

# **Environmental Impact Assessment (EIA)**

## **1. INTRODUCTION**

### **1.1 Environment and Environmental Impacts**

Environment is the totality of the surrounding biosphere, atmosphere, lithosphere and biosphere and the dynamic interactions inherent in these components. According to ISO 14001, Environment can be defined as 'Surrounds which an organization operates, including air, water, land, natural resources, flora, fauna, human and inter relation'. The two main categories of the environment are biotic and abiotic environments. The biotic and abiotic components constantly affect each other and cannot be isolated from each other. The environment has never been constant and static. It has always been changing, sometimes slowly and sometimes rapidly or drastically. Thus like other organisms, man is also affected by his environment and these changes in environment may benefit or harm the man or other organisms living in it. Many species on earth could not cope up with changing environment, as a result of which they have since vanished and many are on the brink of vanishing.

The environment is the ultimate source for basic needs of human beings. Human being by utilizing environmental resources, releases energy and waste products which have detrimental impacts. Environmental impacts associated with socio-economic development harm or improve the environment in one way or another. As a result, an environmental impact associated with any economic, social, political and cultural practices has to be studied systematically as the carrying and buffering capacity of the environment is limited. Our understanding of the connections between human life and other elements of nature is limited. We also have the power to destroy the natural systems that sustain us. Our capacity for destruction is illustrated through the deterioration of the ozone layer, through the extinction of species, and through mass deforestation and desertification. In many parts of the world, economic development projects directed at improving levels of material comfort have had unintended detrimental effects on people and natural resources. Water, land, and air have been degraded to the point where they can no longer sustain existing levels of development and quality of life. With inadequate environmental planning, human activities have resulted in the disruption of social and communal harmony, the loss of human livelihood and life, the introduction of new diseases, and the destruction of renewable resources. These and other consequences can negate the positive benefits of economic development. Economic development in developing countries has been focused on immediate economic gains environmental protection has not been a priority because the economic losses from environmental degradation often occur long after the economic benefits of development have been realized.

**Environmental impact** is any change to the environment or its component that may affect human health or safety, biophysical conditions, or cultural heritage, other physical structure with positive or negative consequences. The **environmental impacts** of a project are that resultant changes/alteration in natural, environmental and man-made parameters. An impact has both spatial and temporal components and can be described as the change in an environmental parameter, over a specified period and within a defined area, resulting from a particular activity compared with the situation which would have occurred had the activity not been initiated.

Impacts are distinguished as direct (primary) and indirect (secondary, tertiary and higher order). Some impacts are a direct consequence of a particular activity. Other impacts however occur as a result of changes in a chain of environmental parameters. An impact that may in itself not be significant but the combination of one or more impacts that can have a greater effect than the sum of the individual impacts is called cumulative impact. The major environmental problems which continue to incite human concern are varied. Over population, soil erosion, depletion of natural resources, poverty, loss of bio diversity, pollution of the environment and many more. All these problems of the environment are mainly due to the anthropogenic activities which are dangerous both to the earth and to us.

## **1.2 What is Environmental impact assessment?**

Simply defined, EIA is a systematic process to identify, predict and evaluate the environmental effects of proposed actions and projects. This process is applied prior to major decisions and commitments being made. **A broad definition of environment is adopted; whenever appropriate social, cultural and health effects are considered as an integral part of EIA.** Particular attention is given in EIA practice to *preventing, mitigating and offsetting the significant adverse effects of proposed undertakings.*

An EIA may be defined as:

- ⊕ A formal process to predict the environmental consequences of human development activities and to plan appropriate measures to eliminate or reduce adverse effects and to augment positive effects. (FAO definition)
- ⊕ A process used to identify and predict the impact on the environment and on man's health and wellbeing of legislative proposals, policies, programs, projects and operational procedures, and to interpret and communicate information about the impacts. (Munn,1979)
- ⊕ 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 judgments on whether the development should go ahead. (UK DoE,1989)

*EIA is a planning tool which is used, together with the project feasibility study, to ensure that the project plan is the optimal economic-cum-environmental plan, that is, the plan is environmentally as well as economically sounds and thus represents the best approach to planning for development projects in order that continuing economic development will be sustainable.* The purpose of the assessment is to ensure that decision makers consider the ensuing environmental impacts to decide whether or not to proceed with the project.

Specifically, an EIA:

- ✓ Identifies the sources of impacts
- ✓ Predicts the likely environmental impacts of projects
- ✓ Finds ways to reduce unacceptable impacts and enhance the positive contributions of the project
- ✓ Presents to decision makers and other concerned agencies the results of the assessed impact of the projects.

Based on the above definitions, one can observe that EIA has three basic functions:

- To predict problems,
- To find ways to avoid them, and
- To enhance positive effects.

### **1.3 History of EIA and The concept of sustainable development**

EIA is one of a number of policy tools that are used to evaluate project proposals. It is also a relatively recent development when compared to use of economic appraisal methods. A number of factors led to the introduction of EIA in the US National Environmental Policy Act (NEPA, 1969), including public concern about the quality of the environment and the increasing effects of new technologies and ever-larger development schemes. In addition, then available economic appraisal techniques, such as benefit cost analysis, did not take account of the environmental and social impacts of major projects.

The first formal process to assess environmental impacts was conducted in the US in the early 1970s, in response to rising public concern over environmental deterioration. The passage of the US National Environmental Policy Act of 1969 (NEPA) mandated the EIA process for all projects involving federal actions, including the issuance of permits, licenses, and financial assistances. NEPA was intended to provide full and fair discussion of the significant environmental impacts of a planned action and to inform decision makers and the public of the reasonable alternatives, which would avoid or minimize adverse impacts, or enhance the quality of the human environment.

In the 1970's, following concern over pesticide deaths in Pakistan associated with a USAID funded activity, environmental groups claimed USID over its lack of compliance with NEPA. Regulation 216 and the environmental review procedure were formulated to address these concerns.

In the past several years, an increasing number of countries and multinational institutions have enacted laws and directives establishing EIA requirements for project reviews. In 1989, The World Bank issued

an operational directive requiring EIAs for certain categories of projects. In 1985, the European Economic Community issued a directive establishing minimum requirements for EIA in all member countries. The United Nations Environment Program (UNEP) adopted goals and principles of EIA in 1987. In 1991, twenty six nations of the United Nations Economic Commission for Europe signed a Convention on EA in a Tran’s boundary Context, requiring all signatory nations to establish EIA procedures for Tran’s boundary impacts.

**Table 1 summary of Major trends in EIA**

Phase	TIME	Key Events
<i>Source: updated and amended from Sadler,1996</i>		
Introduction and early development	1970-1975	Mandate and foundations of EIA established in the USA; then adopted by a few other countries (e.g. Australia, Canada, and New Zealand); basic concept, procedure and methodology still apply.
Increasing scope and sophistication	mid 70s to early 80s	More advanced techniques (e.g. risk assessment); guidance on process implementation (e.g. screening and scoping); social impacts considered; public inquiries and reviews drive innovations in leading countries; take up of EIA still limited but includes developing countries (e.g. China, Thailand and the Philippines).
Process strengthening and integration	early 80s to early 90s	Review of EIA practice and experience; scientific and institutional frameworks of EIA updated; coordination of EIA with other processes, (e.g. project appraisal, land use planning); ecosystem- level changes and cumulative effects begin to be addressed; attention given to monitoring and other follow-up mechanisms. Many more countries adopt EIA; the European Community and the World Bank respectively establish supra-national and international lending requirements.
Strategic and sustainability orientation	Early 90s to date	EIA aspects enshrined in international agreements (see Section 2 Law, policy and institutional arrangements); marked increase in international training, capacity & building and networking activities; development of strategic environmental assessment (SEA) of policies and plans; inclusion of sustainability concepts and criteria in EIA and SEA practice; EIA applied in all OECD countries and large number of developing and transitional countries.

Sustainable development is a key concept that has gained increasing international acceptance during the last two decades. A milestone in this process was the ‘*Brundtland*’ report, which defined sustainable development as “*development that meets the needs of the present generation without compromising the ability of future generations to meet their own needs*” (World Commission on Environment and Development (WCED), 1987). Five years later, the UN Conference on Environment and Development (UNCED), the Earth Summit, established a number of international agreements, declarations and commitments (see table 2 below). Agenda 21, the global action plan for sustainable development,

emphasizes the importance of integrated environment and development decision-making and promotes the use of EIA and other policy instruments for this purpose.

**Table 2 Four cornerstones of the Earth Summit**

<b>Cornerstone</b>	<b>Summary</b>
The Rio Declaration on Environment and Development	A set of principles which provide guidance on achieving sustainable development
Framework Convention on Climate Change	An internationally treaty to stabilize greenhouse gas concentrations in the atmosphere.
Convention on Biological Diversity	An international convention with three objectives: the conservation of biodiversity, the sustainable use of its components, and the equitable sharing of benefits from genetic resources
Agenda 21	A global program of action for achieving sustainable development to which countries are ‘politically committed’ rather than legally obligated

#### **1.4 Purpose and Significance of EIA**

EIA is applied primarily to prevent or minimize the adverse effects of major development proposals, such as power stations, dams and reservoirs, industrial complexes, etc. It is also used as a planning tool to promote sustainable development by integrating environmental considerations into a wide range of proposed actions. Most notably, strategic environmental assessment (SEA) of policies and plans focuses on the highest levels of decision making, when better account can be taken of the environment in considering development alternatives and options. More limited forms of EIA can be used to ensure that smaller scale projects, conform to appropriate environmental standards or site and design criteria. Such projects include dredging activities, road realignment and upgrading, and housing subdivisions.

The aims and objectives of EIA can be divided into two categories. The **immediate (short term) aim of EIA** is to inform the process of decision-making by identifying the potentially significant environmental effects and risks of development proposals. The **ultimate (long term) aim of EIA** is to promote sustainable development by ensuring that development proposals do not undermine critical resource and ecological functions or the wellbeing, lifestyle and livelihood of the communities and peoples who depend on them.

Immediate objectives of EIA are to:-

- provide information for decision-making on the environmental consequences of proposed actions;
- Improve the environmental design of the proposal;

- Ensure that resources are used appropriately and efficiently;
- Identify appropriate measures for mitigating the potential impacts of the proposal; and
- Facilitate informed decision making, including setting the environmental terms and conditions for implementing the proposal

Long term objectives of EIA are to:-

- ❖ Promote environmentally sound and sustainable development through the identification of appropriate enhancement and mitigation measures.
- ❖ protect human health and safety;
- ❖ avoid irreversible changes and serious damage to the environment;
- ❖ safeguard valued resources, natural areas and ecosystem components; and
- ❖ Enhance the social aspects of the proposal

### **1.5 Constraints for Implementing Environmental Assessment Procedures in Developing Countries**

1. The legal, administrative, institutional, and procedural frameworks for EIA often constrain the implementation of EIA in developing countries.
2. Highly trained technically competent people are required to operate and manage an EIA process.
3. Failure to review the EIA within the defined timeframe is treated as a *de facto* authorization to the Permitting agency to issue a permit.
4. In making general observations about EIA in many developing countries;-
  - I. The EIA process is seen as a bureaucratic requirement needed to obtain project approval;
  - II. Political interference determines the outcomes of some environmental reviews;
  - III. Questionable practices by public servants serve to discredit the process; and
5. The treatment of projects in environmentally critical areas is less than satisfactory. All four of these are common to many developing countries. Except for the limited amount, public participation is largely absent from the practice of EIA in most developing countries.
6. There are very real constraints on the availability of environmental information to be used in an EIA report.

## **2. POLICY, SOCIAL, INSTITUTIONAL AND LEGAL ASPECTS OF EIA**

### **2.1. Environmental Policy of Ethiopian (EPE)**

Environmental Policy of Ethiopia (EPE), which was adopted in April 1997, supports Constitutional Rights through its guiding principles including ensuring:

- ❖ environmental sustainability, (minimize degrading and polluting impacts on ecological and life support systems),
- ❖ wise use and management of renewable and non-renewable resources,
- ❖ public involvement and empowerment, full environmental and social costs or benefits foregone or lost, and
- ❖ The integrated implementation of cross sectoral and sectorial federal, regional and local policies shall be seen as a prerequisite to achieving the objectives of this Policy on the Environment.

The EPE has also provides Sectoral Environmental Policies and Cross-sectoral Environmental Policies. Environmental Impact Assessment policies are included in the latter. The EIA policies are to ensure that:-

- A. EIA Consider not only physical and biological impacts but also address social, socio-economic, political and cultural conditions.
- B. Public private sector development programs and projects recognize any environment impact early and incorporate their containment into the development design process;
- C. To recognize that public consultation as an integral part of EIA and ensure that EIA procedures make provision for both an independent review and public comment before consideration by decision makers;
- D. Environmental impact statement always includes mitigation plans for environmental management problems and contingency plans in case of accidents;
- E. at specified intervals during project implementation, environmental audit regarding monitoring, inspection and record keeping take place for activities where these has been required by the environmental Impact Statement;
- F. To ensure that preliminary and full EIAs are under taken by the relevant sectoral ministries or departments, if in the public sector, and by developer, if in the private sector;
- G. To create by law an EIA process which requires appropriate environmental impact statements and environmental audits for private and state development projects;
- H. To establish the necessary institutional framework and determine the linkages of its parts for undertaking, coordinating and approving EIAs and the subsequent system of environmental audits required to ensure compliance with conditionalities;
- I. To develop sectoral technical guidelines in EIAs and environmental audits;

- J. To ensure that social , socioeconomic, political and cultural conditions are considered in environmental impact assessment procedures and included in sectoral guidelines;
- K. To develop EIA and environmental audit capacity and capability in the Environmental Protection Authority, sectoral ministries and agencies as well as in the region

#### **2.4 Legal Framework for EIA**

Environmental policy without appropriate legislation will be ineffective as, in turn, will be legislation without enforcement. In many developing countries legislation on environmental issues has been in existence for many years. For example, laws exist in most countries for the prevention of water pollution. Much of the existing legislation or regulations have not been considered "environmental". Recently, much specific new environmental legislation has been enacted. This may be as a response to major disasters, or may result from government policy, public pressure or the general increased international awareness of the environmental dangers that now exist in the world. Relevant water and land law as well as environmental protection legislation needs stating, understanding and analyzing as part of an EIA.

