Project's monthly reports for submission to EdL. In addition, the Project will support a formal review of mitigation implementation once a year. The review will include progress on compensation, mitigation, and the status of biological resources (ADB, 1997c).

COMPARATIVE ANALYSIS OF EIA IN SELECTED ASIAN COUNTRIES

Although Environmental Impact Assessment (EIA) procedures vary with each country's unique laws and local practices, the following key steps seem generic and public participation should be infused into each:

- Project identification and definition
- Screening and determination of clearance level
- Scoping
- Baseline data collection and analysis
- Impact prediction and analysis
- Identification of impact-mitigation measures and monitoring plans
- Circulation and review of EIA report (perhaps in conjunction with public hearing)
- Publication of EIA report
- Formal approval (with or without conditions)
- Compliance monitoring and impact management.

The EIA is an important phase in the process of deciding about the final shape of a proposed project. It helps officials make decisions about a project and it helps the project's proponents achieve their aims more successfully (UNDP, 1988):

- A project that has been designed to suit the local environment is more likely to be completed on time and within budget, and is more likely to avoid difficulties along the way.
- A project that maintains the natural resources it relies upon will continue to be sustained by the environment for years to come.
- A project that yields its benefits without causing serious problems is more likely to bring credit and recognition to its proponents.

In summary, an Environmental Impact Assessment:

- Predicts the likely environmental impacts of projects

- Find ways to reduce unacceptable impacts and to shape the project so that it suits the local environment
- Presents these predictions and options to decision makers.

Even though Indonesia have been practicing EIA in making decisions for its developing projects since 1970s, it has recently enacted its legislation for EIA. EIA is not only a decision-making tool, but also an on-going process through which a nation can sustain its growth, and manage its resources. By proper utilization of EIA it is possible to avoid the unpredictable. Most of these countries are overpopulated and suffering from a lack of investment in their development sectors. Actions have been taken by these countries to frame a suitable infrastructure to sustain growth. China, India, and Bangladesh are in the process of forming EIA legislation. Although Laos does not have any EIA legislation, it is undertaking EIA as an initial component in its development process. Following are the performance matrices (Table 9 to 12) of the Environmental Impact Assessment Report that have been selected from the development works of these countries. In the current research attempts have been made to sketch performance matrices of the EIA reports of the selected Asian countries to recognize the effectiveness of the report in addressing relevant issues. For all of these projects a complete EIA was required (Category A) except one in Laos (Category B) that was under the recommendation by the Asian Development Bank to perform an EIA in order to get the loan.

Interaction matrices were developed to link environmental factors with project activities. Matrices are grid diagrams with one set of factors on the horizontal axis and another on the vertical. These matrices are similar to Leopold Matrix in terms of the relationship between impacts and actions. However, these matrices are designed to assess the performance of the selected EIA reports from the selected countries. These provide a systematic checking of performance in preparing the EIA reports against a listing of most common and similar environmental factors for these countries.

Table 9: EIA Report Performance Matrix
Name of the Project: Guizho Shuibai Railway Project

Category		Description	PERFORMANCE				
A	B	C	D	E			
		Not Applicable					
		Not Mentioned					
		Only Mentioned					
		Adequately Discussed					
		Appropriately Described					
ENVIRONMENTAL IMPACT ASSESSMENT (EIA)	EIA Constraints	Political		✓			
		Social (skills & expertise)		✓			
		Spiritual (taboos)					
		Historic	✓				
		Economic			✓		✓
		Sufficient Infrastructure					
		Cost Benefit Analysis					
		Speculative		✓			
		Sufficient Local \$\$ Resource		✓			
		Outside Aid Requirement		✓			
		Govt. Regul.			✓		
		National			✓		
		regional			✓		
		Local					
		Tied to Outside Stipulations	✓				
		Contr-oller			✓		
		Civil Agency			✓		
		Military Agency					
		Independent Agency		✓			
		Other Controls (oversight)					
		Performance Stipulations					
		Required Effect Compensation					✓
		Non Renewable and Renewable Resources	✓				
		Waste and Hazard Management Protocols		✓			
		Mitigation Measure					✓
		Alternatives			✓		
		Institutional Requirement			✓		
		Post Project Monitoring			✓		
	Impact	Human Population			✓		
		Distribution			✓		
		Displacement			✓		
		Settlement			✓		
		Health Effects	✓				
		Employment		✓			
		Education	✓				
		Other: Living Standard			✓		
		Bio-ta			✓		
		Natural			✓		
		Managed			✓		
		Unusual					
		Physical Factors			✓		
		Regional /Local Landform			✓		
		Weather Events					
		Flood					
		Wildfire					
		Climate			✓		
		Erosion					
		Water Quality			✓		
		Air Quality			✓		
		Noise			✓		
		Other					
		Biotic Factors					✓
		Habitat					✓
		Systematic Interaction					
		Introduction, Undesirables	✓				
		Other					
		Socioeconomic Impact			✓		
		Public Safety					✓
		Solid Waste/Hazardous Waste					✓

Table 10: EIA Report Performance Matrix
Name of the Project: LPG Pipeline Project (India)

<u>Category</u>		<u>Description</u>	PERFORMANCE				
A	B	C	D	E			
		Not Applicable					
		Not Mentioned					
		Only Mentioned					
		Adequately Discussed					
		Appropriately Described					
ENVIRONMENTAL IMPACT ASSESSMENT (EIA)	EIA Constraints	Political		✓			
		Social (skills & expertise)			✓		
		Spiritual (taboos)					
		Historic		✓			
		Economic	Sufficient Infrastructure		✓		
			Cost Benefit Analysis				✓
			Speculative				
			Sufficient Local \$\$ Resource		✓		
			Outside Aid Requirement		✓		
		Govt. Regul.	National			✓	
			regional		✓		
			Local		✓		
			Tied to Outside Stipulations		✓		
		Contr-oller	Civil Agency			✓	
			Military Agency			✓	
			Independent Agency			✓	
			Other Controls (oversight)				
			Performance Stipulations				
			Required Effect Compensation			✓	
			Non Renewable and Renewable Resources		✓		
			Waste and Hazard Management Protocols		✓		
			Mitigation Measure				✓
			Alternatives			✓	
			Institutional Requirement			✓	
			Post Project Monitoring			✓	
	Impact	Human Population	Distribution			✓	
			Displacement			✓	
			Settlement			✓	
			Health Effects			✓	
			Employment			✓	
			Education			✓	
			Other: Living Standard				
		Bio-ta	Natural			✓	
			Managed			✓	
			Unusual				
		Physical Factors	Regional /Local Landform		✓		
			Weather Events				
			Flood				
			Wildfire				
			Climate				
			Erosion			✓	
			Water Quality			✓	
			Air Quality			✓	
			Noise			✓	
			Other				
		Biotic Factors	Habitat		✓		
			Systematic Interaction		✓		
			Introduction, Undesirables		✓		
			Other				
		Socioeconomic Impact			✓		
		Public Safety			✓		
		Solid Waste/Hazardous Waste					✓

Table 11: EIA Report Performance Matrix

Name of the Project: North Java Road Improvement Project(Indonesia)

Category		Description	PERFORMANCE				
			A	B	C	D	E
A		Not Applicable					
B		Not Mentioned					
C		Only Mentioned					
D		Adequately Discussed					
E		Appropriately Described					
ENVIRONMENTAL IMPACT ASSESSMENT (EIA)	EIA Constraints	Political				✓	
		Social (skills & expertise)		✓			
		Spiritual (taboos)					
		Historic		✓			
		Economic	Sufficient Infrastructure		✓		
			Cost Benefit Analysis			✓	
			Speculative		✓		
			Sufficient Local \$\$ Resource		✓		
			Outside Aid Requirement			✓	
		Govt. Regul.	National			✓	
			regional				
			Local				
			Tied to Outside Stipulations				
		Contr-oller	Civil Agency			✓	
			Military Agency				
			Independent Agency				
			Other Controls (oversight)				
			Performance Stipulations				
		Required Effect Compensation		✓			
		Non Renewable and Renewable Resources		✓			
		Waste and Hazard Management Protocols					
		Mitigation Measure				✓	
		Alternatives				✓	
		Institutional Requirement					
		Post Project Monitoring				✓	
	Impact	Human Population	Distribution			✓	
			Displacement		✓		
			Settlement			✓	
			Health Effects			✓	
			Employment		✓		
			Education				
			Other: Living Standard		✓		
		Bio-ta	Natural		✓		
			Managed		✓		
			Unusual		✓		
		Physical Factors	Regional /Local Landform				
			Weather Events				
			Flood		✓		
			Wildfire				
			Climate				
			Erosion			✓	
			Water Quality			✓	
			Air Quality		✓		
			Noise			✓	
			Other				
		Biotic Factors	Habitat		✓		
			Systematic Interaction		✓		
			Introduction, Undesirables		✓		
			Other				
		Socioeconomic Impact				✓	
		Public Safety				✓	
		Solid Waste/Hazardous Waste			✓		

Table 12: EIA Report Performance Matrix

Name of the Project: Power Transmission and Distribution Project (Lao PDR)

Category		Description	PERFORMANCE				
			A	B	C	D	E
A		Not Applicable					
B		Not Mentioned					
C		Only Mentioned					
D		Adequately Discussed					
E		Appropriately Described					
ENVIRONMENTAL IMPACT ASSESSMENT (EIA)	EIA Constraints	Political			✓		
		Social (skills & expertise)			✓		
		Spiritual (taboos)				✓	
		Historic					
		Economic			✓		
		Sufficient Infrastructure		✓			
		Cost Benefit Analysis			✓		
		Speculative			✓		
		Sufficient Local \$\$ Resource		✓			
		Outside Aid Requirement			✓		
		Govt. Regul.				✓	
		National			✓		
		regional			✓		
		Local			✓		
		Tied to Outside Stipulations			✓	✓	
		Contr-oller			✓		
		Civil Agency					
		Military Agency			✓		
		Independent Agency					
		Other Controls (oversight)					
	Impact	Performance Stipulations					
		Required Effect Compensation					✓
		Non Renewable and Renewable Resources	✓				
		Waste and Hazard Management Protocols	✓				
		Mitigation Measure					✓
		Alternatives					✓
		Institutional Requirement				✓	
		Post Project Monitoring					✓
		Human Population				✓	
		Distribution				✓	
	Impact	Displacement				✓	
		Settlement				✓	
		Health Effects					✓
		Employment				✓	
		Education		✓			
		Other: Living Standard				✓	
		Bio-ta			✓		
		Natural					✓
		Managed					
		Unusual					
	Impact	Physical Factors				✓	
		Regional /Local Landform				✓	
		Weather Events					
		Flood					
		Wildfire					
		Climate					
		Erosion					
		Water Quality				✓	
		Air Quality				✓	
		Noise					
	Impact	Other					
		Biotic Factors			✓		
		Habitat					
		Systematic Interaction					
	Impact	Introduction, Undesirables		✓			
		Other					
		Socioeconomic Impact				✓	
	Impact	Public Safety					✓
		Solid Waste/Hazardous Waste					✓

All of these projects have followed guidelines adequate to perform its EIA. Among these the projects in China and Indonesia have the greatest impact on the surrounding environments. The EIA report of China's project is much more elaborated than that of Indonesia. The EIA report of the Laos's project is the most complete one. However, all of these EIA reports are lacking in one way or another because they fail to address some of the issues more appropriately, such as local skills and expertise, post project monitoring, involvement of NGO's, continuity to a proper environmental action plan. But the attempt at performing a meaningful EIA toward sustainable growth in the development process is quite apparent from these EIAs.

