

# 2

## CHAPTER

# EIA in India

Since the Stockholm U.N. conference in 1972, the increasing awareness for environmental management and need to develop new methods for sustainable development gained momentum. The passage of the U.S. National Environmental Policy Act (NEPA) 1969 incorporated the requirement for assessing the environmental impact of major projects significantly affecting the quality of the human environment. Since then, the concept of environmental impact assessment has spread out through various countries and developed as per the enviro-legal requirements of that country. However, the basic meaning, intent and usage of various terminologies in EIA has remained the same throughout, except for minor differences.

## 2.1 EIA

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The environmental assessment terminology used in the countries of Asia, Australia, N. America and Europe tends to vary both in the meaning of terms and scope of their application. The American system uses the terms EIA and EIS while the British system uses the terms EA and ES for Environmental Impact Assessment and Environmental Impact Statement respectively.

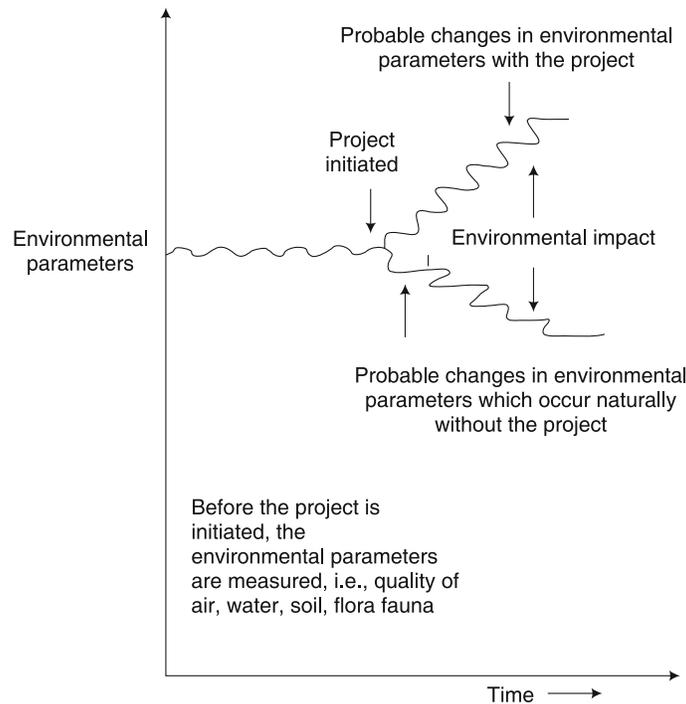
According to the American system, Environmental Impact assessment (EIA) or Environmental assessment (EA) implies determination of the environmental consequences or impact of proposed activities. EIA includes the determination of the effects or impacts of a proposed project or activity on aesthetic, historical, cultural, economic and social aspects and on the natural and physical surroundings and the interrelationship of people with the environment.

The British system defines EA as an attempt to evaluate the consequences of a proposed action on each of the descriptors in the environmental inventory.

In simple terms, the EIA is an exercise to be carried out before any project is undertaken and any major activity or plan is executed. It is an assessment of the consequences of any decision on the quality of the total environment, on which man largely depends for his well-being.

The report had carefully rejected the use of the word 'impact', as it is a misnomer and instead used the word 'effects'. However, now the word impact is used widely and both the terms 'impact' and 'effects' are frequently used synonymously.

Environmental systems are not static but change over the course of time even without the influence of man. In order to make predictions about impacts assumptions have to be made about natural change. In order to assess the impact of a development project, it would be necessary also to analyse natural changes over the same period. The Fig. 2.1 shows an environmental impact.



**Fig. 2.1** An environmental impact.

*Source* Wathern, Peter - EIA Theory and Practice, 1988. pp. 14

The major deficiency of many EIS has been the failure to establish a time frame indicating when impacts are likely to manifest. It is useful to distinguish between direct impacts and indirect impacts.

**Direct or primary impacts** are direct consequences of a particular activity. For example, without adequate mitigating measures, the construction of a dam on a river will prevent the upward movement of migratory fish.

**The indirect or secondary impacts** occur as a result of changes in a chain of environmental parameters, for example, reduction in stream flow would lower the oxygen and affect survival. Reduced water flow will also affect the nature of stream bed and consequent siltation will make conditions unsuitable for migratory fish to

breed. Examples of environmental impact or effects are given in Table 2.1. Categories of impacts or effects are given in Table 2.2.