New legislation may include a statutory (constitutional) requirement for an EIA to be done in a prescribed manner for specific development activities. When carrying out an EIA it is thus essential to be fully aware of the statutory requirements and the legal responsibilities of the concerned institutions. These are best given as an annex to the terms of reference. The legal requirements of the country must be satisfied. New laws can impose an enormous burden on the responsible agencies. The statutory requirement to carry out an EIA for specific projects will, for example, require expert staff to carry out the study, as well as officials to review the EIA and approve the project.

Laws designating what projects require EIA should, ideally, limit the statutory requirements to prevent EIA merely becoming a hurdle in the approval process. This will prevent large volumes of work being carried out for little purpose. Most legislation lists projects for which EIA is a discretionary requirement. The discretionary authority is usually the same body that approves an EIA. This arrangement allows limited resources to be allocated most effectively. However, it is essential that the discretionary authority is publicly accountable.

When external financial support is required it will also be necessary to satisfy the obligations of the donor organization. Most major donors now require an EIA for projects relating to irrigation and drainage. The function of environmental legislation can vary. It is not easy to give a precise definition of when an EIA is needed. Therefore the statutory requirement for an EIA is not particularly well suited to law. On the other hand many of the most important environmental hazards are easily addressed by law. For example, it is straightforward to set legal limits for pollution, flow levels, compensation etc. here the problem is one of enforcement. It is normal for an EIA to assess the acceptability or severity of impacts in relation to legal

limits and standards. However, it is important to highlight cases where existing standards are insufficiently stringent to prevent adverse impacts and to recommend acceptable standards. Enforcement problems can be partially addressed by changing institutional structures.

Laws relating to irrigated lands are complex and according to an FAO study of five African countries they are not generally applied (FAO, 1992). There are conflicts between modern and customary laws: the former tend to be given prominence although the latter are usually strong locally. Traditional and customary rights have often developed in very different historical and political contexts and can vary greatly over a short distance. They may also be mainly oral and imprecise. Local participation in the preparation of the EIA will help to understand important customary rights and highlight possible weaknesses in any proposed development.

#### **2.4.1 Legal Acts in Ethiopia**

The proclamation No1/1995 to pronounce the coming into effect of the constitution of the FDRE (issued on 21, August 1995) gave very good columns, which consider environmental issues. The same is done the Amhara National Regional State in the Regional Constitution Declared on Gazette No-2; 22, June 1995. These legislations have shown up the recognition of environmental rights and obligations in line with regional/country development.

**Article 43, 44 and 92 of the Federal Constitution** state the following people's environmental concerns.

##### **❖ Article 43: The Right to Development**

1. The peoples of Ethiopia as a whole and each Nation, Nationality and people in Ethiopia in particular have the right to improve living standards and to sustainable development.
2. Nations have the right to participate in national development and, in particular, to be consulted with respect to policies and projects affecting their community
3. All international Agreements and relations concluded, established or conducted by the state shall protect and ensure Ethiopia's right to sustainable development.
4. The basic aim of development activities shall be to enhance the capacity of citizens for development and to meet basic needs.

##### **❖ Article,44 : Environment Rights**

1. All persons have the right to live in a clean and healthy environment.
2. All persons who have been displaced or whose livelihoods have been adversely affected as a result of state programs have the right to commensurate monetary or alternative means of compensation, including relocation with adequate state assistance.

##### **❖ Article, 92: Environmental Objective**

1. Government shall endeavor to ensure that all Ethiopians live in a clean and healthy environment

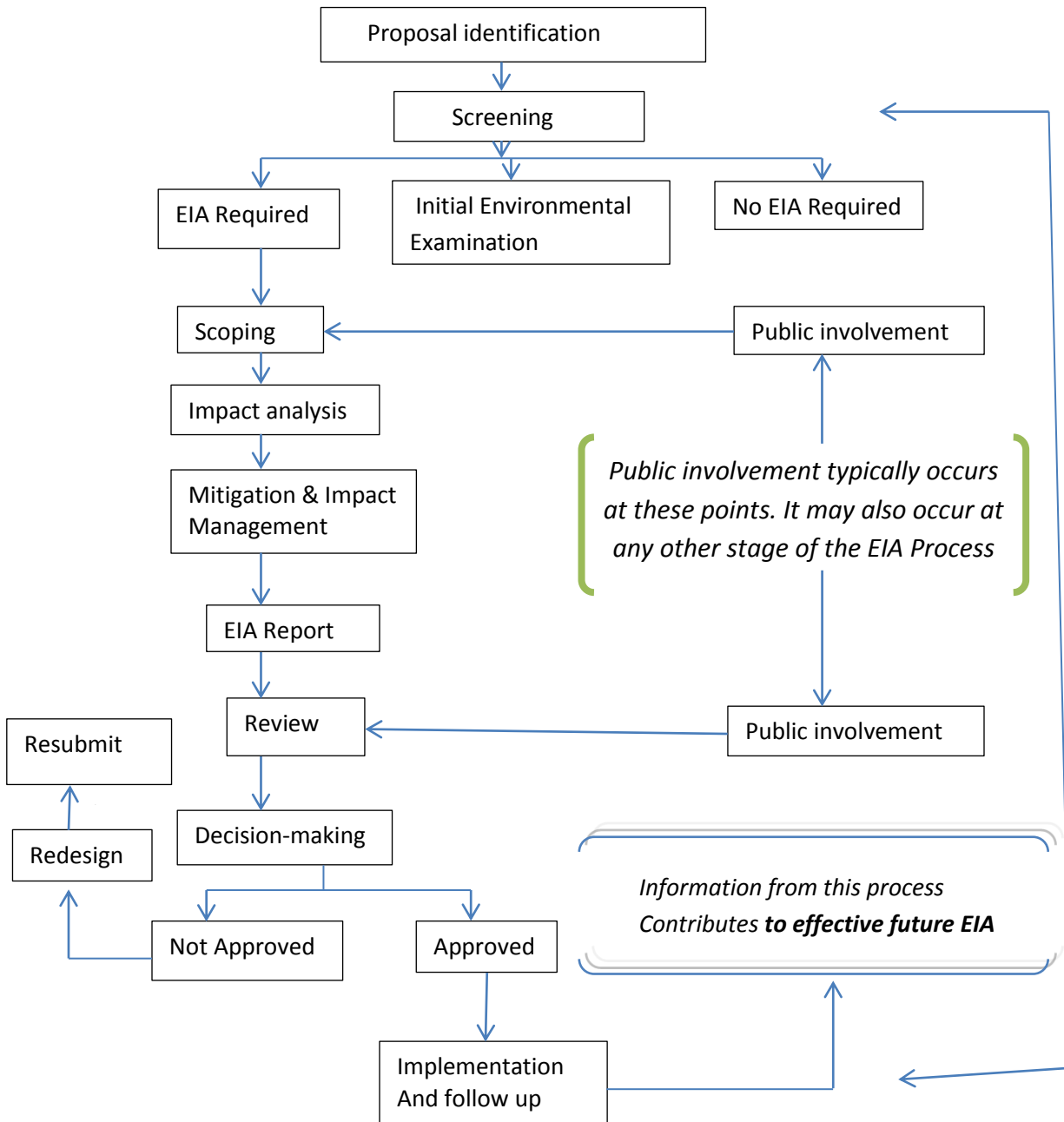
2. The design and implementation of programs and projects of development shall not damage or destroy the Environment.
3. People have the right to full consultation and the expression of views in the planning and implementation of environmental policies and projects that affect them directly
4. Government and citizens shall have the due to protect the environment "Environmental Protection organs Establishment proclamation No.295/2002" has stipulate the need to establish a system that enables to foster coordinated but differentiated responsibilities among environmental protection agencies at federal and regional levels. The proclamation has also requires the establishment of Sectoral and Regional Environmental Units and Agencies, respectively.

The Environmental Impact Assessment Proclamation (Proc. No. 299/2002) Has made it mandatory that development projects or public instruments (policies, Programs, Plans) have to subject to EIA/EA scrutiny. It means that EA is a legal requirement. The proclamation has also defined the jurisdictions at Federal and Regional environmental agencies. Moreover, includes several provisions including incentives and punitive measures. This proclamation is a backbone to harmonizing and integrating environmental, economic, cultural, and social considerations into a decision making process in a manner that promotes sustainable development.

The "Environmental Pollution Control Proclamation No. 300/2002" is promulgated with a view to eliminate or, when not possible to mitigate pollution as an undesirable consequence of social and economic development activities. This proclamation is one of the basic legal documents need to be observed as corresponding to effective EIA administration.

### 3. EIA PROCESS

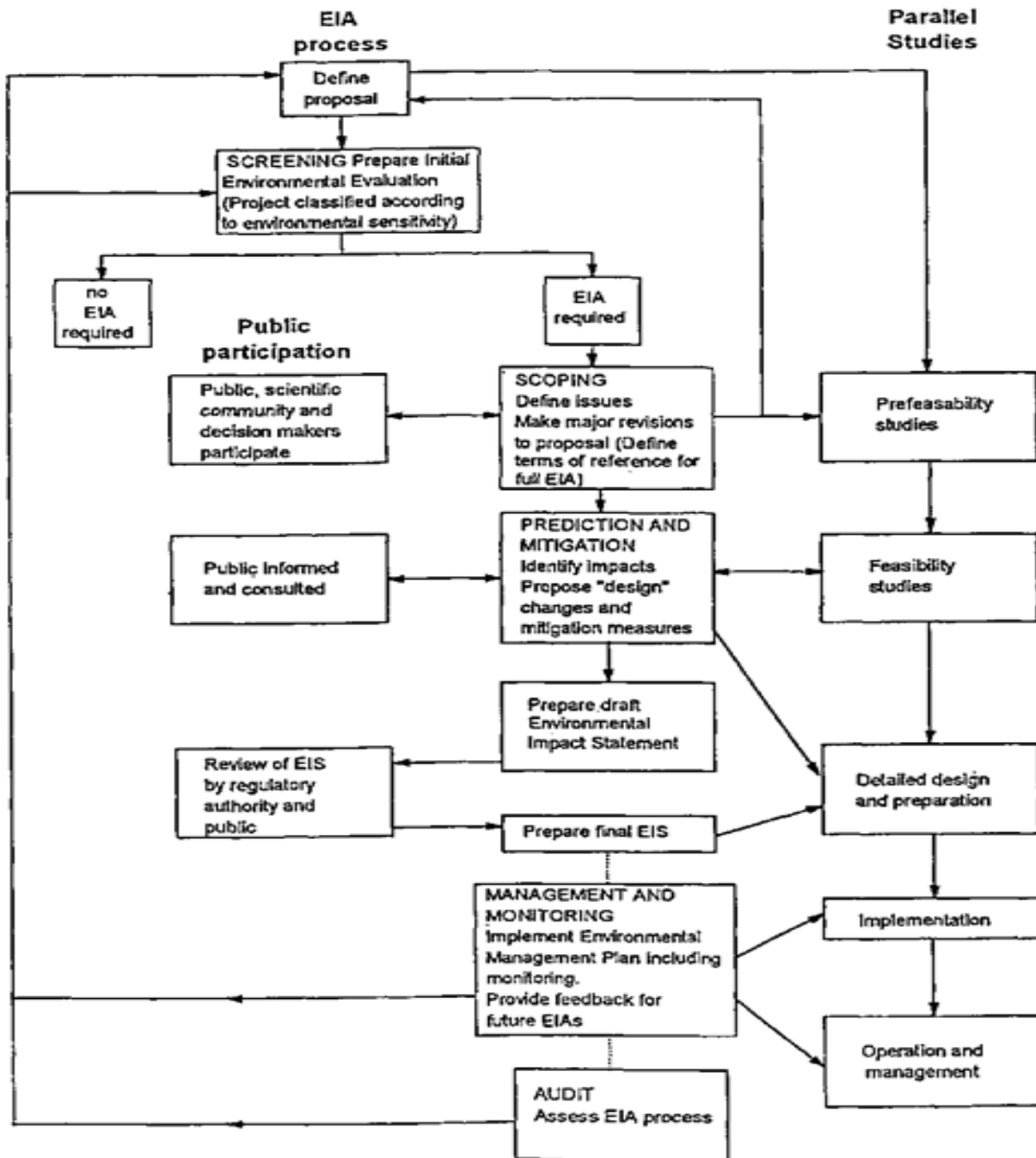
The particular components, stages and activities of an EIA process will depend upon the requirements of the country or donor. However, most EIA processes have a common structure and the application of the main stages is a basic standard of good practice. Typically, the EIA process begins with screening to ensure time and resources are directed at the proposals that matter environmentally. It should end with some form of follow up on the implementation of the decisions and actions taken as a result of an EIA report.



Clearly speaking EIA is part of a project planning process. EIA report is attached as part of the project plan before the inception of the project. The aim of EIA is to balance the environmental

interest in the larger scheme of development issues and concerns. The primary objective of EIA is to ensure that potential problems are foreseen and addressed at an early stage in the project's planning and design.