The following chapter elaborates the EIA capacity in Bangladesh. It evaluates the Environmental Management Action Plan (EMAP) of the Jamuna Multipurpose Bridge Project, one of the most significant development projects, to test the effectiveness of the environmental management process for sustainable development.

CHAPTER THREE

EIA IN BANGLADESH

Evaluating the Environmental Action Plan of the Jamuna Multipurpose Bridge Project

INTRODUCTION

In the recent past all countries of the world have been working towards the creation of adequate legal framework to prevent the gradual decline of the environment and conserve the natural resources capital (UNCED, 1992). Such concern has also been expressed at the Earth Summit held at Rio de Janeiro, Brazil. In June 1992 representatives of 178 nations met to decide what actions were needed to promote environmentally and socially sustainable development. The commitment of leaders from around the world to achieving sustainable development was embodied in Agenda 21, the centerpiece agreement that emerged from the Earth Summit (WCED, 1997). The action programs and activities of Agenda 21 are organized under six themes where both environmental and developmental concerns are discussed. These themes are:

- The quality of life
- Efficient use of natural resources
- Protection of the global commons
- Management of human settlements
- Waste management
- Sustainable economic growth

At the Rio summit “sustainable development” was the key issue. The word “sustainability” has become very useful in describing the overall growth of nations especially of developing countries. It has become the primary goal of both economic development and resource management. In achieving sustainable growth the development must comply with the norms of sustainability—achieving growth ensuring that

opportunities for continuing development remain undiminished to future generations. Most of the development projects have impacts on environment and human interest that conflict with the idea of sustainable development. If proper assessment of those impacts can be measured, proper mitigation plans can be adopted to reduce the impacts to ensure sustainability. Environmental impact assessment (EIA) is a tool that helps to achieve sustainable development. EIA is a planning and management tool that can be linked to the developmental projects that can ensure proper decision-making.

Bangladesh, one of the least developed countries of the world, is characterized by endemic stagnation of national income growing at around 4 percent (CIA, 1997) per annum, which has been the experience for nearly 30 years. The effort must be made to overcome the different constraints of development and enhance the dynamics of economy to raise the growth rate up to a significant level to sustain the nation by the turn of the century. Rapid economic development, however, would put ever-increasing pressure on natural resources such as land, water, energy etc. Basic resources such as land, water, and air are adversely affected due to industrial activity, tending to increase the discharge of pollutants to the environment in varying degrees. For example over-use of agricultural raw material resource base, inundation of large areas due to construction of hydroelectric dam, pollution of land, water and air due to dumping and discharge of wastes, loss of land due to infra-structural, mining and other activities, all adversely affect the environment. Bangladesh has a very large population with a population density of over 870 person in per square kilometer area (CIA, 1997). The high population growth has given rise to the mutually reinforcing situation of increase the occupied area as well as diminishing the tree resources to meet fuel wood requirements, and increasing the needs of bricks for construction, roads, bridges and other infrastructures thus adding to the degradation of the environment.

It is essential to choose the future development in such a way that environment degradation be minimized through judicious use of resources on an inter-temporal basis to achieve sustainable development. Such effort must focus attention on creation of a

quality culture in our development activities. Along with the increase in capital and labor efficiency, the contribution of the residual factors to the development process must be maximized through such measures as technology development, use of appropriate technology, industrial linkages, internal and external economics in production, and maintenance of environmental quality.

Even though the government of Bangladesh has keen interest in adopting EIA legislation to make EIA essential for all kind of developmental projects, EIA practice is not as established as some other Asian countries. In this chapter, an attempt has been made to recognize the effectiveness of EIA in Bangladesh by evaluating one of the most significant development projects in Bangladesh.

COUNTRY PROFILE

Located in Southern Asia Bangladesh is one of the most densely populated countries. It has a population of 125,340,261 (July 1996 est.; CIA, 1997) with an average literacy rate of 38.1%. Despite sustained domestic and international efforts to improve economic and demographic prospects, Bangladesh remains one of the world's poorest, most densely populated, and least developed nations. Annual GDP growth has averaged over 4% (4.7%) in recent years from a low base. Per capita purchasing power parity in 1996 was US \$ 1,260.

Geography, Government and Legal System:

Geography

Location

Southern Asia, bordering the Bay of Bengal, between Burma and India.

Area

Total: 144,000 sq km

Land: 133,910 sq km

Water: 10,090 sq km

Climate

Tropical, cool, dry winter (October to March); hot, humid summer (March to June); cool, rainy monsoon (June to October).

Natural Resources

Natural gas, arable land, timber.

Land Use

Arable Land:	73%
Permanent Crops:	2%
Permanent Pastures:	5%
Forests and Woodland:	15%
Other:	5%

1993 est. (CIA, 1997)

Population Density

870 people per square kilometer.

Government:

Bangladesh possesses a republic type of government. Chief of the state is President and head of the state is Prime Minister. The President is elected by National Parliament for a five-year term. The President usually appoints following the legislative elections, the leader of the party that wins most of the seats Prime Minister. There are numerous political and social groups in Bangladesh.

Legal System:

Based on English common law.

Environmental Issues and Trends:**Natural Hazards:**

- Droughts
- Cyclones
- Much of the country routinely flooded during the summer monsoon season

Current Issues:

- Many people are landless and forced to live on and cultivate flood-prone land
- Limited access to potable water
- Water-borne diseases prevalent
- Water pollution especially of fishing areas results from the use of commercial pesticides
- Intermittent water shortages because of falling water tables in the northern and central parts of the country
- Soil degradation
- Deforestation
- Severe overpopulation

Source: CIA, 1997

Environmental Laws:

- Constitutional provision for Conservation 1972
- Guidelines for Private Appraisal in Water Sector 1991
- Guidelines for EIA in Water Sector
- National Environmental Policy 1992
- Guidelines for people's Participation in Water Sector 1992
- National environmental Guidelines for Industries 1993
- Environmental Conservation Act (ECA) 1995
- Environmental Conservation Rules, 1997 (SRO 117-law/17)
Under ECA (Act 1 of 1995)
- Environmental Pollution Control Ordinance 1997
- No specific EIA legislation

Source: Smith and Wansem, 1995; Farooque and Hasan, 1996; Syed, 1998

The Jamuna Multipurpose Bridge Authority Ordinance 1985

(Ordinance No. XXXIV of 1985)

An ordinance to provide for the establishment of the Jamuna Multipurpose Bridge Authority.

- Ordinance to override other laws, etc.- The provision of this ordinance and the rules made thereunder shall have effect notwithstanding anything inconsistent therewith contained in any other law for the time being force.
- Establishment of Authority – (1) There shall be an Authority to be called the Jamuna Multipurpose Bridge Authority for carrying out the purpose of this ordinance.
- Functions of the Authority – Subject to the general direction, supervision and control of the Government, the functions of the Authority shall be to:
 - a) undertake a feasibility study for the establishment of the multipurpose bridge on Jamuna river on an integrated concept of rail-cum-road-cum-gas-cum-electric power line;
 - b) prepare a comprehensive plan for the establishment of the multipurpose bridge for consideration and approval of the Government;
 - c) take all necessary actions for implementation of the plan of the multipurpose bridge approved under clause (b).
- Acquisition of land –
 - (1) Any land required by the Authority for carrying out the purpose of this Ordinance shall be deemed to be needed for a public purpose and such land may be requisitioned and acquired according to the requirements of the Authority.
 - (2) Whenever the Authority decides to lease or sell land acquired by it from any person, it shall offer that person, or heirs, executors or administration, as the case may be, a prior right to take on lease or to purchase land, at a rate to be fixed by the Authority.
- General power of the Authority – Subject to the other provisions of this Ordinance and such rules made thereunder the Authority may take such

measures and exercise such powers as may be necessary for carrying out the purposes of this Ordinance.

- Clearing and breaking up of certain land prohibited – (1) No person shall, except with the previous permission of the Authority, clear or break any land within such area neighboring the area of the Jamuna river where the multipurpose bridge is being established as may be specified by the Authority by notification in Official Gazette.

- Power of entry -

- (1) The Executive Director or any officer authorized by him in this behalf may, with or without assistants of workmen, enter into or upon any land or order to make any inspection, survey, experiment or inquiry or to erect pillars, make boring and excavation or to do any other act which may be necessary for the purpose of the Ordinance:

Provided that no such entry shall be made without giving the owner or the occupier of the land at least three previous notice of the intention to make such entry.

- (2) The Authority shall pay compensation for damage, if any, caused to the land on account of any action under taken under subsection (1) at such rate and in such manner as may be prescribed.

Source: Farooque and Hasan, 1996

EIA and Its Capacity:

Even though EIA is considered as a primary tool for development projects in the decision-making process (LGED, 1994), Bangladesh does not have any EIA legislation to date (Syed, 1998). There is continuous effort by the government to comply with the current needs of a sustainable environment. As far as EIA is concerned, the Environment Conservation Act (ECA) 1995 is the most recent legislation that has created the basis for environmental impact assessment. The ECA 1995 is as follows:

“Law Enacted for Conservation, Improvement of Quality Standard, and Control and Mitigation of Pollution of the Environment”

To fulfill the purpose of this Act, the Government has established the Department of Environment under the Ministry of Environment and Forestry (MOEF). According to this act no industrial unit or project can not be established without obtaining Environmental clearance from the department of environment (Syed, 1998). The government from time to time, by notification in the official gazette, will formulate and declare environmental guideline for the control and mitigation of environmental pollution and the conservation and improvement of environment.