**Table 2.1** Environmental impacts or effects.

<i>Sr. No.</i>	<i>Subject</i>	<i>Effect</i>
1.	Pollution	Effect on air, water, soil, flora and fauna, ecology biological diversity, soil erosion, land degradation, waste generation and management, radiation, climate contamination levels, health, areas of outstanding natural beauty, natural and artificial landscape, visual environment and aesthetics, noise and vibration levels.
2.	Natural Resource Utilisation	Effects on agricultural land, forest resources, water supplies, minerals, marine resources, energy resources, building materials, wetlands, mangroves, corals, rainforests, wilderness and bushes.
3.	Social Implications	Effects on settlement patterns, employment, land use, housing social life, community facilities, unemployed, aged, women, socio-economic profile of the affected community.
4.	Economic Implications	Effect on employment opportunities, facilities services, urban infrastructures

*Source* Gilpin, Alan - EIA Cutting Edge for the 21<sup>st</sup> Century, 1995, p. 9.

**Table 2.2** Categories of impacts or effects.

<i>Micro Environmental Impacts</i>	<i>Macro Environmental Impacts</i>
• Effect or problems which immediately affect the lives of citizens.	• Effects or problems which are problems of a regional, national or international character.
• Dereliction, slums and blight in certain localities.	• Dereliction, slums and blight in certain parts of the world.
• Unsafe water supplies.	• Unsafe water supplies.
• Inadequate or non-existent sewage systems.	• Inadequate or non-existent sewage systems and pollution of waterways of the world.
• Vector breeding.	• Vector breeding.
• Air, water and noise pollution.	• Regional, Transboundary and global air pollution.
• Lack of space for play or recreation.	• Flood, drought, famine, desertification.
• Loss of light in the buildings.	• Threats to natural resources, including ecosystems forest wood land and mangroves.
• Loss of heritage buildings.	• Threats to endangered flora and fauna. • Atmospheric warming, climate change and ozone layer depletion.

*Source* Gilpin, Alan - EIA Cutting Edge for the 21<sup>st</sup> Century, 1995, p. 9.

## 2.4 MEANING OF THE WORD “SIGNIFICANT”

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EIA implies a special type of analysis involving a careful, thorough and detailed analysis of the likely implications of a development. This indicates the need for some threshold of ‘significance’ being exceeded in order to trigger the full EIA process.

In U.S.A. under NEPA (1969) and the executive order and regulations of the Council on Environmental Quality (CEQ) EIA is mandatory for every recommendation or report on proposals for legislation and other major federal actions, significantly affecting the quality of the human environment. In actions which will have no significant impact on the human environment, NEPA is deemed to be complied with, without the filling of an EIA.

The question arises, what is the meaning of the word “**significance**”?

The USA council on environmental quality has provided **guidance** on the **word significance in CEQ regulations** as follows:

- (i) **Context:** The significance of an action must be analysed without the context of society as a whole, within the affected region, the affected interest, and the locality as appropriate. Both short-term and long-term effects are relevant.
- (ii) **Intensity:**
  - (a) The degree to which the proposed action affects public health and safety.
  - (b) Proximity to historical or cultural resources, parks, farmlands, wetlands, wild and scenic rivers or ecologically sensitive areas.
  - (c) The degree to which the effects are likely to be highly controversial.
  - (d) The degree to which the possible effects are highly uncertain or involve unique or unknown risks.
  - (e) The degree to which the action might establish a precedent or affect future considerations.
  - (f) The implications for cumulatively significant impacts.
  - (g) The degree to which the action might adversely affect districts, structures or objects listed in, or eligible for listing in the National Register of Historical Places.
  - (h) The degree to which the action might cause loss or destruction of significant, cultural or historical resources.
  - (i) The degree to which the action might adversely affect endangered or threatened species or its habitat that has been determined as critical under the endangered species act.
  - (j) Whether the action threatens a violation of federal, state or local law or requirement imposed for the protection of the environment.

The word ‘significant’<sup>1</sup> also appears in the EC C1A directive of 1985 and in the UN ECE convention of EIA in a trans boundary context. It appears several times in the UN Environment Programme (UNEP) principles of EIA; and in the World Bank 1992 operational directive on EA. It appears again in such national documents as the

Canadian cooperative principles for EA and the national principles for EIA in Australia. The word significant occurs in most of the national EIA legislations.