Figure 1 The EIA study and project planning processe as shown below daigrammatically.



## Guiding Principles of EIA

The basic principles that underline the objective of EIA are:

<b>Guiding principles of EIA good practice</b>	
<b>Principles</b>	<b>Practical application</b>
Purposive	EIA should meet its aims of informing decision making and ensuring an appropriate level of environmental protection and human health.
Focused	EIA should concentrate on significant environmental effects, taking into account the issues that matter.
Adaptive	EIA should be adjusted to the realities, issues and circumstances of the proposals under review.
Participative	EIA should provide appropriate opportunities to inform and involve the interested and affected publics, and their inputs and concerns should be addressed explicitly.
Transparent	EIA should be a clear, easily understood and open process, with early notification procedure, access to documentation, and a public record of decisions taken and reasons for them.
Rigorous	EIA should apply the best practicable methodologies to address the impacts and issues being investigated.
Practical	EIA should identify measures for impact mitigation that work and can be implemented.
Credible	EIA should be carried out with professionalism, rigor, fairness, objectivity, impartiality and balance.
Conservation based:	The EIA/EA process should strive to promote conservation based development
Flexibility	The assessment process should be able to adapt to deal efficiently with changing circumstances and decision making situations.
Accountability	This in particular focuses on answerability of proponent consultant and environmental agencies for their respective roles and responsibilities pertinent to the activities they had.
Time and cost effectiveness	The assessment process, its outcomes and decision taking will ensure environmental protection at the least cost and within reasonable time to society and developer alike.
Efficient	EIA should impose the minimum cost burden on proponents consistent with meeting process requirements and objectives.

### **Present clear options for the mitigation of impacts and for sound environmental management:**

To help decision makers, the EIA must be designed so as to present clear choices on the planning and implementation of the project, and it should make clear the likely results of each option. This principle thus focuses on the evolution of the environmental management plan as well as a post-project monitoring plan. For instance,

*To mitigate adverse impacts, the EIA could propose:*

- ⊕ Pollution control technology or design features;
- ⊕ The reduction, treatment, and/or disposal of wastes;

- ⊕ Compensation or concessions to affected groups.

*To enhance environmental compatibility, the EIA could suggest:*

- ✓ Several alternative sites;
- ✓ Changes to the project's design and operation (e.g., clean technology);
- ✓ Limitations to its initial size or growth;
- ✓ Separate programs which contribute in a positive way to local resources or to the quality of the environment.

*To ensure that the implementation of an approved project is environmentally sound, the EIA may prescribe:*

- ❖ Monitoring programs or periodic impact reviews;
- ❖ Contingency plans for regulatory action;
- ❖ Involvement of the local community in later decisions.

**Provide information in a form useful to the decision makers:** The objective of an EIA is to ensure that environmental problems are foreseen and addressed by decision makers. To achieve this objective, information should be presented to decision makers in terms and formats that are immediately meaningful.

- Briefly present hard facts and predictions about impacts, comments on the reliability of this information, and summarize the consequences of each of the proposed options.
- Write in the terminology and vocabulary that is used by the decision makers and the community affected by the project.
- Present the essential findings in a concise document, supported by separate background materials where necessary.
- Make the document easy to use and provide information visually whenever possible

### **3.1. Public participation for EIA**

Public involvement is a fundamental principle of the EIA process. Timely, well planned and appropriately implemented public involvement programed will contribute to EIA studies and to the successful design, implementation, operation and management of proposals. Specifically public involvement is a valuable source of information on key impacts, potential mitigation measures and the identification and selection of alternatives. It also ensures the EIA process is open, transparent and robust, characterized by defensible analysis. Public involvement of most of EIA processes are undertaken through consultation and must provide an opportunity for those directly affected by a proposal to express their views regarding the proposal and its environmental and social impacts.

The purpose of public involvement is to:

- Inform the stakeholders about the proposal and its likely effects;

- Canvass their inputs, views and concerns; and
- Take account of the information and views of the public in the EIA and decision making.

The key objectives of public involvement are to:

- Obtain local and traditional knowledge that may be useful for decision-making;
- Facilitate consideration of alternatives, mitigation measures and tradeoffs;
- Ensure that important impacts are not overlooked and benefits are maximized;
- Reduce conflict through the early identification of contentious issues;
- Provide an opportunity for the public to influence project design in a positive manner (thereby creating a sense of ownership of the proposal);
- Improve transparency and accountability of decision-making; and increase public confidence in the EIA process.

*Information and notification*, strictly speaking, are preconditions of meaningful public involvement. *Consultation* denotes an exchange of information designed to canvass the views of stakeholders on a proposal and its impacts. *Participation* is a more interactive process of engaging the public in addressing the issues, establishing areas of agreement and disagreement and trying to reach common positions. *Negotiation* among stakeholders is an *alternative dispute resolution* (ADR) mechanism, which is based on joint fact-finding, consensus building and mutual accommodation of different interests.

**Table 3: Levels and forms of public involvement**

<b>Form of public involvement</b>
<b><i>Informing-</i></b> One way flow of information from the proponent to the public
<b><i>Consulting-</i></b> Two way flow of information between the proponent and the public with opportunities for the public to express views on the proposal.
<b><i>Take part-</i></b> Interactive exchange between the proponent and the public encompassing shared analysis and agenda setting and the development of understood and agreed positions on the proposal and its impacts.
<b><i>Negotiating-</i></b> Face to face discussion between the proponent and key stakeholders to build consensus and reach a mutually acceptable resolution of issues, for example on a package of impact mitigation and compensation measures.

***The range of stakeholders involved in an EIA typically includes:***

- The people (individuals, groups and communities) who are affected by the proposal;
- The proponent and other project beneficiaries;
- Government agencies;
- NGOs and interest groups; and
- Others, such as donors, the private sector, academics etc.

Key principles for public involvement, which are widely agreed, are outlined as:

- Inclusive – covers all stakeholders;
- Open and transparent – steps and activities are understood;

- Relevant – focused on the issues that matter;
- Fair – conducted impartially and without bias toward any stakeholder;
- Responsive – to stakeholder requirements and inputs; and
- Credible – builds confidence and trust.

### **Scope of involvement**

The scope of public involvement and its relationship to the EIA process should be commensurate with the significance of the environmental and social impacts for local people. Ideally, public involvement should commence during the preparatory stage of project development and continue throughout the EIA process. This is particularly important for major projects that affect people's livelihood and culture. Five main steps at which public involvement can occur in the EIA process are discussed below.

**1-Screening** For certain categories of proposal, the responsible authority may consult with people likely to be affected in order to gain a better understanding of the nature and significance of the likely impacts. This information can assist in determining if an EIA is required and at what level. In addition, the early identification of affected parties and their concerns provides information that can be incorporated into the scoping stage of EIA and assists future planning for public involvement.

**2-Scoping** Public involvement is commonly undertaken at the scoping stage. This is critical to ensure that all the significant issues are identified, local information about the project area is gathered, and alternative ways of achieving the project objectives are considered. Terms of Reference for an EIA provide a means of responding to and checking against these inputs. They should also outline any specific requirements for public involvement in EIA preparation, review, and follow up.

**3-Impact analysis and mitigation** The further involvement of the public in these phases of EIA preparation can help to:

- avoid biases and inaccuracies in analysis; • assist in the consideration of mitigation measures;
- select a best practicable alternative and. • identify local values and preferences

**4-Review of EIA quality** A major opportunity for public involvement occurs when EIA reports are exhibited for comment. However, making written comments is daunting to all but the educated and literate. Other means of achieving responses should be provided where proposals are controversial. Public hearings or meetings may be held as part of EIA review. They can be formal or informal but should be structured in a way which best allows those affected to have their say. Many people are not comfortable in speaking in public and other or additional mechanisms may be needed.

### **5-Implementation and follow up**

The environmental impacts of major projects will be monitored during construction and operational start up, with corrective action taken where necessary. Local representatives should scrutinize and participate in the follow up process. This arrangement can assist proponents and approval agencies to respond to

problems as they arise. It can also help to promote good relations with local communities that are affected by a development.

### **Planning a public involvement programme**

Planning by the proponent for a public involvement programme needs to begin early before other EIA work. Following scoping, the terms of reference for an EIA study should include specifications for the proposed programme, including its scope, timing, techniques and resources. The plan should describe the means of notifying and informing the public about the proposals and the EIA process, beginning at an early stage and continuing with updates on the progress of the EIA study and feedback on community concerns. Specific reference should be made to the ways in which the public will be engaged, how their inputs (knowledge, values and concerns) will be taken into account and what resources (people and money) are available to assist their involvement. Wherever possible, meetings and inquiries should be held within the local community, especially if there are basic constraints on its involvement

Some of the underlying factors that may constrain meaningful public involvement are poverty, Remote and rural settings, Local values/culture, Illiteracy, Languages, Legal systems, Interest groups, Confidentiality and etc.

**Public involvement technique /tool/** are Education and Information Provision, Information Feedback, Involvement & Consultation.

## **3.3. Basic steps of EIA Process**

### **3.3.1 Screening**

Screening is the first key decision of the EIA process. The purpose of screening is to determine whether a proposal requires an EIA or not and the level at which the assessment should occur. The conduct of screening thus involves making a preliminary determination of the expected impact of a proposal on the environment and of its relative significance. A certain level of basic information about the proposal and its location is required for this purpose. The time taken to complete the screening process will depend upon the type of proposal, the environmental setting and the degree of experience or understanding of its potential effects. The screening process can have one of the three outcomes: No EIA is required, EIA required and further study is necessary to know EIA requirement

#### ***Criteria for the determination of the need for, and level of, EIA***

Screening criteria is used for the determination of the need for, and level of, environmental impact assessment. The following is adapted from criteria developed by the Australian and New Zealand Environmental and Conservation Council (ANZECC), 1996a. The most important criteria to be considered are:

- ✚ Character of the receiving environment (the sensitivity of the project location),
- ✚ Potential impact of proposal,

- ✦ Resilience of natural and human environments to cope with change,
- ✦ Confidence of prediction of impacts and
- ✦ Degree of public interest.
- ✦ Initial Environmental Examination (IEE) as it provides:
  - ✓ Information about the proposal
  - ✓ Describes the proposal and examine alternatives

### **Screening approaches**

Different approaches to screening have been adopted by different agencies and governments in the world. For a project, generally decision whether to recommend IEE or a full EIA is made according to its type, location, sensitivity, scale, the nature and magnitude of its potential impact, and the availability of cost-effective mitigation measures. Screening criteria can be derived from one or a combination of the following methods:

**a) Checklists:** are lists of project types that must be subjected to different levels of environmental assessment. **Check lists tend to be the most widely used and effective screening method.** Countries and organizations that use such checklist type approaches include: the World Bank: the European Union, the European Development Bank and the African Development Bank. Checklists of Environmentally Critical Projects /ECP/ requiring EIA include the following and Projects defined as ECP require an EIA based on type, regardless of location.

- ✓ Heavy industries: non-ferrous metal industries, iron and steel mills, petroleum and petrochemical industries, smelting plants.
- ✓ Resource extractive industries: major mining and quarrying projects, forestry projects, fishery projects.
- ✓ Infrastructure projects: major dams, major power plants, major reclamation projects, major roads and bridges.

**b) Sensitive area criteria:** focuses on areas that are environmentally sensitive. Projects that require an EIA are those located in environmentally critical areas, **regardless of type.** Environmentally Critical Areas /ECA/ are:

- ⊕ National parks, protected areas, watershed reserves, wildlife reserves, and sanctuaries;
- ⊕ Potential tourist spots, habitat for any endangered or threatened species of indigenous wildlife (flora and fauna), areas of unique historical, archaeological, or scientific interest; or areas traditionally occupied by cultural communities or tribes, Areas frequently visited and/or hard-hit by natural calamities, areas with critical slopes, wetlands, prime agricultural lands; recharge areas of aquifers, water bodies and etc.

**c) Preliminary assessments are** undertaken when more information is required to determine a screening decision. Preliminary assessments are low- cost environmental evaluations which make use of information that is already available.

**d) Exclusion lists** according to these all proposals are subject to EIA unless it can be shown that they should not be. Usually, a number of small insignificant projects are given exemption from EIA based on project type or size. This approach is used by the United States of America and elsewhere. Different countries and donors use different criteria for screening project. The prominent ones are the criteria used by the World Bank, the European Union and EPA. Other screening guidelines like for example the one set by Africa Development Bank and the Asian Development Bank is can followed depending on the requirement. Each nation also has their own guidelines on how to screen projects for the undertaking of EIA. **The World Bank lists three categories of projects in relation to EIA:** *Category A* (environmental analysis is normally required as the project may have adverse and significant environmental impact) *Category B* (limited environmental analysis is appropriate, as the project may have specific environmental impact) A case-by-case screening is carried out when the significance of the potential environmental impact of a proposal is unclear or uncertain and *Category C* (environmental analysis is normally unnecessary).

### **3.3.2 Scoping**

Scoping is a critical, early step in the preparation of an EIA and the process identifies the issues that are likely to be of most importance during the EIA and eliminates those that are of little concern. Scoping is the process of identifying the key environmental issues and is perhaps the most important step in an EIA. Typically, this process concludes with the establishment of Terms of Reference (ToR) for the preparation of an EIA. In this way, scoping ensures that EIA studies are focused on the significant effects and time and money are not wasted on unnecessary investigations.

Scoping occurs early in the project cycle at the same time as outline planning and pre-feasibility studies.