While the enacting of ECA 1995 was most certainly an achievement, the enforcement of the Act became a problem as the Rules required to be notified by the Act had not yet been drafted. Hence, the department of environment was unable to fulfil the mandate under the Act. Under financial assistance from International development Agency (IDA/World Bank) with the help of several consulting agencies the department of environment framed the Environmental Conservation Rules in 1997. Finally, these rules came into force by the Government Gazette on August 1997 (Syed, 1998).

EIA is an integral part of multiple resource development planning and feasibility study of a project currently in Bangladesh (FPCO, 1992). The proponent needs to make the EIA report to submit it to the Department of Environment for approval. Department of Environment makes the final decision according to the impacts of the project and suggests necessary recommendations. Although not a numbered step in the recommended EIA procedure, active participation of local people should be sought in project study, appraisal, planning, implementation, operation, and maintenance. Figure 18 shows the flow diagram of recommended steps in EIA in Bangladesh (MOEF, 1995a, 1995b).

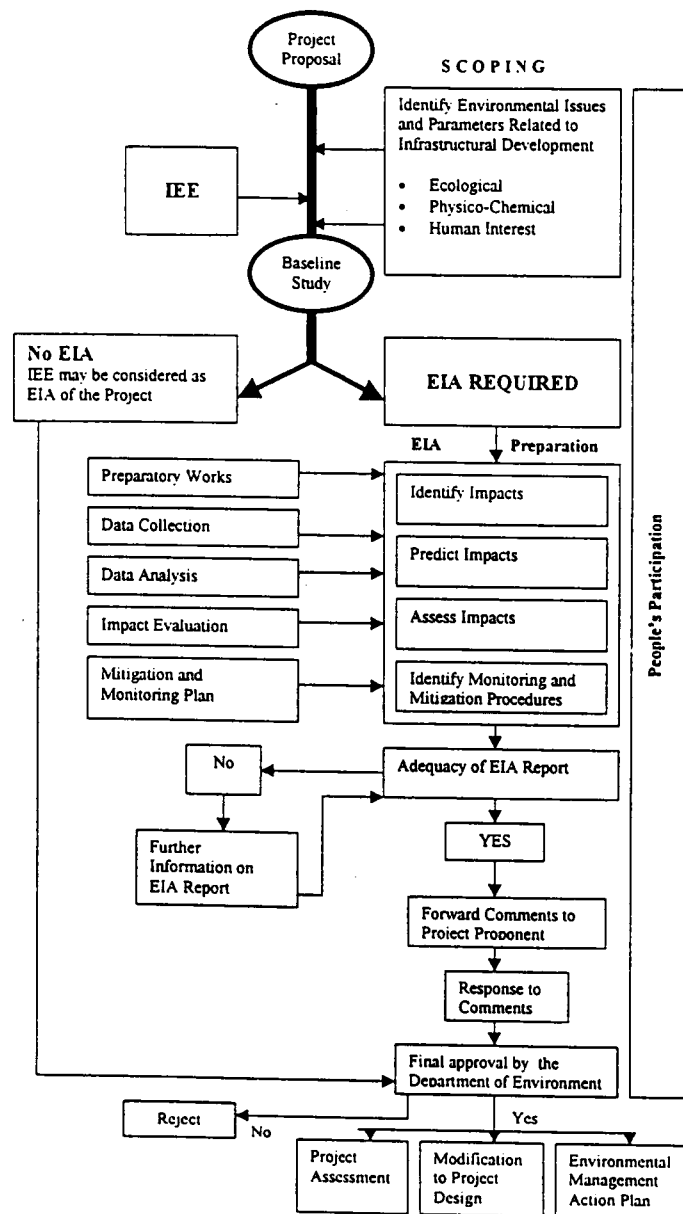


Figure 18: Flow Diagram of EIA in Bangladesh
*Adapted from the information of Guidelines
 For EIA in Bangladesh (FPCO, 1992)*

JAMUNA MULTIPURPOSE BRIDGE PROJECT

For centuries the river Jamuna has effectively isolated parts of Bengal-- not always the same parts, since the river changed its course in the nineteenth century. Today the Jamuna has isolated the western part of Bangladesh from the eastern part. Nowadays it flows more or less in a north-south direction down to its confluence with the Ganges (Fig. 19). The Jamuna is not just a river, it is a mighty stream with a huge catchment area. In the world's list of mighty rivers it ranks fourth in terms of peak discharged and second as regards sediment load.

Bangladesh, which gained its independence in 1971, has long dreamed of bridging the river but until recently this was considered to be technically impossible. The advances in offshore engineering for the oil industry over recent decades and new hydraulic engineering techniques developed in the Netherlands for coastal protection works and ports have made it possible to review the situation. Following a number of studies carried out from 1986 onwards, construction of a bridge across the Jamuna began in October 1994. The river crossing is due to be completed in 1998.

Description of the Project:

In 1985 the Bangladesh government decided to have studies carried out to determine the technical and economic feasibility of bridging the Jamuna. In the first phase (1986), various potential bridging points were considered on the Jamuna and the River Padma to the south and some preliminary designs were produced by RPT-NEDECO-BCL, a Netherlands based company. Not only the location but also the character of the bridge had to be decided: should it carry only a road link and energy carriers (electricity and gas) or a railway as well? Early in 1987, the location was determined: some 5 to 10 km south of Sirajganj (Fig. 19). The decision on the link took more time. Only in 1990 was it decided to reserve space on the bridge for a meter-gauge rail. The bridge is 18.5m wide and can either accommodate a four-lane road or four narrow road lanes plus a meter-gauge railway.

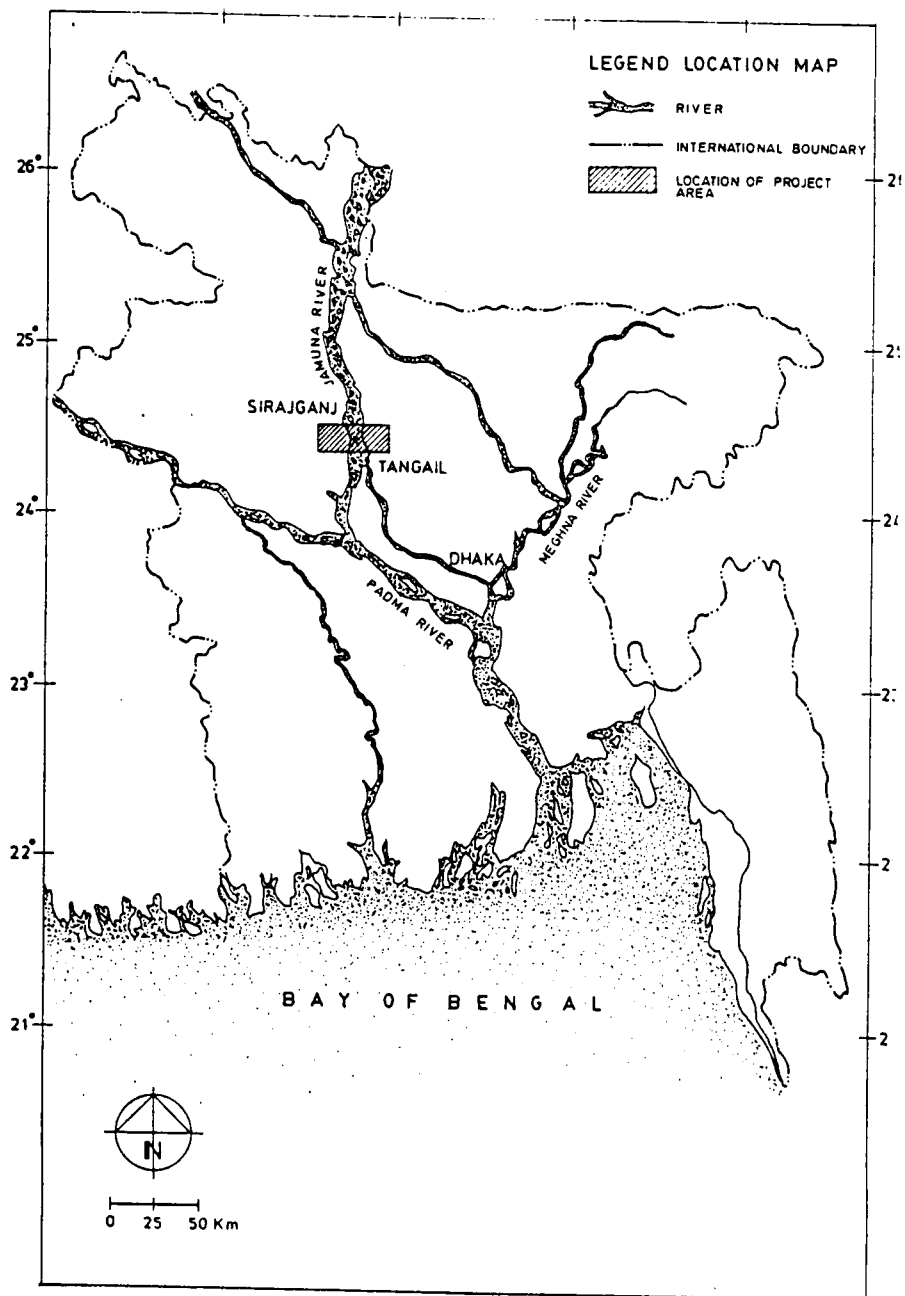


Figure 19: Location of Jamuna River and Jamuna Bridge in Bangladesh
Source: JMBA, 1993a

During the second phase (1987-1994), feasibility studies were carried out, detailed designs were made and international tendering procedures took place. The main construction contracts were signed in May 1994 and construction on site started in October of that year. The construction is being carried out by Korean contractor Hyundai; one for river training works and reclamation, carried out by a Netherlands consortium of HAM and Van Oord ACZ; and two for approach roads on the east and west sides of the river, being carried out by Samwhan (also a Korean contractor). The overall cost of the project will be in the order of US \$ 970 million. Some 62% of this amount is being provided by the International Development Agency (IDA), the Asian Development Bank (ADB), and the Japanese government (OECD), with the government of Bangladesh itself supplying the remainder (GOB, 1994).