Yet at no point, is 'significant'<sup>1</sup> defined, general dictionary definitions merely suggest meaningful important or notable. Specialized dictionaries suggest something outside of acceptable limits. As a measures of significance a variation of 5% of a component in the physical environment might well have some validity. For example, a deterioration in salinity of irrigation water. However, significance is much more difficult to apply to the loss, of a view, or habitat or rare species. The concept of significance is therefore highly subjective depending upon the opinion of an assessment officer.

Some governments have sought to resolve the problem by scheduling categories of activities, which must have an EIS followed by an EIA. These statutory schedules remove the responsibility of decision makers to decide on significance. The uniformity of these schedules reveals the degree of unanimity, internationally on what kind of activity will have a significant negative effect on the environment.

Many countries have developed list of projects which should be subject to EIA on the basis of significance of the likely impacts. The main considerations are the project location as determinant of impact, as development in one area may be far more severe than if it were located elsewhere.

## 2.5 WHO SHOULD PREPARE AN EIA OR ENVIRONMENTAL ASSESSMENT DOCUMENTS

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There is dilemma in determining who shall prepare an EIA or EA document. Obviously, a proponent will have more information on the characteristics of a proposal than any other person involved in EIA.

Section 102(2) (A) of NEPA, requires that a "systematic and interdisciplinary approach" be used in preparing environmental document. Within the federal government, the responsible official of the federal agency, which is proposing the action is required to prepare environmental document and is called the Proponent of the Action.

If EIA is to be fully integrated into project formulations, responsibility for EIA preparation must lie with the proponent. Without adequate safeguards the proponent may be tempted to consider EIA simply as a means of obtaining project authorization and present only those results which show proposals in a favourable light. Therefore in most countries, proponents are required to submit an EIS with an application for authorization. During review, the technical experts, administrators, interest groups and the public are given the opportunity to comment.

In certain cases, more than one federal agency may be involved in a project due to, sharing of project leadership, joint funding of projects functional interdependence, in such cases one federal agency needs to be designated as the '**lead agency**' and consequently is the proponent of the project or the action. Any other agencies are termed "**cooperating agencies**".

In certain cases, where federal agency is merely issuing a permit licence or lease, it relies on the applicant to submit much of the environmental information needed for documentation and analysis. The applicant may be required to submit an essentially complete study. The agency should at least assist the applicant by outlining the types of information required. It is permitted for the agency to prepare the EA or EIS itself. However, in all cases granting permit, the agency must make an independent evaluation of the environmental issues involved and must take full responsibility for the scope and content of the environmental documentation actually prepared. As a result of NEPA mandated environmental assessment a number of separate documents may be required at different phases of the process. For example, notice of intent, scoping summary, EA Finding of No Significant Impact (FONIS) FIS and record of decision.

## 2.6 ISSUES IN EIA PROCESS

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In order to serve the purpose of NEPA an EIA must deal effectively with four key problems.

### 1. Impact identification

- (a) There should be comprehensiveness in the impacts identified, the full range of impacts, i.e., both direct and indirect impacts are to be identified.
- (b) Specificity should be there in the impacts identified. The specific parameters should be identified by the available methodologies and detailed parameters under categories of air, water and ecology be examined.
- (c) Isolating project impacts is very essential; the appropriate methods to be used to identify project impacts to distinguish from future environmental changes due to other factors.
- (d) Timing and duration of the impact identification,
- (e) Data sources

### 2. Impact measurement

- (a) Explicit indicators should be used to quantify impacts upon.
- (b) the methodology should provide for measurement of impact magnitude.

### 3. Impact Interpretation

- (a) Significance of measured impacts on local, regional, national scale be required.
- (b) Explicit criteria used to determine the impact significance be required.
- (c) Uncertainty in impact significance to be assessed.
- (d) Risk identification of impacts with high damage or low potential.
- (e) Method for comparing alternatives be provided.
- (f) Public involvement in interpretation of impact significance.

### 4. Impact Communication

- (a) Affected parties: mechanism for linking impacts to the specific affected geographical area or social groups.

- (b) Summary format should be provided for presenting the results of analysis in summary form.
- (c) Key issues: a format for highlighting key issues and impacts identified in analysis should be provided.
- (d) NEPA compliance: guidelines for summarizing results in terms of specific points required by NEPA and subsequent CEQ regulation should be provided.