Scoping refers to the early, open and interactive process of determining the major issues and impacts that will be important in decision-making on the proposal, and need to be addressed in an EIA. The requirements and procedures established for this purpose differ from country to country. In many EIA systems, the involvement of the public, as well as the competent authority and other responsible government agencies, is an integral part of the scoping process. Public input helps to ensure that important issues are not overlooked when preparing Terms of Reference and/or initiating the EIA study.

Scoping is *important for two reasons*. First, so that problems can be pinpointed early allowing mitigating design changes to be made before expensive detailed work is carried out. Second, to ensure that detailed prediction work is only carried out for important issues. A major activity of scoping is to identify key interest groups, both governmental and non-governmental, and to establish good lines of communication. Scoping is completed when the detailed studies required in the EIA have been specified often this involves preparing Terms of Reference or an equivalent document. This document sets out what

the EIA is to cover, the type of information to be submitted and the depth of analysis that is required. It provides guidance to the proponent on how the study should be conducted and managed.

Scoping provides the foundations for an effective and efficient EIA process. When systematically carried out, scoping highlights the issues that matter and results in Terms of Reference for an EIA that provide clear direction to the proponent on what is required. This increases the likelihood of an adequately prepared EIA report. It helps to avoid the problem of unfocused, voluminous reports and the attendant delay while their deficiencies are addressed and corrected. Scoping thereby helps to make sure that resources are targeted on collecting the information necessary for decision-making and not wasted on undertaking excessive analysis.

**The purpose of scoping is to identify:**

- ❖ The important problems and issues of the project;
- ❖ The appropriate temporal, spatial and institutional boundaries of the project and its impact;
- ❖ The likely data (information) necessary for the study; and
- ❖ The significant positive and negative impacts and factors to be studied in detail.

**More specifically the role (Key objectives) of scoping in the EIA Process is to:**

- Inform the public about the proposal;
- Identify the main stakeholders and their concerns and values;
- Define the reasonable and practical alternatives to the proposal;
- Focus the important issues and significant impacts to be addressed by an EIA;
- Define the boundaries for an EIA in time, space and subject matter;
- Identifies assessment methods;
- Identify baseline and other information needs
- Establish the Terms of Reference for an EIA study.

**Guiding principles for carrying out the scoping process include the following:**

- Recognize scoping is a process rather than a discrete activity or event;
- Design the scoping process for each proposal, taking into account the environment and people affected;
- Start scoping as soon as you have sufficient information available;
- Prepare an information package or circular explaining the proposal and the process;
- Specify the role and contribution of the stakeholders and the public;
- Take a systematic approach but implement flexibly;
- Document the results to guide preparation of an EIA; and
- Respond to new information and further issues raised by stakeholders.

**In the absence of appropriate scoping, the following problems occur:**

- ⊕ EIA reports and impact statements become voluminous and detailed with unnecessary data
- ⊕ Significant or important issues are not identified during the EIA
- ⊕ Time and money is wasted in assessing irrelevant and/or insignificant issues; and
- ⊕ Content and presentation of reports may follow a sectoral or professional bias reflected the background of those undertaking the EIA study.

### **EIA Terms of Reference- a final output of scoping**

Prior to writing the TOR the following questions should be asked and answered:-

- Is the study for an environmental scoping, a full EIA or other type of study?
- Before preparing the TOR the purpose must be clear.
  - Is the study to be for a site specific project or a regional or sectoral program?
- The breadth of the study needs to be well defined.
  - Will the EIA team be required to collect baseline data or does this already exist?
- The depth of the study, the type and quality of information already available or needed must be known.
  - Who will use the final report? Different end users will often require different information.
  - What output is required from the EIA study?
- Is an Environmental Action Plan to be prepared? A draft contents page for the final report as an annex to the TOR will give some guidance to the team carrying out the study.
  - Is the team responsible for all issues or are other organizations responsible for some environmental studies?
- The TOR should clearly delimit responsibilities and give information on other work being done.
  - What types of experts are needed in the team and for how long?
- An approximate estimate is needed to prepare a budget for the study and to estimate the time period.

### **Contents of the TOR**

The TOR should commence with a brief description of the program or project. This should include a plan of the area that will be affected either indirectly or directly. Basic data should be given on existing and proposed area and area characteristics. The institutions that are involved in the proposal should also be given. An overview of the local environment should follow the general description. This will include socio-economic information, land use, land tenure, water use in the area and any particular aspect of the flora and fauna. If other studies have been completed a list of available reports should be given. A brief description should be given of the most important institutions, including those responsible for the EIA, the project executing agency and future managers. This should be presented in the form of an

organogram. A description of the work to be undertaken should give a general set of requirements for determining the potential impacts of, and impacts on, the proposed project. The TOR should require the consultants to cover the following points:

Terms of Reference for a full EIA has to cover some or all of the following items:

- ✚ Purpose and application of the Terms of Reference;
- ✚ Statement of need for and objectives of the proposal;
- ✚ Project background and description;
- ✚ Study area or impact zone(s) (e.g. the affected environment and community);
- ✚ Applicable policy and institutional considerations;
- ✚ EIA requirements and decision-making particulars;
- ✚ Provisions for public involvement;
- ✚ Alternatives to be examined;
- ✚ The impacts and issues to be studied;
- ✚ The studies to be carried out (e.g. approach, time & space boundaries);
- ✚ The requirements for mitigation and monitoring;
- ✚ The information and data to be included in the EIA report;
- ✚ The timeframe for completion of the EIA process; and
- ✚ The means for making changes to the ToR if necessary.

The TOR should give an indication of the team considered necessary for the study. For example in the irrigation and drainage project, depending on the scope of the study this may include one or several of the following: an irrigation specialist, drainage specialist, rural sociologist, terrestrial ecologist (of various specializations), aquatic ecologist/fisheries expert, hydrologist, agronomist, soil chemist or physicist, economist and epidemiologist. However, as mentioned earlier the team should not be rigidly imposed on the consultant. The expected date of commencement and time limit should be given. In most cases scoping can be done in one to three months using checklists or other techniques assuming adequate data is readily available. Up to 12 months is needed for a full EIA for a medium or large scale project although this could be longer if the project is complex or considerable primary data have to be collected or field measurement undertaken.

### 3.3.3 Impact Analysis (Impact identification, prediction and Evaluation)

#### 3.3.3.1 Impact identification

Environmental impact is the change in an environmental parameter, over a specific period and within a defined area resulting from a particular activity compared with the situation, which would have occurred, had the activity not been initiated. The aim of impact identification is to ensure that all potentially significant environmental impacts (adverse or favorable) are identified and taken into account in the EIA process. Having established the range of impacts associated with a development project, it is then necessary to predict their potential magnitude and evaluate their significance. The following are the major types of impacts.

1. Primary and secondary impacts
2. Short - term and long -term impacts
3. Reversible and irreversible impacts

Distinguishing impact based on their type is important;-1) to manage the environmental impacts,2) to assess the significance of impacts, 3) to minimize adverse impacts and, 4) for consideration of the alternatives. Over time, a number of EIA methodologies and tools have been developed for impact identification.

**The most common formal methods used for impact identification are:-**

#### **a) Ad-hoc approach/expert opinion**

Ad- hoc method is a simple approach to identify the total impacts of a project and would *consider each environmental area*. In this method, each environmental area i.e. air, water etc. are taken separately. The ad hoc method involves assembling a team of specialist to identify impacts in their area expertise i.e. expert opinion. Expert opinion on the impact of any activity can be sought by:-

- Meeting with (panel discussion)
- Writing to the experts and asking their answers to specific questions.
- Content analysis or literature survey or plain survey.

The *advantage of expert opinion* data gathering techniques is its speed and inexpensiveness. For these reasons expert opinion has been continues to be used, very extensively used in EIA. *The limitation* is that it is inherent subjectivity and biasness. These limitations may not come only in the form of the opinion of the expert but also in the choice of expert by the convener (of a meeting) or the compiler (of published opinion). A convener of an expert meeting may pick and choose experts known to be leaning towards view point desired by the convener.

#### **b. Delphi approach**

Delphi is a method of collecting opinions, from different expertise by building different methods to minimize the various negative attribute of other opinion gathering methods (expert opinion). This method can avoid Ad-hoc approach limitation effects and handle large number of opinion givers than panels or brainstorming session can.

*Procedure*

1. A structured, formal and detailed questionnaire is given to the participants by mail or in person.
2. The organizer DA then collects, analyses, combines and averages the responses and represents them medians.
3. Questionnaire for second round are given with modification if necessary.
4. The averaged response of 1st questionnaire is provided to the participants.

5. After scrutinizing 2nd round, respondents may be asked to justify the response.
6. Further interactions are continued, if necessary
7. Convergence of opinion emerges (***NOT BY FORCE***)

#### *Limitations*

- ⊕ There is pressure towards convergence and this may suppress other valid perspectives.
- ⊕ The role of the Delphi coordinator is crucial and subjective biases may be introduced through this route.
- ⊕ Lack of item clarity or the common interpretation of scales and feedback may lead to invalid results.
- ⊕ Delphi is time consuming and if the questionnaires are long, one may tend to fill them in a casual manner.

#### C. Checklists

Checklists methods are developed from list of environmental features or activities that should be investigated for possible /potential impacts. It combines a list of potential impact areas that need to be considered in the EIA processes with an assessment of often qualitative of the individual impacts. Checklists are “***one dimensional***” lists of potential impacts which tell whether an impact will occur or not. It includes extensive data collection sheets. The collected data can then be used to answer a series of questions to identify major impacts and to identify shortages of data. It identifies impacts based on a set of questions to be answered. Some of the questions may concern indirect impacts and possible mitigation measures. They may also provide a scale for classifying estimated impacts; from highly adverse to highly beneficial.

Checklists provide a systematized means of identifying impacts. They also have been developed for application to particular types of projects and categories of impacts (such as dams or road building).

#### **Advantage of checklist method**

- ✓ Easy to understand and use
- ✓ It promotes thinking about the array of impacts in a systematic way and allows concise summarization of effects.
- ✓ It is the simplest assessment methodologies (simple ranking and weighting)

#### **Limitations**

- ⊕ Checklists do not usually include direct cause-effect links to project activities
- ⊕ Do not distinguish between direct and indirect impacts
- ⊕ Checklist may be too general or incomplete
- ⊕ They do not illustrate interactions between effects
- ⊕ The same effect may be registered in several places under heading that overlap in content
- ⊕ The number of categories to be reviewed can be immense thus destructing attention from the more significant impacts.
- ⊕ The identification of effects is qualitative/subjective

#### **D. Matrices**

A matrix is a grid-like table that is used to identify the interaction between project activities, which are displayed along one axis, and environmental characteristics, which are displayed along the other axis. Using the table, environment-activity interactions can be noted in the appropriate cells or intersecting points in the grid. Entries are

made in the cells to highlight impact severity (magnitude of impacts) or other features related to the nature of the impact, for instance:

- Ticks or symbols can identify impact type (such as direct, indirect, cumulative) pictorially;
- Numbers or a range of dot sizes can indicate scale; or
- Descriptive comments can be made.

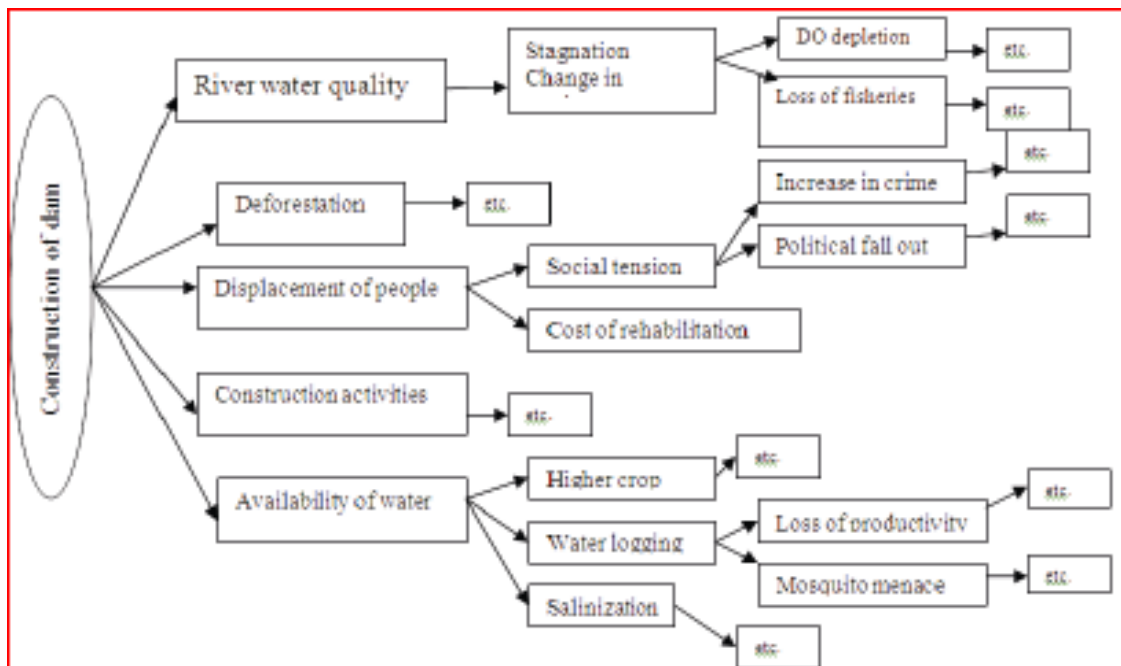
There are four common types of matrices. These are Simple matrix, Magnitude matrix, Leopold Weighted and matrices matrix

### E. Networks or impact trees

A network diagram is a technique for illustrating how impacts are related and what the consequences of impacts are. Network methods illustrate the multiple links between project activities and environmental characteristics. It also recognizes the interactive nature of environment components. Environmental subsystems are interconnected and any impact on one of the subsystems effects several other subsystems. That is why a ‘primary’ impact may lead to ‘secondary’, ‘tertiary’ and higher order impacts. Therefore, it takes an ecological approach for identifying the secondary, tertiary and higher order impacts. Impact identification using networks involves following the effects of development through changes in the environmental parameters in the model. Environmental impacts can result either directly from a development action or indirectly through induced changes in environmental conditions. A change in environmental conditions may result in several different types of impact. This method should lead to the identification of remedial measures and monitoring schemes. Either diagrams or tables are used to show the logical consequences of a certain action of a given project.