Jamuna Multipurpose Bridge at a glance:

- Length of the Bridge 4.80 km
- Width of the Bridge 18.5 m
- Length of the Viaduct 128 m
- No. of Spans 49
- Length of each Spans 99.375 m
- No. of Road Lanes 4
- Length of the guide bund
on the West bank 2.2 km
- Length of the link road
on the East bank 15.3 km
- Length of the link road
on the west bank 14.4 km

Other Facilities on the Bridge:

- Meter Gauge Rail
- Power Transmission Line
- Telecommunication Line

Justification of Jamuna Multipurpose Bridge Project in context of the socio-economic conditions of Bangladesh

The Jamuna Multipurpose bridge under construction will contribute greatly towards the development of Bangladesh. From the engineering point of view this project has a good deal of similarity with the East-West Inter-connector construction. East-West Inter-connector connects power transmission between the eastern and western parts of Bangladesh. The successful completion of East- West Inter-connector Project did actually give birth to this concept of constructing a multipurpose bridge over the Jamuna river. Later the necessity of the proposed second Inter-connector Linkage project in the energy plan of the country proved to be helpful in taking decision for the implementation of Jamuna Multipurpose Bridge. This decision was taken as it was estimated that only an amount of 5 million dollar will be required to implement the Second Inter-connector over the Bridge. On the other hand nearly 110 million-dollar will have to be spent to construct the proposed second Inter-connector. However, later at the time of study of the Bridge Project even without the electric Inter-connector the economic justification of the bridge has been proved. Moreover, arrangement has been made to set gas line over the bridge in future and this arrangement of the gas transmission will save nearly 210 million U.S. Dollar. This Inter-sectoral compatibility proves the justification of the construction of Jamuna Multipurpose Bridge (GOB, 1994).

Development of an integrated transport system is a must for socio-economic development of a country. The proposed Jamuna Multipurpose Bridge, After being implemented, will create a favorable atmosphere in the socio-economic field of Bangladesh including a coordinated arrangement of transportation and fuel supply. The necessity of such equality is undeniable for a balanced economic development. After the completion of the bridge a permanent traffic system will make the movement of passengers and cargo and also transmission of power easier and less expensive in between the two regions of the country. This will also accelerate the speed of economic development.

From a technical point of view Jamuna Multi purpose Bridge is a complex one. The total implementation cost of the project will be nearly Tk. 3600 crore (Tk. 1 crore = US \$ 2,50,000 approx.) of which the local currency is nearly Tk. 1526 crore including the cost of rehabilitation. With a view to verifying the technical justification and economic feasibility of this big project a detailed techno-economic study was conducted from 1985 to 1993. The feasibility of the project has been verified separately by the Jamuna bridge Authority, Co-financiers and the consultant. The positive side of this project's economic and technical feasibility has altogether been proven through techno-economic studies.

Recent statistics show that the North-western region of Bangladesh has attained commendable success in agricultural products like grain. With a view to attaining more success in agriculture of that region and to establish agro-based industries it is absolutely necessary to develop the infrastructure of the villages and remove greater obstacles like the crossing of Jamuna river in the present transport system. The government has given stress in its long term plan on the development of a suitable and integrated transportation system. From that point of view the investment for Jamuna bridge Project is fully justified and well-timed. The completion of the under construction Jamuna Bridge will make easier the process of marketing the produces of both the sides and this will encourage the economic activities. This Bridge Project will play a vital role as a development catalyst in the overall development of the comparatively less developed North- western region of Bangladesh.

EIA for the Jamuna Multipurpose Bridge Project (JMBP):

Government of Bangladesh had no requirement for an EIA on development projects at the time this project was initiated (Matin, 1998). EIA for JMBP was a prerequisite condition by the donors, primarily World Bank, during the preparation of the feasibility report of the project in 1989. According to that study the potential environmental and other impacts due to the construction of the bridge are as follows:

- The environmental impact assessment has shown that no major environmental affects are expected during the construction period of about 3.5 years, except such normal construction hazards as disruption of drainage, temporary interruption of agricultural practices and some pollution of soil and water.
- As a result of the construction of the project, some 1,200ha of agricultural land will be lost. A resettlement program is recommended for approximately 650 families.
- The closure of the northern intake of the Dhaleswari River (Fig. 20) will have negative impact on fish resources in the river, yield of dry season crops and navigation and positive impact on agriculture as a result of flood reduction (1992a).
- The annual agricultural benefits due to flood reduction are estimated to outweigh slightly the combined disbenefits mentioned earlier. The net economic effect of the environmental impact of the bridge is a benefit of some US\$ 6.7 million expressed in 1987 terms at a discount rate of 12 percent (JMBA, 1993a).
- Mitigatory measures have been recommended in respect of drainage, and other normal problems associated with a large construction site.
- It has been recommended that a master plan be prepared for future Urban and Industrial development in the area, and an inventory of wildlife should also be prepared. Finally, recommendations have been formulated regarding an environmental management framework with the aim of coordinating and monitoring progress on the necessary environmental measures.

Table 13 shows the detail impacts due to the construction of Jamuna Multipurpose Bridge and their possible mitigation measures. Following the feasibility study or EIA, an Environmental Management Action Plan (EMAP) has been prepared according to the World Bank's Operation Directive (OD) 4.00 as guidelines to minimize the impacts.

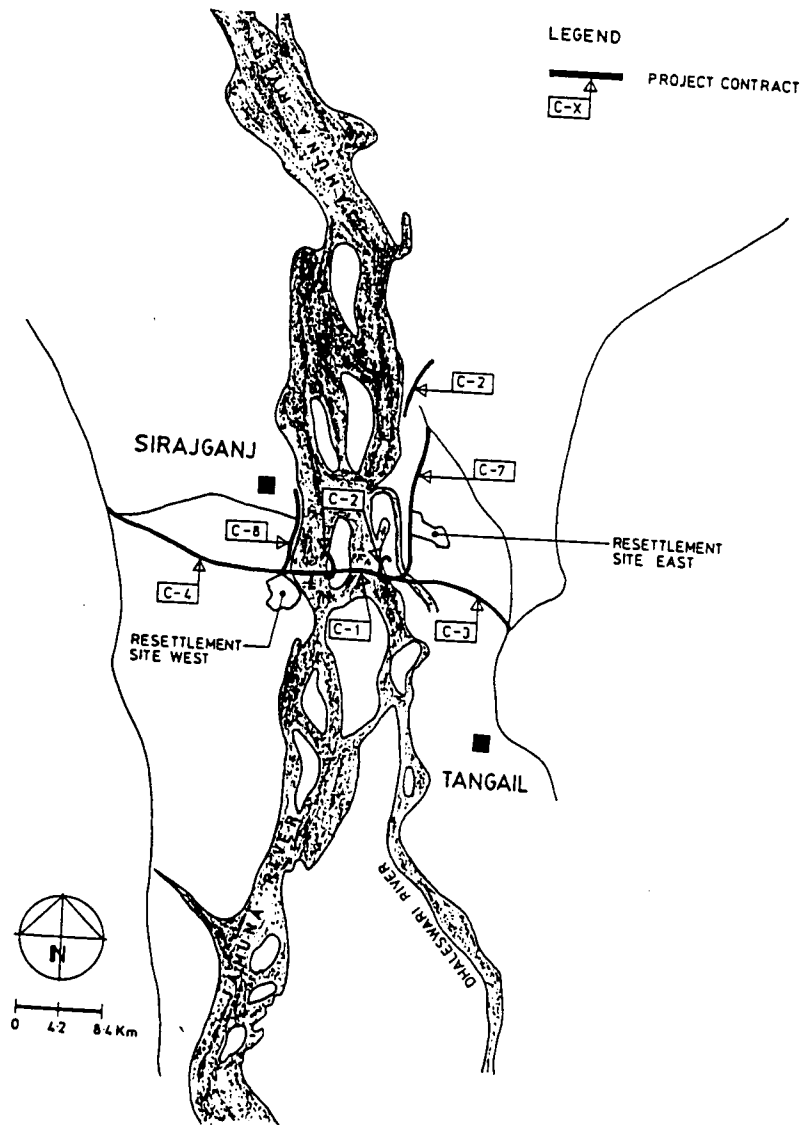


**Figure 20: Project Location Map of Jamuna Bridge Indicating the Closure
Of the Northern Intake of Dhaleswari River**

Source: JMBA, 1993a

Table 13: Impact and Mitigation Matrix Jamuna Multipurpose Bridge (Bangladesh)

Activity	Potential Impact	Significance	Duration	Mitigation
Potential Impacts due to Design and Location				
Resettlement	Social inequities	Significant	Short	i. Followed operational directive of World Bank for involuntary displacement of people. ii. Cash compensation iii. Transfer grant iv. House construction grant v. Housing into resettlement site vi. Easy loan, training, etc.
Historical/Cultural monuments	Loss of values	None	N/A	Avoided through appropriate siting
Residual effect of the project on local and regional flooding situation	Loss due to flooding, soil erosion etc.	Not determined	Long	Siting avoids ecologically sensitive areas; monitoring; compensation
Interference with utilities/traffic	Disruption of services	Minor	Short	i. Practice caution in using vehicles ii. Prevent use of private properties
Potential Impacts during Construction				
Construction and movement of construction materials	Disruption of navigation	Moderate	Short	i. Maintain close liaison with the BITWA ii. Provide proper navigational instructions iii. Place buoys and navigational lights iv. Conduct dredging operations, if required
River dredging and dredging of char land	Dredged spoils disposal	Significant	Short	i. Dredging may be synchronized with high river flow to induce flushing ii. Outflow from hydraulic fill should have maximum retention time to enhance settling at the reclaimed site iii. Outflow water quality should not be worse than the receiving water iv. Avoid water congestion v. Prevent spillage of

Table 13 (continued)				
Activity	Potential Impact	Significance	Duration	Mitigation
				filling spoil on private properties
Earthworks	Disruption of irrigation and surface drainage	Moderate	Short	i. Avoid disruption of surface water irrigation system ii. Ensure alternative source of irrigation iii. Provide compensation, if disruption is unavoidable iv. Provide adequate drainage facilities v. Construct cross drainage provisions
Dredging	Deterioration of surface water quality	Moderate	Short	Increase retention time of the outflow hydraulic fills to increase sedimentation, thus, reduce sediment load to Jamuna river. Prevent discharge of untreated, inorganic, toxic wastes in surface water
Earthworks and operation of construction equipment. Preparation of construction materials	Air pollution	Minor	Short	Maintain optimum moisture content during compaction, transportation and handling of soils. Regulatory spray water on dry surfaces to reduce dust generation; Strictly regulate vehicle emissions
Transportation, dredging, electricity generation, pile-driving	Noise pollution	Minor	short	i. Install the power generator unit inside a soundproof room ii. Install temporary soundwalls iii. Regulate the use of horns
Disposal of construction materials and wastes	Accidents/ health hazards	Minor	Short	Implement strict handling and storage practices to prevent accidental spillage
Disruption of agricultural practices	Crop loss, monetary loss	Significant	Short	i. Prevent unauthorized earthworks ii. Provide alternative job opportunities iii. Provide adequate job compensations
Disturbance of wildlife	Temporary habitat loss for migrating birds. Species impacts	Moderate	Short/ Long	i. Prevent unplanned invasion outside the project area ii. Strictly adhere to the wildlife protection guidelines
Construction operation land acquisition and	Destruction of plant and	Moderate	Short	i. Planting of trees ii. Spray water on