Hence, to perform an EIA, it is essential to have a complete, clear understanding of the proposed action, to have an understanding about the affected environment, to have an idea about what factors of the environment are going to be affected, to know about what will be the possible impacts of the proposed action on the factors of environment, to report the results of the study in a manner such that the analysis of probable environmental consequences of the proposed action may be used in the decision making process.

## 2.7 THE EIA PROCESS COMPONENTS

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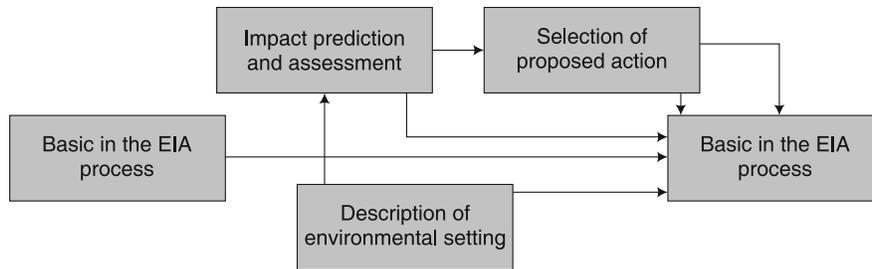
This essentially involves the complete EIA process, leading to a decision. In USA, the term used is environmental review process and is applied not only to physical projects but can also apply to plans, programmes, policies, legislation and regulations which could cause, potentially significant environmental impacts.

EIA procedures differ in detail around the world, i.e., different procedures are adopted in different countries. Yet basically they are united, in being designed to deal with particular issues. The need for certain activities at certain points dictates the nature of the process. These individual issues and the procedural needs which they generate are fitted together to show the whole EIA process.

The unified model of EIA process basically has three components:

- (a) First, the appropriate information necessary for a particular decision to be taken must be identified and collected.
- (b) Second, changes in environmental parameters, resulting from implementation must be determined and compared with the situation likely to take place without the proposal.
- (c) Finally, actual change must be recorded and analysed.

Figure 2.2 shows four activities of environmental assessment process. There are certain basics, which are required to accomplish an environmental assessment. They are related to the (i) description of the environmental setting; (ii) impact prediction and assessment; (iii) selection of proposed action and (iv) preparation of environmental impact statement.



**Fig. 2.2** Elements of EIA process.

*Source* Lohani N. Bindu - Environmental Quality Management, 1984, p. 197.

In order to be able to predict and assess the impacts associated with a proposed action, it is necessary to describe the environmental setting in which a proposed action is to take place. This gives the baseline information against which prediction and assessment can be made and provide input information for preparation of the EIS.

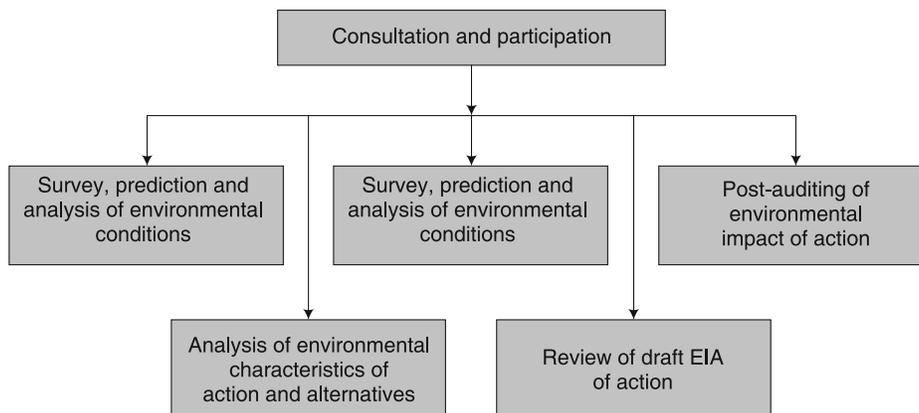
Impact prediction and assessment is the major step in the environmental assessment process. It involves projection of the environmental setting into the future without the proposed action and predicting the impact and assessing the consequences.

The next step is the aggregation of the impact formation on each alternative and selection of the proposed action based on this.

The last step involves the preparation of a draft EIS according to the CEQ. After review and comment by the authorities, a final EIS is prepared and filled with the CEQ. Thirty days after the filling, the initiation of the proposed action can begin.

This approach is generally applicable but strict adherence to these steps is not a must.