Procedure

- ✦ Start with a project activity and identify the types of impacts which would initially occur.
- ✦ Select each impact and identify the impacts which may be induced as a result. This process is repeated until all possible impacts have been identified. Sketching results in ‘impact tree’ (see Figure below).



## **Advantage**

- ✓ link action to impact
- ✓ useful in simplified form for checking for higher order impacts of proposed development
- ✓ handles direct and indirect impacts

## **Disadvantage**

- ⊕ It does not establish the magnitude or significance of interrelationships between environmental components, or the extent of change.
- ⊕ It requires considerable knowledge of the environment.
- ⊕ Can become very complex if used beyond simplified version

## **F. Overlay and GIS**

Overlays provide a technique for illustrating the geographical extent of different environmental impacts. Each overlay is a map of a single impact. For example, salt affected areas, deforested areas, etc. can be analyzed and clearly demonstrated to non-experts. The original technique used transparencies which is somewhat cumbersome. However, the development of Geographic Information Systems (GIS) can make this technique particularly suitable for comparing options, pinpointing sensitive zones and proposing different areas or methods of land management.

This method is easily adaptable for use with a computer programmed to perform the tasks of aggregating the predicted impacts for each geographical subdivision and of searching for the areas least affected. The overlay approach can accommodate both qualitative and quantitative data. The weakness of the overlay approach is that it is only moderately comprehensive, because there is no mechanism that requires consideration of all potential impacts. When using overlays, the burden of ensuring comprehensiveness is largely on the analyst. Also, the approach is selective because there is a limit to the number of transparencies that can be viewed together. Finally, extreme impacts with small probabilities of occurrence are not considered. However, a skilled assessor may make indications in a footnote or on a supplementary map.

### **Advantages:**

- ✓ Easy to understand
- ✓ Focus and display spatial impacts
- ✓ Good siting tool
- ✓ Excellent for impact identification and spatial analysis
- ✓ Good for 'experimenting'

### **Disadvantages:**

- ⊕ Can be cumbersome
- ⊕ Poorly suited to address impact duration or probability
- ⊕ Heavy reliance on knowledge and data
- ⊕ Often complex and expensive

### 3.3.3.2 Impact prediction

The characteristics of environmental impacts vary. Typical parameters to be taken into account in impact prediction and decision-making are *nature* (positive, negative, direct, indirect, and cumulative), *magnitude* (severe, moderate, low), *extent/location* (area/volume covered, distribution), *timing* (during construction, operation, decommissioning, immediate, delayed, rate of change), *duration* (short term, long term, intermittent, continuous, reversibility/irreversibility), *likelihood* (probability, uncertainty or confidence in the prediction); and *significance* (local, regional, global).

#### Methods for predicting the characteristics of impacts include:

- best estimate - professional judgment;
- quantitative mathematical models;
- experiments and physical models; and
- Case studies as analogues or points of reference.

### 3.3.3.3 Impact Evaluation

Following impact identification and prediction, impact evaluation is the formal stage at which a test of significance is made. A systematic process should be followed in evaluating significance, distinguishing between as predicted and residual impacts. **Step (1)** involves evaluating the significance of ‘as predicted’ impacts to define the requirements for mitigation and other remedial actions. **Step (2)** involves evaluating the significance of the ‘residual’ impacts, i.e. after mitigation measures are taken into account. This test is the critical measure of whether or not a proposal is likely to cause significant impacts. It is determined by the joint consideration of its characteristics (magnitude, extent, duration etc.) and the importance (or value) that is attached to the resource losses, environmental deterioration or alternative uses which are foregone (see the figure below).

#### Impact evaluation methods

##### 1. Comparison

The most formal evaluation method is the comparison of likely impacts against legal requirements and standards (e.g. air quality standards, building regulations etc.). Of course, for some type of impacts including socio-economics, there are no clear-cut standard. Socio-economic impacts provide a good example of fuzziness in assessment, where the line between being significant or not significant extends over a range of values which build on perceptions as much as facts. Socio-economic impacts can raise in particular the distributional dimensions to evaluation, *who wins and who loses*. Beyond the use of standards and legal requirements, all assessments of significance either implicitly or explicitly apply weights to the various impacts (i.e. some are assessed as more important than others). The social effects of resource allocation decisions are too extensive to allow the decision to emerge from some opaque procedure free of over political.

##### 2. Cost -benefit analysis and input-output methods

Cost-benefit analysis is an impact evaluation method that seeks to apply monetary values to costs and benefit. The basic principle of CBA is to measure the cost and benefit in monetary terms as money is the common measures of value; and monetary values are best understood by the community and decision makers. CBA methods seek to treat

environmental impacts in monetary terms as if the environment was a machine in which some monetary inputs (environmental costs) result in some monetary outputs (material benefits).

CBA has several stages: project definition, the identification and enumeration of costs and benefits, evaluation of costs and benefits, and the discounting and presentation of results. If the benefit-to-cost ratio comes out greater than one the activity causing environmental impact may be declared acceptable. In other words, if the net social benefit minus cost is positive, then there may be a presumption in favor of a project. However, the final outcome may not always be that clear. The presentation of results should distinguish between tangible and intangible costs and benefits, as relevant, allowing the decision makers consider the trade-off involved in the choice.

Cost benefit analysis has excited both advocates and opponents. It does have many problems, including identifying, enumerating and monetizing intangibles. Many environmental impacts fall in to the tangible category, for example the loss of a rare species, the urbanization of a rural landscape and the saving of a human life. The incompatibility of monetary and non-monetary units makes decision making problematic.

For several types of impacts one has no idea of the costs such as extinction of certain species; extreme human sufferings such as death cannot be compensated by any amount of profit. Another problem is the choice of discount rate: for example, should a very low rate be used to prevent the rapid erosion of future costs and benefits in the analysis?

Impact evaluation is a difficult and contestable exercise, which cuts across the fluid boundary between facts and values and between EIA and decision-making. *First*, a technical judgment must be made of the extent to which mitigation will reduce as predicted impacts. *Second*, a subjective value must be placed on the significance of residual impacts, using criteria and tests. *Finally*, the attribution of significance usually will influence final approval and condition setting; for example by indicating whether or not the impact of a proposal is acceptable or not.

Evaluation of significance should take place against a framework of criteria and measures established for the purpose. *These may be defined in EIA legislation and procedure*; for example, by definition of what constitutes an environmental impact and guidance on how to determine significance. Often specified criteria are listed to aid such evaluation; for example, environmental standards and thresholds, protected and sensitive areas, valued ecological functions and components and resource and land use capabilities

**EIA guidelines related to significance fall into two main categories:**

1. **Emissions based** standards will be jurisdiction specific (although certain standards may be internationally recognized) and provide an objective, technical means of determining significance; for example the anticipated residual impacts either do or do not exceed the relevant standard. However, reliance on standards suffers from certain deficiencies and limitations. The relevant technical standard may be the subject of disagreement or public concern (e.g. blood lead levels, traffic noise levels, electromagnetic field strengths). In many cases, an appropriate technical standard will not be available for the evaluation of significance (e.g. ecological, social and visual impacts).
2. **Environmental quality based** criteria or thresholds are qualitative, broadly drawn and require interpretation. In this context, impact evaluation is a subjective exercise, linking scientific criteria to social preferences (as discovered through public involvement or SIA methods) and relating them to the environment and community

affected. Some of the impact identification techniques discussed earlier in this topic have built in scales or weightings (and hence values) based on prior experience. When applying them, the criteria should be modified to take account of local value systems and traditional practices.

*Table 3.1 World Bank guidelines for environmental sustainability*

<p><b>Environmental Aspects of Bank Work</b>          “The Bank endeavors to ensure that each project affecting renewable natural resources (e.g., as a sink for residues or as a source of raw materials) does not exceed the regenerative capacities of the environment.”</p>
<p><b>Output Guide</b>          Waste emissions from a project should be within the assimilative capacity of the local environment to absorb without unacceptable degradation of its future waste absorptive capacity or other important services.</p>
<p><b>Input Guide</b>          Harvest rates of renewable resource inputs should be within regenerative capacity of the natural system that generates them; depletion rates of non-renewable resource inputs should be equal to the rate at which renewable substitutes are developed by human invention and investment.</p>

Criteria to evaluate whether or not adverse impacts are significant include:

- Environmental loss and deterioration
- Social impacts resulting directly or indirectly from environmental change;
- Non-conformity with environmental standards, objectives and guidelines; and
- Likelihood and acceptability of risk.

Criteria to evaluate adverse impacts on natural resources, ecological functions or designated areas include:

- ⊕ Reductions in species diversity;
- ⊕ Depletion or fragmentation on plant and animal habitat;
- ⊕ Loss of threatened, rare or endangered species;
- ⊕ Impairment of ecological integrity, resilience or health e.g. disruption of food chains, decline in species population, alterations in predator-prey relationships and the likes

Criteria to evaluate the significance of adverse social impacts that result from biophysical changes include:

- Threats to human health and safety e.g. from release of persistent and/or toxic chemicals;
- Decline in commercially valuable or locally important species or resources e.g. fish, forests and farmland;
- Loss of areas or environmental components that have cultural, recreational or aesthetic value;
- Displacement of people e.g. by dams and reservoirs;
- Disruption of communities by influx of a workforce e.g. during project construction; and
- Pressures on services, transportation and infrastructure.

Environmental standards, objectives and targets to evaluate significance include:

- ✚ Prescribed limits on waste/emission discharges and/or concentrations;
- ✚ Ambient air and water quality standards established by law or regulations;
- ✚ Environmental objectives and targets contained in policy and strategy; and
- ✚ Approved or statutory plans that protect areas or allocate, zone or regulate the use of land and natural resources.

### 3.3.4 Impact mitigation and Environmental Management Plan (EMP)

Mitigation is a critical component of the EIA process. It aims to prevent adverse impacts from happening and to keep those that do occur within an acceptable level. The objectives of mitigation are to:

- Find better alternatives and ways of doing things;
- Enhance the environmental and social benefits of a proposal;
- Avoid, minimize or remedy adverse impacts; and
- Ensure that residual adverse impacts are kept within acceptable levels.

Early links should be established between the EIA and project design teams to identify mitigation opportunities and incorporate them into consideration of alternatives and design options. In practice, mitigation is emphasized in the EIA process once the extent of the potential impact of a proposal is reasonably well understood. This typically takes place following impact identification and prediction, and recommended measures for mitigation will be an important part of the EIA report. Usually, these measures will be incorporated into the terms and conditions of project approval and implemented during the impact management stage of the EIA process.

The objectives of impact management are to:

- ✓ Ensure that mitigation measures are implemented;
- ✓ Establish systems and procedures for this purpose;
- ✓ Monitor the effectiveness of mitigation measures; and
- ✓ Take any necessary action when unforeseen impacts occur.

The elements of mitigation are organized into a hierarchy of actions:

- First, avoid adverse impacts as far as possible by use of preventative measures;
- Second, minimize or reduce adverse impacts to as low as practicable levels; and
- Third, remedy or compensate for adverse residual impacts, which are unavoidable and cannot be reduced further.

Key principles for the application of mitigation consistent with the above framework include the following:

- ⊕ Give preference to avoid and prevent measures;
- ⊕ Consider feasible alternatives to the proposal and identify the best practicable environmental option;
- ⊕ Identify customized measures to minimize each of the main impacts predicted;
- ⊕ Ensure they are appropriate, environmentally sound and cost-effective; and
- ⊕ Use compensation or remedial measures as a last resort.

EIA good practice in mitigation requires a relevant technical understanding of the issues and the measures that work in the circumstances.

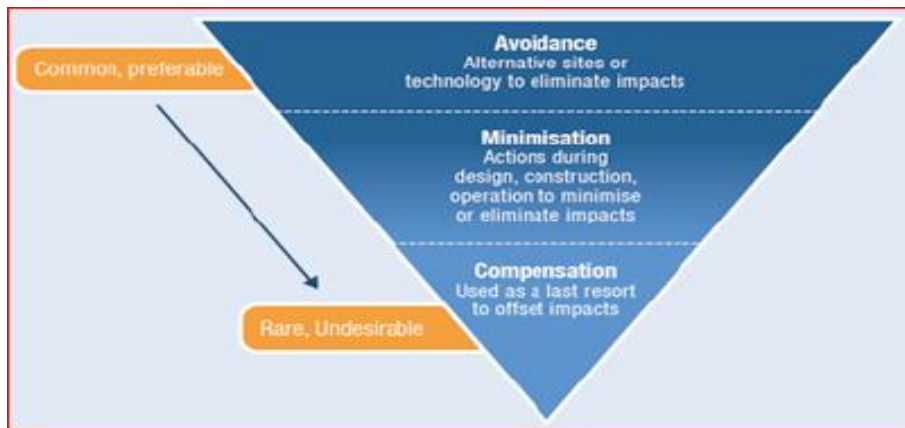
Mitigation can be carried out by:

- ❖ *Structural measures*, such as design or location changes, engineering modifications and site treatment; and
- ❖ *Non-structural measures*, such as economic incentives, legal, institutional and policy instruments, provision of community services and training and capacity building.