Table 13 (continued)				
Activity	Potential Impact	Significance	Duration	Mitigation
cleared of vegetation	vegetation, crop loss			iii. existing plants to remove dust iv. Organize tree planting and landscape maintenance team v. Provide compensation to private owners
Creation of stagnant water bodies in borrow pits	Health hazard/ Mosquito breeding	Minor	Short/ Long	Assess vector ecology in work areas and adopt appropriate measures. Spray insecticide on breeding ground
Lack of excreta disposal system and wastewater drainage system	Health hazard	Minor	Short	Provide good planned sanitary facilities; septic tanks, waste treatment facility, etc.
Contamination of drinking water	Health hazard	Moderate	Short	i. Establish small scale water treatment facilities ii. Install deep tubewell with provisions post treatment for iron and manganese iii. Install proper water disinfecting provisions
Uncontrolled disposal of solid wastes	Accidents/ Health hazards	Minor	Short	i. Install proper solid waste disposal facilities ii. Organize proper collection and transportation of solid wastes
Transmission of diseases among workers	Health hazards	Moderate	Short	i. Provide regular health inspection and vaccination among workers ii. Promote health education campaign among workers
Labor force employed in the project	Social disruption among workers and villagers	Minor	Short	i. Reduce social tension through public outreach programs ii. Set up mosques, market, etc. near the labor camp
Land acquisition	Social inequities	Moderate	Short	Compensation
Health and Safety	Sickness/ accidents	Minor	Short	i. Adopt appropriate safety measures ii. Make the workers aware of hazardous materials and proper handling methods

Table 13 (continued)				
Activity	Potential Impact	Significance	Duration	Mitigation
Potential Impacts during Operation				
Land value changes and population movement	Social inequities	Moderate	Long	No specific monitoring program
Increase in affluent/poor income gap	Social imbalance	Minor	Long	No specific monitoring program
Disturbance of wildlife	Loss of habitat, species impacts	Moderate	Long	No specific mitigation or monitoring program at present
Health and Safety	Accidents	Not determined	Long	No specific monitoring program

Adapted from the EIA Report, Jamuna Multipurpose Bridge Project (JMBA, 1992a; 1992b; 1992c; 1993a; 1993b; 1994. GOB, 1994 and 1998)

Environmental Management Action Plan (EMAP)

An Environmental Impact Assessment (EIA) of the Jamuna Multipurpose Bridge Project (JMBP) was prepared as an integral component of the feasibility study in 1989 in order to identify and evaluate major environmental issues and incorporate measures required to minimize or mitigate adverse economical impacts of the projects. The EIA study included all areas around the bridge site where changes in the components of environment were expected. But it excluded more distant areas where economic changes are expected to occur as a results of the improvement of the communication network. The EIA also recommended to conduct some further studies and activities related to conservation and protection of the environment. The following special environmental studies were completed to substantiate the impact and to develop definite action plan:

- Dhaleswari River Mitigation Plan (January, 1992)
- Land Use Master Plan (January , 1992)
- Fisheries Impact and Mitigation Study (January, 1992)
- Wildlife Study (1990-92)
- Bridge End Planning Integration Study (July, 1992)

Based on these studies, the Fisheries Action Plan and Wildlife Action Plan were drawn up by the Jamuna Multipurpose Bridge Authority (JMBA, 1994).

A preliminary household survey was carried out for resettlement as a part of the EIA and subsequently a Resettlement Strategy was drawn up. In the mean time, resettlement came out to be the vital issue and a detailed survey of the Project Affected Persons (PAPs) was conducted and a Resettlement Action Plan (RAP) was prepared by the JMBA. The resettlement component of JMBP, considering its importance and magnitude of the activities involved, was decided to be dealt with under separate action plan. The RAP was reviewed and Revised Resettlement Action Plan (RRAP) has been prepared in October, 1993 to make it consistent with the Operation Directives OD 4.30 of the World Bank (JMBA, 1994). The RRAP is to be implemented by the Jamuna

Multipurpose Bridge Authority – Resettlement Unit (JMBA-RU) under the Executive Director (ED) of the JMBA.

The environmental study report and the action plans were reviewed during the appraisal mission by the environmental group consisting of the experts of the World Bank, OECF and ADB as well as the local panel of experts of the JMBA and a brief outline of an Environmental Action Plan (EAP) was prepared. It was urged to translate and expand the brief EAP outline into a complete Environmental Management Action Plan (EMAP) for JMBP. This EMAP is the outcome of the decision of the environmental group to elaborate EAP outline prepared by environmental experts during the appraisal mission in 1993.

Functional Components of the EMAP

In the preparation of the EMAP, the environmental studies were carefully reviewed, the environmental components and sub-components were identified and the possible magnitude and nature of the impacts were ascertained. The major functional components of the EMAP include:

- Mitigation measure to reduce or eliminate adverse impacts
- Measures to off-set or compensate irreversible and residual adverse impacts
- Enhancement measure to maximize positive impacts
- Monitoring requirements
- Implementation schedule of the EMAP activities
- Budgets estimates for EMAP activities
- Institutional arrangement for implementation of the EMAP

Mitigation measures have been identified, evaluated in terms of practically, manageability and cost. These were incorporated in the components to eliminate or reduce the adverse impacts. The residual and non-mitigable adverse impacts have been identified and quantified where possible. Feasible measures to off-set or compensate such impacts have been devised and incorporated in the management plan. Environmental

enhancement has been considered where significant gains in production, resources enhancement and management, and environmental protection can be achieved with financial support from the project. Potential enhancement measures include:

- Replacement or upgrading of affected resources
- Technical support to increase production
- Training to allow more effective management of resources
- Introducing community management practices.

In view of the high degrees of uncertainties in impact prediction based on mathematical models and assumptions, monitoring has been highly emphasized in the EMAP. The uncertainties have become prominent from the differences in predicted impacts noted in different studies. Environmental monitoring in the EMAP has been designed with the objectives to:

- Measure the extent of expected or poorly quantified impacts
- Ensure incorporation of Environmental Protection Measures (EPMs) during implementation of the project
- Observe effectiveness of the EPMs
- Ensure early detection of unexpected impacts and adoption of appropriate protection measures
- Provide periodic reviews to observe adherence to Environmental Quality Standards (EQS) and adjust EPMs, if required
- Detect unacceptable level of impacts and adopt corrective measures

The monitoring program is expected to generate enough data for use in future EIA (JMBA, 1994).

ORGANIZATION OF THE EMAP

The EMAP has been prepared and presented in several sections incorporating similar components of the environment and environmental resources influenced by the

project under one section. The major sections of the EMAP are as follows (JMBA, 1994):

- Construction Related Environmental Impacts
- Promotion of Changes in cropping pattern
- Fisheries Mitigation plan
- Wildlife Protection Plan
- Boat Navigation
- Plantation and Social Afforestation
- Monitoring and Management of Water Resources
- Environmental planning of bridge ends and settlements
- Organizational Arrangement
- Implementation Schedule and Costs

The last two sections present the institutional support for the implementation of the EMAP, organizational arrangements, schedule of implementation and a summary of the costs of implementation of the EMAP.

Comparative Analysis of Environmental and Social Consequence

The design and construction of a bridge across a river involve many factors. The location of the bridge is determined on the one hand by economic considerations and on the other by river engineering issues. Most bridges have little environmental impact, though sub-studies were conducted in this respect and an environmental management action plan was produced. There are inevitable social impacts in the immediate vicinity, some positive and some negative. Construction work is also providing employment for local people (in Winter 1996, 5700 local workers), but 5000 families have had to be displaced. The World Bank made its funding conditional on the production of a resettlement plan for these people, who are being compensated for the loss of their land. The bridge will produce major economic benefits for Bangladesh in terms of creating the first fixed transport link between the eastern and western parts of the country. It will

boost fertilizer exports to Nepal and permit very significant economies and transit traffic from India, as well improving utilization of road and rail vehicles by eliminating ferry waiting times. The most significant impact due to the construction of the bridge is on human settlement.

Jamuna Multipurpose Bridge Authority (JMBA) completed a Resettlement Action Plan (RAP) under the EMAP in 1993. The policy objectives of RAP are as follows that is derived from the OD 4.30 and adjusted to the specific circumstances for the JMBP (JMBA, 1993a).

- Involuntary resettlement should be minimized where feasible, exploring all viable alternative project designs.
- Since some displacement is unavoidable, resettlement plans should be developed. Displaced persons should be
 - Compensated for their losses at full replacement cost
 - Assisted with the move and supported during the transition period in the resettlement site
 - Assisted in their efforts to improve their former living standards, income earning capacity, and production levels, or at least to restore them.
- Particular attention should be given to the needs of the poorest groups to be resettled.
- Community participation in planning and implementing resettlement should be encouraged.
- Resettles should be integrated socially and economically into host communities in such a way that host communities also benefit from the project.
- Land, alternative source of income, skill training, housing, infrastructure and other compensation should be provided to the adversely affected population.

The project affected households depend on a variety of sources such as farm land, tenant farming, wage labor, trading etc for their livelihood. Often a single household may

rely on more than one means of livelihood. A large number of households suffer different kind of losses in the process of relocation. The entitlement policy of the RAP take this into consideration to ensure that the individuals and the households get their entitlement proportionate to their losses. Following are the entitlement packages (JMBA, 1993a):

- Loss of Land: All Projected Affected Persons (PAP) affected by loss of farm land are entitled for a monetary package adequate to buy an equal area of replacement land. Land-losing PAPs are also eligible for an additional credit up to 50 percent of the total compensation for purchase of land.
- Loss of Homestead: All PAPs who have lost their normal place of residence to project works are entitled to an equivalent replacement homestead land.
- Loss of Residential and Commercial Structures: PAPs affected by loss of residential structures are entitled to a transfer and house construction grant of Tk 7,000 (1 US \$ = approx. 45 Tk). PAPs who are displaced from a rented/occupied commercial premise are entitled for a moving/ transfer grant of Tk 2,000.
- Loss of Rented in/ Shared Cropped Farm, Wage Labor/ Employment: Persons affected by such losses are entitled to a one-time maintenance grant of Tk 3,600 and for vocational training at project cost.