Figure 2.3 shows the representation of activities involved in EIA.



**Fig. 2.3** Representation of activities involved in EIA.

*Source* Wathern, Peter - EIA Theory and Practice, 1988, p. 6

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## 2.8 SCOPING METHODS AND BASELINE STUDIES IN EIA

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Scoping and baseline studies are activities that are undertaken at early stages in an environmental impact assessment.

Scoping refers to the process of identifying the priority of issues to be addressed by an EIA.

**Baseline studies** are designed to provide information on the issues and questions raised during the scoping exercise.

**Scoping:** It is a process undertaken for identification of impacts to be assessed, many of the impacts of a proposed development may be trivial or of no significance to the decision which have to be taken. Scoping is the process for determining which issues are likely to be important.

The term scoping has recently appeared on the EIA scene as a result of the 1979 regulations under the US National Environmental Policy (NEPA) which requires lead agencies to undertake an early and open process for determining the scope of issues to be addressed and for identifying the significant issues related to a proposed action (Council on Environmental Quality, 1980).

It is a very early exercise in an EIA in which an attempt is made to identify the attributes of components of the environment for which there is public (including professional) concern and upon which the EIA should be focussed. (Beanlands and Duinker, 1983)

There are various direct and indirect ways of conducting a scoping exercise. Regardless of which approach is used, however, it should always occur very early in the EIA process. Under NEPA regulations the sponsoring federal agency is required to have meetings involving all parties directly or interested in the proposed project. At these sessions, the participants are encouraged to present their concerns about the project and an attempt is made to define the priorities in these perceived problems.

Under the Canadian Federal Environmental Assessment Review Process (EARP), similar approach is used. Prior to formal EIA hearings, similar community based meetings are held at which local residents and other interested parties are given the opportunity to discuss their concerns in the presence of the assessment panel and representatives of the industrial proponents.

The advantages of the scoping meeting is that it gives an opportunity for an open dialogue between those responsible for the EIA and the public whose interests they are supposed to represent. It provides a list of priority concerns which in turn would be incorporated into guidelines for the preparation of an EIS. Thus, the scoping programme may have a major influence on the focus of the entire EIA and therefore upon the advice given to the decision makers.

The scoping exercise may thus be described as the process identifying the status of the project within the context of planning and environmental law; national, state, provincial and local planning requirements and policies; clarifying the potential

economic, social and environmental benefits and disbenefits of the proposed policy, plan program or project.

Meeting of the decision making body with affected and interest individuals, groups, agencies and departments at all levels of government help to identify the scoping of the issues to be addressed. All this would help to prepare the Terms of Reference (TOR) for the EIS or EIA on the proposal.

The disadvantage of scoping is that it is time consuming, requires financial and manpower resources and needs complete corporation of the industrial proponent.

### 2.8.1 Baseline Studies

One of the first steps in the environmental assessment process is to describe the environmental setting for the project area. This description provides baseline data against which prediction and assessment of the impact of the proposed action and alternatives can be compared. Before assessing the environmental impact of a development project, the background data on the natural conditions of the ecosystem should be collected. This will include information on the physical, chemical, biological and social environment, which could be affected by the development project under consideration, the distribution and abundance of species and the normal variation in these attributes over the annual cycle.

The term “**baseline studies**” entered the environmental literature at about the same time as the concept of EIA, about 15 years ago. Although the phrase did not appear in the wording of NEPA, it quickly became standard terminology in EIS prepared under that legislation. There is no universally accepted definition for environmental baseline studies. Walsh (1983) in a major dissertation the subject records more than 15 formal written definitions of the term. In general, it is directed towards establishing a valid description of selected environmental components prior to the onset of the project. Then an attempt is made to predict the extent to which the values would change as a result of the project.

The important uses of baseline studies are the following:

- (1) They provide data for impact evaluation and project design (particularly for pollution control measures).
- (2) They are useful in the monitoring of environmental quality changes after a project is implemented.
- (3) It is advisable for governments to sponsor baseline studies in connection with private developments so that pressure can be later applied if there is serious deterioration of environmental quality.
- (4) They establish the assimilative capacity of a natural system.
- (5) They also establish the project need, whether the project involves the construction of a highway, reservoir or sewage treatment plant, etc.