Structural measures are well established for certain types of projects, such as dams, roads, and oil and gas exploration and development. In some cases, industry codes of good practice will be available. However, these need

to be applied with regard to the nature and severity of environmental impacts; for example taking account of nearby protected areas, patterns of wildlife mitigation or constraints imposed by natural hazards. Other projects involving new technology may require non-standardized or even untried measures to mitigate the adverse impacts. These need to be given special attention during impact management.

Non-structural measures are used increasingly. They can be applied to reinforce or supplement structural measures or to address specific impacts. For example, many types of social, community and health impacts are addressed by non-structural measures and their use is becoming broader.



**Figure 3.1: The elements of mitigation**

Depending on the timing of the project cycle and the nature of impacts, a number of approaches can be taken to achieve the objectives of mitigation. These include:

- developing environmentally better alternatives to the proposal;
- making changes to project planning and design;
- carrying out impact monitoring and management; and
- Compensating for impacts by monetary payment, in kind measures, site remediation bonds, Resettlement plan.

An environmental management plan (EMP), also referred to as an impact management plan, is usually prepared as part of EIA reporting. It translates recommended mitigation and monitoring measures into specific actions that will be carried out by the proponent.

The main components of an EMP are described in the table 3.2 below, which reflects the World Bank at the World Bank. The EMP should contain the following:

- summary of the potential impacts of the proposal
- description of the recommended mitigation measures
- statement of their compliance with relevant standards
- allocation of resources and responsibilities for plan implementation;
- schedule of the actions to be taken;
- programme for surveillance, monitoring and auditing; and
- contingency plan when impacts are greater than expected

**Table 3.2 the main components of an EMP the World Bank AT the World Bank**

EMP Component	How to address
Summary of impacts	The predicted adverse environmental and social impacts for which mitigation is required should be identified and briefly summarized. Cross referencing to the EA report or other documentation is recommended.
Description of Mitigation measures	Each mitigation measure should be briefly described with reference to the impact to which it relates and the conditions under which it is required (for example, continuously or in the event of contingencies). These should be accompanied by, or referenced to, project design and operating procedures which elaborate on the technical aspects of implementing the various measures.
Description of monitoring programme	The monitoring program should clearly indicate the linkages between impacts identified in the EIA report, measurement indicators, detection limits (where appropriate), and definition of thresholds that will signal the need for corrective actions.
Institutional arrangements	Responsibilities for mitigation and monitoring should be clearly defined, including arrangements for co-ordination between the various actors responsible for mitigation.
Implementation schedule and reporting procedures	The timing, frequency and duration of mitigation measure should be specified in an implementation schedule, showing links with overall project implementation. Procedures to provide information on the progress and results of mitigation and monitoring measures should also be clearly specified.
Cost estimates and sources of funds	These should be specified for both the initial investment and recurring expenses for implementing all measures contained in the EMP, integrated into the total project costs, and factored into loan negotiations.

Environmental Action Plan or Environmental Management Plan not only sets out the mitigation measures needed for environmental management, both in the short and long term, but also the institutional requirements for implementation. All the management proposals need to be clearly defined and costed. The Environmental Management Plan needs to not only include clear recommendations for action and the procedures for their implementation but must also define a program and costs.

**Mitigation measures for some of the environmental impacts are list in table 3.3 to 3.7**

**Table 3.3: Possible impacts on air quality and their mitigation measures**

Possible Impacts	Some mitigation measures
1. Depletion of ozone layer and climatic change due to emission of some gases (SO <sub>2</sub> , CO <sub>2</sub> , NO <sub>2</sub> , fluoride, CO, CFCS etc.) to the atmosphere	<ul style="list-style-type: none"> <li>➤ Control the emission of SO<sub>x</sub>, NO<sub>x</sub>, Co and other applicable chemicals by scrubbing with water or alkaline solutions, incineration or absorption by other catalytic processes.</li> <li>➤ recycle wastes to reduce the amount of pollutants released to the atmosphere</li> <li>➤ Choose environmentally friendly processes, technologies or raw materials.</li> <li>➤ Treat effluent gases to reduce the amount of pollutants. establish treatment plant</li> </ul>
2. Reduction of air quality due to dust	<ul style="list-style-type: none"> <li>➤ Control particular matters by scrubbers, fabric filter collectors or electrostatic precipitators.</li> <li>➤ choice of environmentally friendly processes, technologies or raw materials reduce the amount and significance of pollutants</li> <li>➤ watering of the area form which dust is generated;</li> </ul>

**Table 3.4: Summary of possible impacts on flora, fauna and ecosystem and mitigation measures**

3. Loss of flora and fauna	<ul style="list-style-type: none"> <li>• locate projects far away from sensitive areas;</li> <li>• carry out necessary rehabilitation measures when phasing out a project</li> </ul>
4. Stability and health of an Eco-system may be affected when habitat is fragmented.	<ul style="list-style-type: none"> <li>• plant with native species in vicinity of a project and adjacent areas to wildlife to provide additional habitats and migration routes/corridors for local animals;</li> <li>• fence wildlife areas to avoid people interference if possible also establish a</li> </ul>

	legal protection system/framework;
5. Direct killing of animals like collisions with vehicles	<ul style="list-style-type: none"> <li>• at important areas use of tunnels/bridges reduces interference and collision rates</li> <li>• fencing or plant barriers can reduce the interference of human beings and traffics to wildlife</li> <li>• take measures, like speed break on roads, to reduce the speed of vehicles where road crosses protected areas</li> </ul>
6. Disturbance of ecosystem because of extraction of sand, gravel or rock	<ul style="list-style-type: none"> <li>• Avoid, if possible, the extraction of sand, gravel etc. from river bottom/water bodies.</li> <li>• use alternative site to exploit the resources</li> <li>• avoid the use of dynamite/explosive in water bodies</li> <li>• avoid construction materials during breeding seasons in both water and terrestrial ecosystems</li> </ul>
7. Flora and fauna in wetlands are affected	<ul style="list-style-type: none"> <li>• avoid the excessive clearance of vegetation from stream banks</li> <li>• locate projects as much as far as possible from wetlands</li> <li>• avoid the releaser or minimize the use of hazardous chemicals in the catchments of vulnerable wetlands;</li> <li>• if possible, the project should not modify water flow/course</li> <li>• Use soil and water conservation measures in the catchments to reduce siltation.</li> </ul>
8. Direct or indirect killing of aquatic and terrestrial animals spreading of pesticide/insecticide for different purposes	<ul style="list-style-type: none"> <li>• use integrated pest management to avoid mass killing of animals</li> <li>• The concentration and length of time to chemicals should be to the level of the standard.</li> <li>• use appropriate and trained man power for application of chemicals</li> <li>• avoid the use of very poisonous pesticides in particular, on fields sloping down to watercourses during rain seasons with heavy precipitation</li> <li>• Apply pesticide, when a number of fauna are at the side. E.g. timing.</li> </ul>
9. Water logging may affect the flora (especially deep rooted plants) and fauna of the area.	<ul style="list-style-type: none"> <li>• digging of canals to lower the water table</li> <li>• planting high water consuming species</li> <li>• minimizing over irrigation</li> </ul>

**Table 3.5 Possible impacts on water and mitigation measures**

10. Flooding, channel modification, river canal siltation	<ul style="list-style-type: none"> <li>• leaving sufficient enough buffer zones of undisturbed vegetation between the site of the project and water bodies</li> <li>• use water flow speed reduction measures e.g. soil conservation measures</li> <li>• Plan carefully to avoid the change/modification of the previous channel flow/natural flow of water.</li> </ul>
11. Reduction/lowering of surface or groundwater table.	<ul style="list-style-type: none"> <li>• locate those water-consuming projects, if possible, in areas where availability of ground or surface water is not a problem</li> <li>• choose the most appropriate techniques to minimize the amount of water consumed</li> <li>• ensure that the utilization of groundwater is within the capacity of natural system to replenish itself</li> <li>• re-use the recycled wastewater</li> </ul>
12. Excess increment of nutrients in water bodies (eutrophication).	<ul style="list-style-type: none"> <li>• sitting projects far away from susceptible areas to erosion in order to reduce chemical pollution of water bodies</li> <li>• carry out soil conservation measures</li> <li>• leaving sufficient enough buffer zones of undisturbed vegetation between the site of the projects and water bodies</li> <li>• avoid direct waste disposal into or near water bodies</li> <li>• reduce the amount of inlet of both chemical and biological fertilizers to water bodies</li> </ul>
13. Pollution of surface and groundwater through direct or indirect addition of toxic chemicals	<ul style="list-style-type: none"> <li>• sitting projects far away from susceptible areas to erosion in order to reduce chemical pollution of water bodies</li> <li>• leaving sufficient buffer zones of undisturbed vegetation between the site of the project and water bodies</li> <li>• install silting basins to reduce silt, pollutants and debris from runoff before it is discharged to adjacent water bodies</li> </ul>

	<ul style="list-style-type: none"> <li>Monitoring pipeline systems and impoundments for leaks to reduce contamination of groundwater. E.g. Preparing waterproof waste water collectors</li> <li>monitor sites even after the project has been closed (as necessary)</li> <li>reclaiming landscapes where devastating activities have been taken place to reduce water pollution</li> <li>recycling wastes to reduce water pollution</li> <li>use treatment techniques especially in industrial activities</li> <li>choice of the most appropriate technique, replacing processing equipment</li> <li>dispose safely/properly expired toxic chemicals</li> </ul>
14. Increment of suspended solids (turbidity) in water bodies through soil erosion or direct release of waste from different activities.	<ul style="list-style-type: none"> <li>siting projects far away from susceptible areas to erosion in order to reduce siltation, turbidity and chemical pollution of water bodies</li> <li>carry out soil conservation measures</li> <li>Leaving sufficient enough buffer zones of undisturbed vegetation between the site of the project and water bodies.</li> <li>installing silting basins to reduce silt, pollutants and debris from runoff before it is discharged to adjacent water bodies</li> </ul>
15. Increment of the amount of silt/sediment in downstream area including agricultural land, reservoirs, etc.	<ul style="list-style-type: none"> <li>Minimize the area of ground clearance; provide good vegetative cover or; control the volume and speed of water flows</li> <li>careful design/plan of projects can avoid soil erosion;</li> <li>Carry out soil conservation measures.</li> <li>Leaving sufficient enough buffer zones of undisturbed vegetation between the site of the project and water bodies.</li> </ul>

**Table 3.6: Possible impacts on soil and their mitigation measures**

16. Soil erosion and loss of nutrients due to different activities	<ul style="list-style-type: none"> <li>Replanting right species of trees, shrubs and grasses in a right time on disturbed areas.</li> <li>Minimize the area of ground clearance.</li> <li>careful design/plan of projects</li> <li>Carry out soil conservation and or agro-forestry measures.</li> <li>Reducing harvest removal.</li> </ul>
17. Soil compaction due to mechanization and machineries	<ul style="list-style-type: none"> <li>Using appropriate machineries/mechanization in appropriate time.</li> <li>Planting leguminous plants improve soil structure.</li> <li>improve soil structure by planting species that improve soil structure or by adding organic matter</li> </ul>
18. Salinization due to irrigation with saline water.	<ul style="list-style-type: none"> <li>adding organic matter/neutralizing</li> <li>planting salt tolerant species</li> </ul>
19. Soil acidity	<ul style="list-style-type: none"> <li>reduce the addition of artificial/organic chemical</li> <li>adding alkaline substance like lime</li> <li>appropriate use/disposal of chemicals</li> </ul>
20. Imbalance of biological activities as a result of contamination of soil with toxic chemicals and loss of organic nutrients due to soil erosion.	<ul style="list-style-type: none"> <li>appropriate use of wastes/toxic chemicals</li> <li>Take any measures that are used to minimize loss of nutrients.</li> <li>Adding organic matter (green maturing, compost).</li> <li>promote cleaner production (preventing/minimizing waste)</li> </ul>
21. Productive topsoil covered by proposed activities or removal of productive top soil for temporary or permanent purposes	<ul style="list-style-type: none"> <li>Collect and reuse the excavated top soil to form a superficial layer.</li> <li>Conversions of borrow pits and spoil dumpsites in to scenic lookouts.</li> <li>Use vertical space than horizontal.</li> </ul>

**Table 3.7: Possible impacts on human health and safety; and their mitigation measures**

22. Transmission of disease between human and	<ul style="list-style-type: none"> <li>sanitary or precaution measures can be accomplished through a</li> </ul>
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from plants/animals to humans	<ul style="list-style-type: none"> <li>comprehensive health awareness campaign</li> <li>curative measures should be in place</li> </ul>
23. Fire, explosions, emission of toxic gases, vapors, dust, emission of toxic liquid, radiation and their cumulative effects badly affect human health in and around the project	<ul style="list-style-type: none"> <li>establishing projects far away from settlements</li> <li>Curative measures have to be in place if accidents from different activities can happen.</li> <li>Provide fire proofing of structures, safety buffer zones around the plant boundary, escape routes and others.</li> <li>Store properly easily flammable/explosive gases or toxic chemicals.</li> <li>preventive/protective instruments have to be provided</li> </ul>
24. Health effects on workers due to fugitive dust, material handling, and noise, mechanical or chemical contact can be occurred.	<ul style="list-style-type: none"> <li>prevent accidents through proper design of projects</li> <li>train responsible personnel how to properly handle chemicals;</li> <li>use protective measure, for example ear/eye masks etc.</li> </ul>
25. noise and congestion may be created and pedestrian hazards could be aggravated by heavy trucks	<ul style="list-style-type: none"> <li>Site selection can be taken as preventive measures..</li> </ul>
26. Death and injuries to human beings and damages to property could be happened in factories, roads etc.	<ul style="list-style-type: none"> <li>facility should implement a safety and health program designed to identify, evaluate, monitor and control health hazards</li> <li>Site selection can be taken as a preventive measure to minimize risk of accidents especially in road projects.</li> <li>prevent accidents through proper design of projects</li> <li>use protective measure, for example ear/eye masks etc.</li> </ul>
27. Extraction of sand or gravel may from unnecessary pond, which creates suitable condition for malaria and water vector borne disease	<ul style="list-style-type: none"> <li>Sanitary or precaution measures can be accomplished through a comprehensive health awareness campaign.</li> <li>avoid stagnating water and give consecutive awareness to reduce the</li> </ul>
28. In mining activities workers are injured when rocks/soils are collapsed,	<ul style="list-style-type: none"> <li>Proper design has to be done well in such a way that rocks doesn't collapse.</li> <li>curative measures have to be in place</li> </ul>

#### 4. EIA REPORTING

The final report of an EIA is often referred to as an Environmental Impact Statement (EIS). In addition to summarizing the impacts of the alternatives under study this report must include a section on follow up action required to enable implementation of proposals and to monitor long-term impacts. The purpose of an EIA is not to reach a decision but to present the consequences of different choices of actions and to make recommendations to a decision maker. Recommendations are a crucial part of the Environmental Impact Statement. The format of the report should preferably follow a standard as recommended by the appropriate institution or required by legislation. The executive summary of the EIS should only be 2 to 5 pages long and the main report, excluding appendices should be preferably about 50 pages long and no more than 100. An exceptionally complex study might require 150 pages. Experts preparing an EIA must appreciate that the final report will be read by a wide range of people and the subject matter may be technically complex. Senior administrators and planners may not understand the importance of technical arguments unless they are presented carefully and clearly. The quality of the executive summary is particularly important as some decision-makers may only read this part of the report.