According to the revised resettlement cost of RAP a total sum of 234 crore Tk would be required by the project to implement Resettlement action Plan (JMBA, 1993a).

The Government of Bangladesh has not introduced environmental impact assessment legislation yet. The Environmental Conservation Act of 1995 has included provision for an EIA for any development projects. Although during the early stage of JMBP the Government of Bangladesh did not require an EIA for this project, it was required by the donor agencies such as the World Bank and the Asian Development Bank. The Government of Bangladesh agreed with the condition imposed by the donors for an EIA for the JMB project. All possible environmental and social consequences were

studied and proper recommendations were made. As a result, an Environmental Action Plan was prepared to monitor the future impacts caused by this development.

Although there are some construction-related impacts on the environment and humans due to this project, proper mitigation measures under the Environmental Management Action Plan lessen the extent of the impact to make the project sustainable. Table 14 shows the progress of the sub-component of the EMAP of the JMBP until January 31, 1998 (GOB, 1998). According to Matin (1998), former Chief Engineer of JMB project, there is no serious environmental impact of JMBP. Besides the resettlement issue, only closure of northern intake of the river Dhaleswary have some impact on fisheries. The Fisheries Mitigation Plan has taken adequate measure for mitigation of fish loss (JMBA, 1992b). Crop diversification and afforestation program have also been undertaken by the EMAP to enhance the economic growth in the project and the surrounding area. Study on the impact of the project on wild-life particularly migratory birds, have been done, and the extent of the impact is minor (JMBA, 1992c). The project is not completed yet. Remedial measures against the impact on the environment have been adopted while executing the project. According to Rahman (1998), former Chief Engineer of Roads and Highway department of Bangladesh, it is expected that if the proper remedial measures can be followed, there will be little impact on environment upon completion of the project.

In this research paper, efforts have been made to conduct an impact matrix to identify the potential impacts of a specific project and recognize the mitigation measures required due to that development project. Moreover, a performance matrix has also been designed to test the effectiveness and strength of the EIA report in addressing all relevant issues. Table 15 sketches the strength and the weakness of the EIA report of Jamuna Multipurpose Bridge. The report is elaborate and covered all possible impacts due to the construction of the project and their mitigation measures. Environmental Management Action Plan is an extension of the feasibility study or EIA that has enhanced the benefits further. Normally a bridge project does not have adverse impact on the environment other

Table 14: Progress of Sub-Component of the EMAP Until January 1998

Component	Results & Remarks
1. Construction Related Environmental Effects	
Monitoring & Evaluation	Monitoring being conducted by CSC
2. Promotion of Changes in Cropping Pattern	
Monitoring (MKS)	Baseline survey of 16,000 household was completed in August 1996, but no baseline date presented by the responsible NGO; 200 monitoring plot identified. No progress in 1997. Action against the responsible NGO (MKS) is under process
Training & Extension (MKS)	No formal training of farmers has been conducted. Action against the responsible NGO (MKS) is under process.
3. Fisheries Mitigation Plan	
Survey, Monitoring & Development (DoF)	Monitoring and survey progressing according to program. Training of farmers going on. Survey near completion
Fish culture Development (GMF)	GMF has plan for development of 90 ha. of Borrow Pit into ponds. 60% of ponds are to be developed by June 1998 and 100% will be developed by July 1999.
4. Wildlife Protection Plan	
Protection and Monitoring (WSB)	Work on first phase completed on December, 1997. Awaiting for final report and recommendations.
Post Construction Evaluation (Agency not selected)	Implementation of the component will be taken after completion of Bridge
5. Boat Navigation	
Training for Alternative Employment	No longer required. The PAPs are involved in different activities of on going components

Continued on page 141

continued

Table 14: Progress of Sub-Component of the EMAP Until January 1998

Component	Results & Remarks
6. Plantation and Social Afforestation	
Eastern Embankment	Initial plantation completed, only around 55% have survived. Action against the responsible NGO (MKS) is under process
East and West Approach Road	Work to be conducted in 1998 planting season
Bridge End Facilities	Tree plantation of 3.7 Km. has recently been undertaken. Rest will be done in the next season
7. Monitoring and Management of Water Resources	
BWDB	Water level monitoring ongoing according to program
Water Quality (BUET)	Annual report for 1996 showed all samples acceptable so contract concluded on June 1997 instead of December 1998
Drainage Congestion	No specified reports of drainage congestion by CSC
8. Environmental Planning	
Health Education Campaign	Contract period expired in July 1997
Resettlement	MC provided environmental input into design of west resettlement site
9. Institutional Elements	
Training of JMBA-EU	Conducted on the job training

Source: GOB, 1998

* BUET: Bangladesh University of Engineering & Technology
 BWDB: Bangladesh Water Development Board
 CSC: Construction Supervising Consultant
 DoF: Department of Fishery
 GMF: Grameen Motsho Foundation
 JMBA-EU: Jamuna Multipurpose Bridge Authority Environmental Unit
 MC: Management Consultant
 WSB: Wildlife Society of Bangladesh

Table 15: E IA Report Performance Matrix

Name of the Project: Jamuna Multipurpose Bridge Project (Bangladesh)

Category			Description		PERFORMANCE				
					A	B	C	D	E
A	Not Applicable								
B	Not Mentioned								
C	Only Mentioned								
D	Adequately Discussed								
E	Appropriately Described								
ENVIRONMENTAL IMPACT ASSESSMENT (EIA)	EIA Constraints	Political				✓			
		Social (skills & expertise)						✓	
		Spiritual (taboos)							
		Historic			✓				
		Economic	Sufficient Infrastructure				✓		
			Cost Benefit Analysis				✓		
			Speculative			✓			
			Sufficient Local \$\$ Resource						✓
			Outside Aid Requirement						✓
		Govt. Regul.	National				✓		
			regional						
			Local						
		Contr-oller	Tied to Outside Stipulations			✓			
			Civil Agency						✓
			Military Agency						
			Independent Agency				✓		
			Other Controls (oversight)						
		Performance Stipulations			✓				
		Required Effect Compensation				✓			
		Non Renewable and Renewable Resources		✓					
		Waste and Hazard Management Protocols			✓				
		Mitigation Measure						✓	
		Alternatives			✓				
		Institutional Requirement				✓			
		Post Project Monitoring						✓	
	Impact	Human Population	Distribution				✓		
			Displacement				✓		
			Settlement				✓		
			Health Effects		✓				
			Employment				✓		
			Education						
			Other: Living Standard				✓		
		Bio-ta	Natural		✓				
			Managed				✓		
			Unusual						
		Physical Factors	Regional /Local Landform				✓		
			Weather Events						
			Flood					✓	
			Wildfire						
			Climate				✓		
			Erosion					✓	
			Water Quality					✓	
			Air Quality			✓			
			Noise			✓			
		Other							
Biotic Factors		Habitat				✓			
		Systematic Interaction		✓					
		Introduction, Undesirables		✓					
		Other							
Socioeconomic Impact					✓				
Public Safety					✓				
Solid Waste/Hazardous Waste					✓				

than infrastructural development projects, but the scenario is slightly different for Bangladesh. Natural hazards along with over-population have made the environment and human needs very vulnerable to development projects. Proper assessment of the adverse impacts is crucial to ensure sustainable growth in Bangladesh. International donor agencies have significant influence in enforcing compliance the proper environmental management. Special legislation is also essential to ensure that necessary actions are taken for proper environmental decision-making.

An attempt has also been made to analyze the performance of the Environmental Impact Assessment Report of JMBP to compare its effectiveness with respect to recently developed EIA reports of some Asian countries. As the matrix shows, most of the issues are thoroughly discussed. Proper monitoring measures has been illustrated in the Environmental Management Action Plan (Table 14) to have the continuity in performing future EIA due to the development of this project. The comprehensiveness of the mitigation measures and the clearness of the post-project monitoring have made this report more complete than earlier projects in Bangladesh.

Chapter four concludes the purpose of this research. It suggests the recommended institutional development and legal basis in integrating EIA into environmental planning and resource management in Asia.

CHAPTER FOUR

FINAL WORDS

Integrating EIA into Environmental Planning and Resource Management in Asia

INTRODUCTION

Environmental protection is a relatively new issue for most Asian countries. Their pertinent legislation and institutional set-ups stem from the late seventies or early eighties, while industrialized countries have a longer tradition. Many developing countries in Asia have EIA regulations and have gained experience with this approach. For example, Bangladesh, China, India, Indonesia, Malaysia, Pakistan, the Philippines, the Republic of Korea, Sri Lanka, and Thailand have legal provisions for government agencies to require EIA approval of specific types of projects. Thailand, Indonesia, and the Philippines have processed several thousand impact documents. Over 10,000 EIA documents are likely to have been produced in Asian developing countries. This indicates the extent of experience that some developing countries have gained with EIA. Most experts from international institutions (e.g. Asian Development Bank, UNEP, World Bank, etc.), national environmental agencies as well as academics, agree that EIA still needs promotion and improvement. It is now possible to make recommendations based on the experience so far gained in the Asian countries. Table 16 shows the EIA capacity in some Asian countries.

The EIA procedure used at present in Asia is more or less standardized and consists of the basic steps of screening, initial environmental examination (IEE), scoping, impact statement preparation, review and final decision, monitoring and auditing (Biswas and Agarwala, 1994). Most countries review projects based on their potential environmental impact. Among the selected countries for this research, only Indonesia has enacted EIA legislation. Bangladesh, China, and India are currently in the process of preparing specific legislation. Lao PDR does not have any particular regulations as far as

Table 16: Current Status of EIA Requirement in Selected Asian Countries

COUNTRIES	LEGISLATIVE AND ADMINISTRATIVE DOCUMENTS	DATE OF ENACTMENT	MAIN OVERSIGHT AGENCY	EIA PREPARER	PUBLIC PARTICIPATION	COORDINATION WITH LOCAL AUTHORITY
Malaysia	▶ Environmental Quality Act ▶ Environmental Quality Act Amendment ▶ Environmental Quality (Prescribed Activity) (EIA) Order	1974 1985 1987	Department of Env. within the Ministry of Science	Project Proponent	Yes	Yes
Philippines	▶ Presidential Decree No. 1121, establishing the National Environmental Protection Council, now called the Environmental Management Bureau ▶ Presidential Decree, No. 1151 Philippine Environmental Policy ▶ P.D. 1586, establishing the Environmental Impact Statement (EIS) system under management of the National Environmental Protection Council (NEPC) ▶ Presidential Proclamation, No. 2146 defining Environmentally Critical Projects and Areas pursuant to PD No. 1586 ▶ Presidential letter of Instructions No. 1179, requiring relevant Ministries to create environmental units to carry out PD No. 1586, but allowing for exemption of certain projects ▶ EMB Office Circular No. 3 further defining Environmentally Critical Projects and Areas ▶ NEPC issues Rules and Regulations to govern EIS ▶ DENR Administration Order (DAO) No. 2, amending EIS rules and Regulations ▶ Inter-agency Memorandum of Agreement creating an EIA network	1977 1978 1981 1983 1985 1982 1992	Environmental Management Bureau within the department of Environment and Natural Resources (DENR)	Project Proponent	Yes, but not Mandatory	Yes
Sri Lanka	▶ National Environmental Act, No. 47 ▶ Coast Conservation Act ▶ Amendments of the National Environmental Act requiring IEEs and EIAs, No. 56 ▶ Regulation for the IEE/EIA process, No. 772/22	1980 1981 1988 1993	Central Environment Authority	Project Proponent	Yes	Yes
Thailand	▶ National Environmental Quality Act known as ICNEQA ▶ ICNEQA Amended ▶ Enhancement and Conservation of ICNEQA	1975 1978 1992	Office of Environ. Quality and Planning	Project Proponent	No	No

Source: Smith and Wansam, 1995

EIA is concerned. However, all of these countries have enacted some regulations that encourage EIA process in one way or the other.

All countries utilize the full-scale impact assessment. This may be called environmental impact statement, impact study or detailed assessment report, and can be considered to be the heart of the EIA process. In terms of the case studies, the contents of an impact statement are as follows:

- Description of the project, focusing on possible sources of environmental impact
- Description of the environmental situation before the implementation of the project
- Analysis and prediction of environmental impacts resulting from the project
- Outline of mitigation measures needed to minimize adverse impacts
- Comparison/ evaluation of environmental conditions with or without the project (eventual project alternatives)
- Post-project monitoring
- Institutional requirements
- Public involvement

The formal responsibility for the preparation of the impact statement usually lies with the project proponents, but consultants mostly carry out the actual work. Project-based EIA is mostly done with the assistance of the project funding agencies. Financial institutions like World bank, Asian Development Bank have further encouraged EIA process in these countries by providing technical support, training, in some instance, and loan program to develop specific legislation.

On the basis of the reviews carried out for various Asian countries, it can be said that mitigation measures and their implementation, environmental monitoring and compliance control need to be strengthened. Most countries do not have specific regulations to monitor and control the extent of the implementation of the proposed

remedial measures. The practical use of EIA in many Asian developing countries leads to the impression that EIA is often considered to be an end rather than a means to ensure better environmental protection. Endorsement of the impact statement often seems to be the final activity. In the vast majority of cases, only very limited sections of the statement deal with environmental management. Research has concentrated on impact identification and evaluation. Legal provisions are incomplete and public participation is limited.

Environmental impact assessment is a process of predicting and evaluating an action's impacts on the environment, from which the conclusions are used as a tool in decision-making. It contributes to prevention of environmental degradation and to conservation of biodiversity by giving decision-makers better information about the likely consequences of their actions. It cannot solve environmental problems, nor do the job of weighing up the merits and producing the decision. These things must still be done in addition; but they are unlikely to be done in a way which is environmentally sustainable unless the process begins by following good practice in EIA.

Although the economies of Bangladesh and Laos remain predominantly low-income and agricultural, some others as China, India, and Indonesia are increasingly middle-class and industrial. Moreover, the population has also grown markedly. Throughout this region economic growth, over-population, and industrialization have been accompanied by increased urbanization, large-scale exploitation of the region's extensive but finite natural resource base, and widespread despoliation of air, water, and soils by industrial and domestic waste. This region's most sensitive and productive natural resources- tropical forests, coastal zones, agricultural land, waterways, etc. are increasingly endangered by inadequately planned development and poorly managed growth. Unless care is taken, the potential for sustaining environmentally sound growth is at risk.

It is time for Asian countries to change. With the use of EIA as a decision-making tool these Asian countries can manage their resources toward sustainability. By enacting

proper legislation for environmental protection and reshaping the institutional frameworks they can further enhance the progress they have made to date. On the basis of the analysis carried out in the research paper, the following conclusion can be made:

To integrate EIA into sustainable resource management

- The environmental management plan must be the heart of the EIA procedure. Impact identification, impact assessment, etc. have to serve the purpose of environmental management. Emphasis on environmental management should be reflected in the project document
- Compliance monitoring and project auditing should be institutionalized and carried out on a regular basis
- Close coordination of EIA with project cycle should be institutionalized
- The legal provisions should be adjusted and expanded accordingly

Strengthening EIA Capacity in Asia

EIA systems in Asia vary widely. Some countries, such as the Philippines and Indonesia, have undertaken EIA studies for nearly two decades. They have developed EIA laws and legislations, acquired considerable practical experience, and marshaled significant institutional and personal resources. Other countries, such as Laos, Cambodia, Vietnam, and Nepal have just begun to carry out EIAs, but have not yet gathered all of the resources needed to conduct EIAs systematically.

No single set of recommendations can apply equally to such widely differing situations. The following recommendations make most sense in countries like Indonesia, the Philippines, India, Sri Lanka, China which are trying to strengthen or “fine tune” an existing EIA system. Countries that are creating or are about to create an EIA system should also find them useful, though a thorough review of environmental policies, capabilities, and institutional structures should be carried out first. According to Smith and Wansem (1995) the recommendations are:

- Recommendation #1 Facilitate Public Participation
- Recommendation #2 Make Information Available to the Public
- Recommendation #3 Clarify Participants' Responsibilities
- Recommendation #4 Provide Training for All Participants
- Recommendation #5 Link EIA to Development Planning,
Programming, and Policy-Making
- Recommendation #6 Collect and Manage Environmental Data
- Recommendation #7 Link EIA to Project Permitting and
Licensing
- Recommendation #8 Prepare Clear, Concise EIA Report
- Recommendation #9 Create an EIA Network
- Recommendation #10 Conduct EIA Demonstration Projects

These ten recommendations address the key problems identified during the World Resource Institute's Comparative Assessment study (Smith and Wansem, 1995). While practicing these recommendations, EIA agencies should focus on the following strengthening efforts:

- Be achievable in the near-term within their country
- Strengthen existing institutions rather than create new ones
- Rely on existing internal sources of funding, rather than new or external sources
- Strengthen institutions and skills at the local or district level, as well as the national and intro-regional levels
- Encourage multi-disciplinary and multi-institutional approaches, rather than more narrow approaches
- Maximize learning opportunities for EIA practitioners within the country or region as well as those from Northern countries

The prospects for resource management in Asian countries rest on efforts directed at curbing poverty through increased growth and sustainable development. Increased growth requires more development that might reduce the effect of sustainability if the development work is not planned and managed properly. To achieve this end, Asian countries have to adopt and adhere to an integrated approach to resource management. Through necessary legislation and institutional arrangement Asian countries can utilize the EIA process as an efficient decision-making for proper environmental management. Although Asian countries are getting more ready to comply with EIA, they still need to improve their strategies for development by following the whole process of EIA.

References

- Anonymous. 1998. Chinalaw: Laws and Regulations of the PRC. WWW document. URL <<http://www.qis.net/chinalaw/prclaw9.htm#20>>.
- Anonymous. 1995. World Bank Environmental Assessment Guidelines. *WWW Document*. URL <<http://www.his.com/%7Emesas/policy1.htm>>.
- Anonymous. 1994. Country Profile: Laos. WWW document. URL <[http://rs6.loc.gov/cgi-bin/query/r?frd/cstdy:@field\(DOCID+la0005\)](http://rs6.loc.gov/cgi-bin/query/r?frd/cstdy:@field(DOCID+la0005))>.
- Asian Development Bank (ADB). 1998. ADB Inspection Policy. *WWW Document*. URL <<http://asiandevbank.org/policy/inspect.htm>>.
- Asian Development Bank (ADB). 1997a. Ghuizho Shuibai Railway Project of China. *EIA Summary Report*. ADB, Manila
- Asian Development Bank (ADB). 1997b. LPG Pipeline Project of India. *EIA Summary Report*. ADB, Manila.
- Asian Development Bank (ADB). 1997c. Power Transmission and Distribution Project of Lao PDR. *EIA Summary Report*. ADB, Manila.
- Asian Development Bank (ADB). 1994. North Java Road Improvement Project of Indonesia. *EIA Summary Report*. ADB, Manila.
- Banham, W. and D. Brew. 1996. A Review of The Development of Environmental Impact Assessment in India. *Project Appraisal*. 11(3): 195-202.
- Basta, D. And B. Bower (eds). 1982. *Analyzing Natural Systems*. Resources for the Future, Washington, D.C.
- Benveniste, G. 1981. *Regulation and Planning: The Case of Environmental Politics*. Boyd and Fraser, San Francisco.
- Bisset, R. 1987. Methods for Environmental Impact Assessment: A Selective Survey with Case Studies, in A.K. Biswas and Q. Geping (eds) *Environmental Impact Assessment for Developing Countries*. Tycooly International, London. 5-64
- Biswas, A. K. and S. B. C. Agarwala. (eds). 1994. *Environmental Impact Assessment for Developing Countries*. Butterworth-Heinemann, Newton.