The executive summary must include the most important impacts (particularly those that are unavoidable and irreversible), the key mitigating measures, proposed monitoring and supervision requirements, and the recommendations of the report. The main text should maximize the use of visual aids such as maps, drawings,

photographs, tables and diagrams. Matrices, network diagrams, overlays and graphical comparisons should all be included. Each individual EIA report should ideally be tailored to fit the circumstances of the project. However, it is useful to follow certain general guidelines to fit together the essential components of the study so as to generate a coherent advisory report helpful to the decision makers as well as the general public. The main text should cover the following points according to World Bank (1991).

- ❖ A description of the program, plan or project including the physical, social and ecological context as well as the time-scale of the proposals under study. Any major revisions made as a result of the scoping process should be identified here.
- ❖ A summary of the EIA methodology, including the limits of the study and the reasons for them.
- ❖ The policy, legal and administrative framework within which the project is situated.
- ❖ A summary of the baseline data providing an overall picture of present conditions and physical, biological and ecological trends. The consequences of the "no-action" option should be described together with a brief description of other developments taking place and their relationship to the study proposal. Major elements of the environment described in base line studies include:
  - **Geology:** geological provinces, bed rock formations, history of geological stability or instability
  - **Topography:** general topography of the region, specific topography of project area.
  - **Soils:** soil mapping, soil series properties, constraints to development.
  - **Ground water resource:** nature of water bearing formations, recharge rates, sustainable safe yields, locations and depths of existing wells, quality.
  - **Surface water resources:** drainage basin and sub basins, named and unnamed water bodies and water courses, regulatory classification of water bodies, flow regimes, water quality data and evaluation, identification of existing permitted discharges to surface waters.
  - **Terrestrial communities:** spatial arrangement of vegetative community types, vegetative species-abundance listings, wildlife species- abundance listings, records of threatened and endangered plant and animal species.
  - **Aquatic communities:** nature of aquatic habitats, species-abundance listings for aquatic macro-invertebrate and fish communities, ecological indexing of community data.
  - **Environmentally sensitive areas:** identification of wet lands, floodplains, steep slopes, stand of mature vegetation, aquifer recharge areas, areas of high water table, areas of rock outcrops, prime agriculture lands, and mines identification of existing projected areas( e.g. national parks and forests)
  - **Air quality:** Regional quality and trends, data from local monitoring stations, reported exceedance of standards.
  - **Sound level:** existing sound level, sources of sound.
  - **Land use:** existing patterns of land use in region, regional planning for future use, and zoning.
  - **Demography:** censuses or estimated population, recent trends and projections for future population.
  - **Socioeconomics:** economic and social structure of communities, tax rates, characteristic types of development.

- **Infrastructural services:** nature and status of human services such as police and fire protection, hospitals, schools, utilities, sewage, water supply, solid waste disposal.
  - **Transportation:** layout and function of existing road ways, railways, air ports; existing and projected capacities and demands.
  - **Cultural resources:** location and characterization identified cultural resources (archeological, historical, cultural land mark), potential for unidentified resources to be presented in project area.
  - **Project economics:** comparative analysis of proposed alternatives with present work cost effective criteria, cost/benefit criteria, or other methods.
- ❖ A description of the governmental and non-governmental participation during the EIA.
  - ❖ Environmental impacts. The most significant beneficial and adverse environmental impacts associated with the options studied need to be clearly stated. Impacts need to be quantified wherever possible and uncertainties in the results need to be highlighted, whether due to a lack of knowledge, lack of data or to critical but indeterminate assumptions such as future policy. The results of economic analyses need to be presented in the same section. Mitigation and enhancement measures that are proposed may either be presented together with information on the environmental impacts or as a separate section. Impacts with no effective mitigation need to be clearly identified as such.
  - ❖ The Environmental Management (Action) Plan (EMP) needs to be presented in two sections. *The first part* covers the implementation of proposed mitigation measures, including both costs and training, and institutional enhancements required to implement them. *The second part* should cover monitoring requirements to measure predicted impacts and to determine the success of mitigation measures. Again, costs and institutional requirements need to be included for each major proposal. A clear program of implementation should be given. The EMP documents should contain an implementation plan for each of the selective mitigate protection and enhancement measures. The EMP may be structured as follows: **1) objective, 2) work plan, 3) implementation schedule, 4) manpower requirements, and 5) Budgetary provision for EMP.**

This chapter is the most crucial and significant part of the entire EIA report and it should be presented with precision and clarity. It might be useful in this case to identify issues of significance due to the project and specify the corresponding mitigation measures. Representation of this in a tabular form may be useful for:-

- ❖ Recommendations and guidance to the decision maker.
- ❖ A statement of provision for auditing, who should carry out it and when.
- ❖ The appendixes should include:
  - ✓ a glossary of technical terms and units
  - ✓ a list of the team who prepared the EIA
  - ✓ records of public meetings and consultations
  - ✓ a catalogue of information, both data and written material, and their source
  - ✓ Technical information too detailed for the main text.

**Table 4.1: Generalized EIA report criteria**

<b>Area of concern</b>	<b>Criteria</b>
A. Readability	<ul style="list-style-type: none"> <li>• Write clearly</li> <li>• Removal all ambiguities</li> <li>• Avoid use of technical jargon; all technical terms should be clearly explained</li> </ul>
B. Consideration and focus	<ul style="list-style-type: none"> <li>• Do not slant or misinterpret findings</li> <li>• Avoid use of value-imparting adjectives or phrases</li> <li>• Avoid confusion or mix-up among economic ,environmental and ecological impacts and productivity</li> <li>• Avoid un substantiated generalities</li> <li>• Avoid conflicting statements</li> </ul>
C. Presentation	<ul style="list-style-type: none"> <li>• Use well-defined, acceptable qualitative terms</li> <li>• Quantify factors, effects, uses, and activities that are readily amenable to quantification</li> </ul>
D. Data	<ul style="list-style-type: none"> <li>• Identify all sources</li> <li>• Use up-to-date data</li> <li>• Use field data collection programmes As necessary</li> <li>• Use technically approved data collection procedures</li> <li>• Give reasons for unofficial data</li> </ul>
E. Methods and Procedures	<ul style="list-style-type: none"> <li>• Use quantitative procedures, techniques, and models for arrival at the best estimates</li> <li>• Identify and describe all procedures and models</li> <li>• Identify sources of all judgments</li> <li>• Use procedures and models acceptable by professional standards</li> </ul>
F. Interpretation of findings	<ul style="list-style-type: none"> <li>• Consider and discuss all impact areas before any are dismissed as not applicable</li> <li>• Analyses controversial issues, and discuss the implications of all results</li> <li>• Consider the implications for each area of range of outcomes having significant uncertainty</li> <li>• Analyse each alternatives in detail and give reasons for not selecting it</li> <li>• Scrutinize and justify all interpretations, procedures, and findings that must stand up under expert professional scrutiny</li> </ul>

## **5. EIA REVIEW**

The purpose of review is to assure the completeness and quality of the information gathered in an EIA. When undertaken as a formal step, it acts as a final check on the quality of the EIA report submitted to obtain a project authorization. Often, this process leads to a requirement for additional information on potential impacts, mitigation measures or other aspects.

### **Key objectives of EIA review are to:**

- Assess the adequacy and quality of an EIA report;
- Take account of public comment;
- Determine if the information is sufficient for a final decision to be made; and
- Identify, as necessary, the deficiencies that must be addressed before the report can be submitted.

In many EIA systems, the review stage is the major opportunity for public involvement. However, the arrangements for this purpose vary considerably from country to country. They range from notification of a period for receiving written comments on the EIA report to holding public hearings. Typically, the latter mechanism is part of an

independent review by an EIA panel or inquiry body, which is considered to be a particularly transparent and rigorous approach.

Whatever procedure is followed, a rigorous approach is necessary, given that the central role of EIA review is to assure the quality of the information prepared. This approach can be based on explicit guidelines and criteria for review, or if these are not available, draw on EIA principles, objectives and terms of references. Over time, their systematic application should improve the general standard of EIA reports by making proponents aware of government or agency expectations.

A comprehensive review of the adequacy and quality of an EIA report would address many or all of the following issues:

- ✚ Does the report address the Terms of Reference?
  - ✚ Is the necessary information provided for each major component of the EIA report?
  - ✚ Is the information correct and technically sound?
  - ✚ Have the views and concerns of affected and interested parties been taken into account?
  - ✚ Is the statement of the key findings complete and satisfactory, e.g. for significant impacts, proposed mitigation measures, etc.?
  - ✚ Is the information clearly presented and understandable by decision makers and the public?
  - ✚ Is the information relevant and sufficient for the purpose of decision making and condition setting?
- The response to the last question is the most significant aspect for review conclusions, and will largely determine whether or not an EIA can be submitted as is or with minor revisions.

The conduct of EIA reviews is based on both informal and formal arrangements. Marked variations exist in their particular requirements, forms of public consultation and the roles and responsibilities of lead agencies. An issue common to all EIA review procedures is how to ensure objectivity. The responsible authority is widely perceived as having a vested interest in the outcome of review, particularly when it is also the proponent.

In general, these can be divided into two main types:

- **Internal review** - undertaken by the responsible authority or other government agency, with or without formal guidelines and procedure. In many cases, internal review is informal and characterized by:
  - relatively low operating costs;
  - discretionary guidance on the conduct of review;
  - lack of transparency on process and factors considered; and
  - Absence of documentation on outcomes and results, e.g. advice tendered to decision-makers.
- **External review** - undertaken by an independent body, separate from and/or outside government agencies, with an open and transparent procedure for public comment. External review procedures are more formal and characterized by:
  - ✓ higher levels of quality assurance;
  - ✓ independence from the responsible authority (to varying degrees);
  - ✓ transparent and rigorous process;
  - ✓ use of guidelines and/or review criteria and methodology;

- ✓ documented outcome or statement on the sufficiency or deficiency of an EIA report; and
- ✓ separate commission, panel, inter-agency or expert committee or other review body

### **Main Steps in the EIA Review**

There are a number of steps that can help to achieve good practice in the review of EIA reports. First you need to establish a framework for the EIA review, including the following steps:

#### **1) Setting the scale/ depth of the review**

Two questions should be addressed at the start of a review:

- How much time is available to carry out the review?
- Are the necessary resources available for this purpose?

The answers to these questions will depend mainly on the provision made for review within the EIA system and the Terms of Reference. The nature of the proposal will determine the speed and intensity of the review. More controversial projects, or those with more significant effects, typically require more detailed review. The choice ranges from a quick overview by one person to an in-depth review by a team of experts assembled to do the job.

#### **b) Selecting reviewer(s)**

The environmental issues and the technical aspects of the proposal will determine the expertise required by a review team or individual. For example, the review of an EIA report for a proposal for a solid waste disposal site might include a landfill engineer, a hydro-geologist and an environmental remediation specialist. Depending on the scale of review, administrative support and technical backup may be necessary.

#### **c) Using input from public comment**

Experience with EIA review in a number of countries has shown that public comment is a critical ingredient of good practice. The input from the public has proved to be important in checking and evaluating the quality of the EIA report; for example, with regard to the description of the affected environment and community, the attribution of significance of residual impacts, the effectiveness of mitigation measures and the selection of an alternative.

Input may come from a public hearing, or from written comments submitted to the proponent or government department. In both cases the summary should focus on information that helps to identify problems with the EIA, contributing to the assessment of impacts, and identifying ways to reduce impacts.

#### **d) Identifying the review criteria**

A systematic review will be based on specified criteria. These criteria can be identified by reference to the following questions: *1) Are terms of reference or other guidelines available for the review?* If not, the first task of the review is to quickly re-scope the main issues and impacts to be addressed in the EIA report. This can be done with the help of scoping methods.