- Biswas, A.K. et al (eds). 1990. *Environmental Modeling for Developing Countries*. Tycooly International, London.
- Blowers A. (ed.). 1993. *Planning for Sustainable Environment*. Earthscan, London.
- Carley, M.J. and E.S. Bustelo. 1984. *Social Impact Assessment and Monotoring*. Westview, Boulder, Co.
- Clark, R. and L. Canter . (eds). 1997. *Environmental Policy and NEPA: Past, Present, and Future*. St. Luice Press, Florida.
- Caldwell, I.K. 1982. *Science and the National Environmental Policy Act: Reading Policy Through Procedural Reform*. University of Alabama Press. Montgomery, Alabama.
- Cayer, N.J. and L.F. Weschler. 1988. *Public Administration: Social Change and Adaptive Management*. St. Martin Press, New York.
- Craine, L.E. 1971. Institutions for Managing Lakes and Bays. *Natural resources Journal*. 11:519-46.
- Central Intelligence of America (CIA). 1997. *The World Fact Book 1997*. Office of Public and Agency Information, Washington, D.C.
- Confederation of Indian Industry (CII). 1995. *Indian Environmental Legislation: Guide for Industry and Business*. CII, New Delhi.
- Craine, L.E. 1971. Institution for Managing Lakes and Bays. *Natural Resources Journal*. 11:519-546.
- Dally, H.F. and J. Cobb. 1994. *For the Common of Good*. Beacon Press, Boston.
- Erickson, P. A. 1994. *A Practical Guide to Environmental Impact Assessment*. Academic Press, Inc., California.
- Farooque, M. And S.R. Hasan. 1996. *Laws Regulating Environment in Bangladesh*. Bangladesh Environmental Lawyers Association (BELA), Dhaka.
- Flood Plan Coordination Organization(FPCO). 1992. *Guidelines for Environmental Impact Assessment (EIA)*. Ministry of Irrigation, Water Development, and Flood Control. Dhaka Bangladesh.
- Gilpin, A. 1994. *Environmental Impact Assessment (EIA): Cutting Edge for the 21st Century*. Cambridge University Press, New York.

- Glasson, J.; R. Therivel and A. Chadwick. 1995. *Introduction to Environmental Impact Assessment: Principles and Procedures, Process, Practice and Prospects*. UCL Press, London.
- Goodland, R. and H. Daly. 1994. Environmental Sustainability: Universal and Non-Negotiable. *Paper Presented to the Conference of Ecological Society of America*. Knoxville, Tennessee. August 7-11.
- Goodland, R. 1992. The Case that the World has Reached Limits. *Population and Environment*. 13(2):167-182.
- Govt. of Bangladesh(GOB). 1998. Documents on Jamuna Multipurpose Bridge. JMBA. Dhaka, Bangladesh.
- Govt. of Bangladesh(GOB). 1994. Documents on Jamuna Multipurpose Bridge. JMBA. Dhaka, Bangladesh.
- Govt. of Indonesia. 1998. Environmental Impact Management Agency (BAPEDAL) of Indonesia. *WWW Document*. URL <<http://www.bapedal.go.in/index-e.html>>.
- Hatfield, S. B. and B. and Evans (eds). 1996. *Environmental Planning and Sustainability*. John Wiley & Sons, Chichester, UK.
- Hollick, M. 1986. Environmental Impact Assessment: An International Evaluation. *Environmental Management*. 10(2): 157-178.
- International Union for the Conservation of Natural Resources (IUCN). 1980. World Conservation Strategy. *IUCN Report*. Gland, Switzerland.
- Jamuna Multipurpose Bridge Authority (JMBA). 1994. *Environmental Management Action Plan*. Conducted by Department of Civil Engineering (Environmental Division), Bangladesh University of Engineering and Technology, Dhaka.
- Jamuna Multipurpose Bridge Authority (JMBA). 1993a. *Revised Resettlement Action Plan*. Conducted by Resettlement Unit, JMBA, Dhaka, Bangladesh.
- Jamuna Multipurpose Bridge Authority (JMBA). 1993b. *Fisheries Impact and Mitigation Study*. Conducted by Agrodev Canada Inc. JMBA, Dhaka, Bangladesh.
- Jamuna Multipurpose Bridge Authority (JMBA). 1992a. *Dhaleswari Mitigation Plan*. Conducted by GHK/MRM International Ltd., JMBA, Dhaka, Bangladesh.
- Jamuna Multipurpose Bridge Authority (JMBA). 1992b. *Land Use Master Plan*. Conducted

by GHK/MRM International Ltd., JMBA, Dhaka, Bangladesh.

Jamuna Multipurpose Bridge Authority (JMBA). 1992c. *Report of the Wildlife Study Group*. Conducted by Department of Zoology, University of Dhaka, Bangladesh.

Lee, N. And C. Wood. 1978. EIA - A European Perspective. *Built Environment*. 4:101-110.

Leopold, L. et al . 1971. *A Procedure for Evaluating Environmental Impact*. Survey Circular 645. US Geological Survey, Washington, D.C.

Local Government Engineering Department (LGED). 1994. *Guidelines on Environmental Issues Related to Physical Planning*. Ministry of Local Government. Dhaka, Bangladesh.

Marriott, B.B. 1997. *Environmental Impact assessment: A practical Guide*. McGraw-Hill, New York.

Matin, A. 1998. Chief Engineer (Retd.), Jamuna Multipurpose Bridge. Roads & Highways Department, Govt. of Bangladesh, Dhaka. *Interview*. March 13, 1998.

McCormick, J.F. 1994. *Handout on Sustainable Development*. Institute for International Training in Sustainable Development. Ecology Department, The University of Tennessee, Knoxville.

McHarg, I. 1969. *Design with nature*. Doubleday, Garden City, New York.

Ministry of Environment and Forestry. 1995a. *National Environment Management Action Plan, Volume I*. Government of the People's Republic of Bangladesh.

Ministry of Environment and Forestry. 1995b. *National Environment Management Action Plan, Volume II*. Government of the People's Republic of Bangladesh.

Mitchell, B. 1989. *Geography and Resource Analysis*, 2nd edn. Longman, London.

Muschett, D.F. (ed). 1997. *Principles of Sustainable Development*. St. Lucie Press, Florida.

Munn, R.E. 1983. The Theory and Application of Modeling in Environmental Impact Assessment, in PADC, EIA and Planning Unit (ed) *Environmental Impact Assessment*. Martinus Nijhoff, the Hague.281-292

Rahman, A. 1998. Chief Engineer (Retd.), Roads & Highways. Govt. of Bangladesh, Dhaka. *Interview*. March 26, 1998.

Ross, W. A. 1993. *Environmental Impact Assessment in the Philippines: Process, Problems,*

- and Directions for the Future. *Environmental Impact Assessment Review*. 14(4): 217-232.
- Roth, R. A. 1993. *Sustainable Development: Political/Ideological Aspects and Implications for Planning (Thesis)*. Virginia Polytechnic Institute and State University, Blacksburg.
- Runnalls, D. 1994. Environmental Management or Management for Sustainable Development. *Environmental Management in Developing Countries*. OECD, Paris. 23-45.
- Sankoh, O. A. 1996. Making Environmental Impact assessment Convincible to Developing Countries. *Journal of environmental Management*. 47(2): 185-189.
- Saunders, A. M. 1996. Environmental Impact Assessment As A Tool for Ongoing Environmental Management. *Project Appraisal*. 11(2): 94-95.
- Schmidheiny, S. 1996. Eco-Efficiency and Sustainable Development. *Risk Management*. 43(7): 51-53.
- Selman, P. 1992. *Environmental Planning: The Conservation and Development of Biophysical Resources*. Paul Chapman Publishing Ltd., London.
- Serageldin, I. 1993. Making Development Sustainable. *Finance & Development*. 30(4): 6-10.
- Sheate, W. 1996. *Environmental Impact assessment: Law and Policy - Making An Impact*. Gaunt Inc., Holmes Beach.
- Slocombe, D. S. 1993. Environmental Planning, Ecosystem Science, and Ecosystem Approaches for Integrating Environment and Development. *Environ-Manag-Springer-Verlag*. 17(3): 289-303.
- Smith, D.B. and M.V. Wansem (eds.). 1995. *Strengthening EIA Capacity in Asia: Environmental Impact Assessment in the Philippines, Indonesia and Sri Lanka*. World Resources Institute, Washington.
- Smith, L.G. 1993. *Impact Assessment and Sustainable Resource Management*. Longman Scientific & Technical, England.
- Syed, A.S. 1998. *Introduction to Environmental Laws of Bangladesh*. ACE Data Products, Dhaka
- Therivel, R.; Glasson, J. and Clark, A. 1994. *Introduction to Environmental Impact Assessment*. Taylor and Francis Inc., Bristol.

- Turner, R.K. (ed.). 1988. *Sustainable Environmental Management: Principles and Practice*. Belhaven, London.
- United Nations Environment Program (UNEP). 1996. *Environmental Impact assessment: Issues, Trends and Practice*. Environment & economic Unit, Nairobi, Kenya.
- United Nations Economic Commission for Europe. 1991. *Policies and Systems of Environmental Impact assessment*. UN, Geneva.
- United Nations Conference on Environment and Development (UNCED). 1992. Agenda 21, As Adopted by the Plenary Session in Rio de Janeiro on June 14, 1992. UN, New York.
- United Nations Development Program (UNDP). 1988. *Environmental Impact Assessment: Basic Procedures for Developing Countries*. UNEP, Regional Office for Asia and Pacific, Bangkok.
- Valappil, M.; Devuyt, D. and Hens, L. 1997. Evaluation of the Environmental Impact Assessment Procedure in India. *Impact Assessment*. 12(1): 75-88.
- Wathern, P. 1988. *Environmental Impact Assessment: Theory and Practice*. Rutledge-Chapman and Hall Inc., New York.
- Wenger, R. B. ; W. Huadong and M. Xiaoyinng. 1990. Environmental Impact assessment in the People's Republic of China. *Environ-Manag-Springer-Verlag*. 14(4): 429-439.
- Wood, C. 1995. *Environmental Impact Assessment - A Comparative Review*. Longman Scientific & Technical, England.
- Wood, C. 1992. The Impact of Environmental Assessment on Local Planning Authorities. *Journal of Environmental Management*. 35(2): 115-127.
- World Bank. 1998. The Inspection Panel for the World Bank. *WWW Document*. URL < <http://worldbank.org/html/ins-panel/overview.html>.
- World Commission on Environment and Development. 1987. *Our Common Future*. Oxford University Press, New York.
- World Resources Institute. 1990. *Toward An Environmental and Natural Resources Management Strategy for ANE Countries in the 1990s*. Submitted to the Asia and Near East Bureau, USAID.

VITA

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Following graduation he entered the Department of Horticulture, Bangladesh Agricultural University, where he received his Master of Science degree in 1992. During 1990-1991 the National Fellowship for Science and Technology Foundation awarded him a Fellowship. In August 1992 he began graduate studies at the University of Tennessee, Knoxville and acquired a Master of Science degree with a major in Ornamental Horticulture and Landscape Design in August 1995.

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He is a member of Bangladesh Society for Horticultural Science and Crop Science Society of Bangladesh. While attending Bangladesh Agricultural University he was engaged in different cultural activities and held several offices. He is an amateur sculptor and musician. He is also a member of American Planning Association (APA) and Knoxville Greenway Coalition.