*2) Are any reviews of EIA reports of comparable proposals in similar settings available?*

EIA reports and reviews of comparable proposals in similar settings provide useful points of reference to check the type of impacts that are considered significant and the information that is necessary for decision-making. These can be from the country concerned or elsewhere. It is particularly useful to learn about problems experienced during the implementation and operation of the projects. These can give insights to the nature of impacts that are likely to occur during implementation and operation.

3) *Which generic review criteria may be useful?* Generic criteria that may help to carry out an EIA review include:

- legal EIA requirements (if any);
- relevant environmental standards, guidelines or criteria;
- principles of EIA good practice; and
- Knowledge of the project and its typical impacts and their mitigation.

4) *When is a comprehensive review appropriate?*

A comprehensive review of the quality of an EIA report may be necessary in certain circumstances, for example when there are serious deficiencies in the information assembled. This involves a review of the conduct of the EIA process. Some or all of the elements and aspects that may require consideration include:

- ✓ performance of scoping;
- ✓ accuracy of impact prediction;
- ✓ criteria used to evaluate significance;
- ✓ comparison of alternatives;
- ✓ effectiveness of proposed mitigation measures;
- ✓ requirements for monitoring and impact management; and
- ✓ Modes of public and stakeholder involvement.

In other cases, particular attention could be directed to the executive summary, which is intended to explain the key findings concisely and in a non-technical manner. This is the only part of the EIA report that decision-makers and the public are likely to read. A review can indicate if the information contained in the main body of the report has been communicated simply and accurately.

**Once you have established this framework for review**, you will then need to undertake and report the review, which involves the following steps;

- carrying out the review;
- determine how to remedy any deficiencies; and Report the findings

## **6. DECISION MAKING IN EIA**

EIA is part of a larger process of decision-making to approve a major proposal. It results in a political decision, which is based on information from a number of different sources and involves making a large number of trade-offs. A balance must be struck between the benefits and costs; their environmental, economic and social elements must be weighed, and uncertainties and arguments over the significance of risks and impacts must be addressed. In many jurisdictions the information of the EIA report and from other sources, like public submissions, is presented to decision-makers in a summary form. Decision-makers then have the use of:

- The EIA Report (often called an Environment Impact Statement); and
- The summary report (called an Assessment Report or similar).

This summary report is likely to be compiled by the government representative responsible for the EIA procedures in the jurisdiction (such as the responsible government minister). It will provide an overall recommendation about the project environmental impacts and about mitigation and ongoing management measures. Decision-makers then have the advice about the environmental impacts that comes from the review of the EIA (the Assessment Report)

and other sources of information available to the EIA minister, and the specific information contained in the EIA report. At a minimum, decision makers are expected to take account of the information from the EIA process in final approval and condition setting.

When making decisions, those responsible seldom have time to read the EIA report, other than an executive summary. Typically, they rely upon the advice of their officials, whose views are likely to be shaped by their policy mandates and responsibilities. The general receptivity of decision-makers to the findings of an EIA report will reflect their confidence in the EIA process and its perceived acceptance by other parties. In this regard, public trust in the EIA process, which is built up over time, may carry particular weight.

**Table 6.1 a summary of Information considered to be important for decision-makers.**

Decision-making stage	Important information
Background	➤ Project background and the most important environmental issues involved
Policy Context	➤ Basic development issue or problem being addressed (e.g. flooding, water shortage, etc.) ➤ The relationship to environmental policies and plans
Alternatives	➤ Alternatives to the proposal (including the best practicable environmental option (BPEO) or equivalent designation)
Public involvement	➤ Key public views ➤ Concerns of affected communities ➤ Areas of agreement and disagreement
Impact analysis	➤ Costs and benefits ➤ Distribution of gains and losses
Mitigation and monitoring	➤ Adequacy of proposal measures
Conclusion and recommendations	➤ main economic benefits, significant environmental effects and proposed mitigation measures ➤ The extent to which the proposal conforms to the principles of sustainable development ➤ Design and operational changes to improve the environmental acceptability of the project

All most of the following rules and conventions for decision-making have been adopted by leading EIA systems are:-

- ✓ no decision will be taken until the EIA report has been received and considered;
- ✓ the findings of the EIA report and review are a major determinant of approval and condition setting;
- ✓ public comment on the EIA report is taken into account in decision-making;
- ✓ approvals can be refused or withheld, conditions imposed, or modifications demanded at the final decision stage;
- ✓ the decision is made by a body other than the proponent;
- ✓ reasons for the decision and the conditions attached to it are published, and
- ✓ There is a public right of appeal against the decision (where procedures have not been followed or they have been applied unfairly).

Normally, all proposals that are subject to EIA will have conditions attached to their implementation as part of the final approval. The conditions that are set may follow the mitigation and impact management measures proposed in the EIA report or vary them, for example by establishing more stringent requirements. In either case, condition setting is based on impact predictions, which have varying levels of reliability.

## 7. EIA MONITORING AND ENVIRONMENTAL AUDITING

### 7.1. EIA monitoring

Monitoring can be defined as the continuous assessment of environmental or socio- economic variables by the systematic collection of specific data in space and time. It can be strictly continuous, e.g. using recording instruments, but more commonly involves periodic repeated data collection, usually by the same or similar methods as in baseline surveys.

The primary aim of monitoring is to provide information that will aid impact management, and, secondarily, to achieve a better understanding of cause-effect relationships and to improve EIA prediction and mitigation methods. Both the immediate and long-term benefits from undertaking monitoring as part of EIA are widely recognized, although not always realized.

Monitoring is essential to learn from both successes and failures. For example:

- it is only mechanisms for comparing predicted and actual impacts, and hence to checking whether mitigations measures have been put in place, testing their effectiveness, and evaluating the efficiency of the project management program;
- if mitigation measures are amenable to modification, it should still be possible to reduce residual impacts identified during monitoring
- it can provide information about responses of particular receptors to impacts;
- It is the only means of EIA/EIS evaluation and of identifying mistakes that may be rectified in future EIAs.
- measure the impacts that occur during project construction and operation;
- check their compliance with agreed conditions and standards;
- facilitate impact management, e.g. by warning of unanticipated impacts; and
- Determine the accuracy of impact predictions and the effectiveness of mitigation measures.

Monitoring in EIA can include:

- ❖ **Base line monitoring** : - monitoring which may be carried out over seasons or years to quantify ranges of natural variation and /or directions and rates of change, that are relevant to the project impact prediction and mitigation .this can avoid the frequent criticism that baseline studies are only ‘snapshots’ in time. However, time constraints in EIA usually preclude lengthy survey program, and assessment of long-term trends normally have to depend on existing data.
- ❖ **Compliance monitoring**: - this is monitoring activity aimed to check that specific conditions and standards are met, e.g. in relation to emission of pollutants.
- ❖ **Impact and mitigation monitoring**: - which aims to compare predicted and actual (residual) impacts, and hence to determine the effectiveness of mitigation measures.

The collection of monitoring data is expensive. It needs to be targeted at the information necessary to manage the impacts that are significant or review the aspects of EIA practice that are of particular importance. These aspects should be identified as early as practicable in the EIA process to optimize the contribution of monitoring data to EIA implementation and follow up. Monitoring involves designing the programme, collecting and analyzing the data,

establishing their linkage to impact management, auditing and other components, and interpretation and reporting of data. The following points need to be agreed before conducting monitoring.

- major impacts to be monitored;
- objectives of monitoring and data requirements;
- arrangements for the conduct of monitoring;
- use of the information to be collected;
- response to unanticipated or greater than predicted impacts; and
- Measures for public reporting and involvement.

The general approach to effects monitoring is to compare the pre- and post-project situation, measuring relevant environmental impacts against baseline conditions. A common issue in all situations is how to differentiate the change attributable to a project from the variability that characterizes all biophysical or socioeconomic systems. In the real world, as opposed to laboratory experiments, cause-effect relationships are difficult to separate from the interaction of other factors. Eliminating or correcting for these intervening variables is the key to the design and conduct of a scientifically defensible effects monitoring programme.

Monitoring data needs to be interpreted and reported to a non-scientific audience, including decision makers, the affected community and the general public. This may be the responsibility of a regulatory body, monitoring team or multi-stakeholder group, established specifically to bring a broad understanding and a range of views to EIA implementation and follow up. Reports should be in plain language and to appropriate technical standards. Some elements of an effective environmental monitoring programme are listed in the table below. The following steps can help to implement these elements:

- define the scope and objectives of monitoring for each impact;
- identify the sites for observation, measurement and sampling;
- select the key indicators for direct measurement or observation;
- determine the level of accuracy required in the data;
- consider how the data will be analyzed in relation to baseline and other data;
- establish a system for recording, organizing and reporting the data;
- specify thresholds of impact acceptability; and
- Set requirements for management action if monitoring indicates these are exceeded.

## **7.2. Environmental Auditing**

Auditing is a term borrowed from accounting to describe a systematic process of examining, documenting and verifying that EIA procedures and outcomes correspond to objectives and requirements. This process can be undertaken during and/or after project construction, and draws upon surveillance reports and monitoring data.

Environmental auditing is a review process similar to that carried out in financial accounting. Both result in a statement of facts, which certifies that practice is (or is not) in accordance with standard procedure. In the case of environmental auditing, there is an added level of interpretation, focusing on the factors of performance. The concern is to identify how the aspects, processes or systems under review can be improved.

The main techniques for conducting an environmental audit are:

- examination of records and documentation relating to impacts, actions taken to manage them and aspects of performance;
- interviews with management and line staff to corroborate factual information and probe areas of concern; and
- Site inspection to check that environmental measures and controls are operating as described and intended.

EIA audits are used to:

- ✓ identify the impacts of project implementation;
- ✓ verify whether or not the conditions of approval have been implemented;
- ✓ test the accuracy of impact predictions;
- ✓ check the effectiveness of mitigation measures; and
- ✓ Improve compliance and performance of EIA practice.

Table ??? Few of major environmental auditing and the most common issues to be considered.

<b>Types of Audit</b>	<b>Definition</b>	<b>Issues to be considered</b>	<b>Systems of approach</b>
Compliance audit	It is the verification process whereby the company established the extent to which it is complying with environmental legislation with environmental legislation, discharge and emission limits, building permit (standards).	Check against that all relevant environmental legislation and Standards are being considered	<ul style="list-style-type: none"> <li>• Interview</li> <li>• Visual observation</li> <li>• Document review</li> </ul>
Environmental risk audit	It is the process of conducting an assessment to identify potential risk points in the chain from receipt of raw material through the production processes to storage and distribution	<ul style="list-style-type: none"> <li>• Assess conditions &amp; working procedures</li> <li>• Assess the likelihood of an environmentally damaging occurrence and the consequences of the event.</li> </ul>	<ul style="list-style-type: none"> <li>• Interview</li> <li>• Visual observation</li> <li>• document review</li> </ul>
Reacquisition audit	This is commonly undertaken before the transfer of ownership from one individual to another.	<ul style="list-style-type: none"> <li>• Assess contaminated land buildings</li> <li>• Undertake historical survey through identifying past and current activities</li> <li>• Undertake site assessment</li> <li>• Undertake sample test</li> </ul>	<ul style="list-style-type: none"> <li>• Interview</li> <li>• Document Review</li> <li>• visual observation</li> <li>• Laboratory testing</li> </ul>
Management systems audit	It is the process of checking the system or procedures against the existing policy and standard and relevance of those standards and procedures for ensuring continual improvement in environmental performance.	<ul style="list-style-type: none"> <li>• Check operations against written procedures</li> <li>• Check their continual improvement program</li> </ul>	<ul style="list-style-type: none"> <li>• Interview</li> <li>• Visual observation</li> <li>• Document review</li> </ul>

**The main types of EIA related audits are:**

- Implementation audits - to verify that EIA implementation met the conditions of project approval.
- Impact audits - to determine the impact of the project and the accuracy of EIA predictions.
- Compliance audits - to verify that project impacts complied with environmental standards and regulatory requirements. It is the verification process whereby the company established the extent to which it is

complying with environmental legislation with environmental legislation, discharge and emission limits, building permit (standards).

- Effectiveness or policy audits - to check the feasibility of mitigation measures and the consistency of EIA practice. It is the process of checking the system or procedures against the existing policy and standard and relevance of those standards and procedures for ensuring continual improvement in environmental performance.

Environmental auditing can be done using methods including: **interview, visual observation, document review, laboratory testing etc.** When selecting projects for a full audit, priority should be given to those:

- ⊕ with a high level of environmental, social, economic or political impact and visibility;
- ⊕ that can yield usable results within the existing technical and budgetary constraints; and/or
- ⊕ Most at risk from deficiencies in the EIA implementation and follow up system, such as limited surveillance capability or lack of authority to enforce mitigation measures.

The case example also underlines some of the difficulties commonly experienced in the conduct of EIA monitoring and audit, including:

- limited baseline information on variability and causal relationships;
- qualitative and non-auditable impact predictions;
- late changes to project design and mitigation (thereby altering the basis on which predictions are made); and
- Long lead times before certain trends and impacts can be identified, for example, large scale but infrequent impacts (such as oil spills) or low dose, repetitive effects (such as exposure to heavy metals).

Other more flexible, less data demanding approaches can be taken in cases where an auditable trail of monitoring data is unavailable or insufficient. For example, spot audits concentrate on significant impacts or priority concerns about mitigation measures. These can be undertaken either as a series of rolling audits or a post-project analysis. An impact-backwards methodology can be used to compare EIA prediction and mitigation with environmental effects and outcomes. Impacts are verified iteratively by consultation and field checks and traced backwards to EIA practice (comparable to an effectiveness or policy audit). The following table depicts an example of environmental audit report.