Regular large scale baseline studies will show the trends of environmental quality change, resulting from man’s activities over a widespread area. They help planned environmental development, especially in coastal zone management. They provide

## **2.12 SCREENING**

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The beneficial and detrimental, short- and long-term effects of each alternative are compared and summarized to facilitate discussion and evaluation by interested parties and the interested and affected general public. The preferred alternative and the reasons for it are also identified. This step in EIA process also identifies, explains and discusses the limits of alternatives, risk and uncertainty.

## **2.13 COMMUNICATION**

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The full involvement of the public should be sought at all stages of the development of the draft and the final EA. Public inquiries and hearings should be held, and small mediation type meetings are appropriate. The proposed mitigation measures should be fully discussed. New issues and aspects might be raised by the public which require explanation. A final document should be issued to the public focussing the reasons for the preferred decision.

## **2.14 DECISION**

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The decision of the decision making body should be released publicly, noting the avenues of appeal that are available to the proponent and members of the public.

## **2.15 MONITORING**

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it is generally undertaken before during and following the construction of a project. A condition of approval might be the preparation of an annual report for public release consolidating the environmental data obtained and reviewing progress with the implementation of all consent conditions. The project might be subject to an annual independent environmental audit. Individual government agencies become responsible for the surveillance of different aspects of the project and the legal enforcement of the conditions. Many consider this phase to be part of the EIA process, while some consider that EIA process terminates with the decision making step.

## **2.16 EIA METHODOLOGIES, CLASSIFICATION AND FUNCTIONS**

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The early EIA literature was dominated by methodological issues. Demand was there for guidance on EIS preparation due to the risk of a court case over an inadequate EIS. Attempts were made to produce complete handbooks for preparing EIS encompassing not only EIA methods but also techniques for determining individual impacts. For example, USA (Canter 1977, Cheremisinoff and Morressi 1977 ) UNEP 1980. it represents

the response of an international agency to the need for guidance on preparing environmental assessments for industrial projects.

EIA methods were developed in early 1970s and are used in assessment of impact. Different methods are used for assessing impacts of different activities. The impact assessment methods are classified in three categories or groups on the basis of three analytic functions.

**(a) Identification**

- For description of the existing environmental system.
- For determination of the components of the project.

The methods for impact identification can assist in specifying the range of impacts that may occur. This usually involves the components of the environment affected by the activities of the project.

**(b) Prediction**

- For identification of environmental modification that may be significant.
- Forecasting of the quantity or dimension of change in the environment identified.
- Estimation of the probability that the impact or environment change will occur in a time period.

The predictive methods will define the quantity or dimension of change in environment due to impact of the specific actions. It can differentiate between various project alternatives in terms of questions concerning “how much? or where?” an impact may occur.

**(c) Evaluation**

- For determination of the incidence of costs and benefit to user groups and populations affected by the project.
- Specification and composition of the trade-off (cost or effects being balanced) between various alternatives.

The methods of evaluation should assist in communicating to the decision maker, what the deficiencies are between possible alternatives or courses of action and the impacts associated with each alternative. It also determines the groups that may be directly or indirectly affected by the project or action.

Under each category different EIA methods are available.

Identification	—	Checklist method Environmental Impact Matrix
Predictive	—	Environmental Information Systems and Models Scaling and Measurements
Evaluation	—	Environmental Evaluation System

**EIA methods are formulated throughout the world**

To select the appropriate tool or method, the points to be considered are application, alternatives, public involvement, the resources available, time limit, and familiarity, issue significance and whether the activity is controversial.

scope of an appraisal, to identify the key components of environmental systems which may be affected. Computer simulations are used to determine the likely outcome of the proposals based upon certain assumptions.

The workshops use scientists, decision makers and computer modelling experts, who construct a simulation model of the system likely to be affected by a development. The participants have to reach consensus on the important features and relationship which characterize the systems studied. The qualitative output from the workshop is 'translated' by modelling experts into a model consisting of quantitative relationships between the selected parameters. Likely impacts resulting from introduction of exogenous factors such as development projects can be seen quickly by operating the model under different assumptions. Constructing the model shows areas where data are deficient and allows appropriate research work to be carried out to provide the data. This method has been used for Nam Pong multipurpose water project project in Thailand (1982), for Salto Grade Dam and reservoir on the borders Uruguay and Argentina.

Advantage of this method is that the assumptions can be varied and the simulation rerun repeatedly to show the implications of a range of decisions. This approach has been most widely used for natural resource management programmes.

**(5) AD-HOC:** It provides minimal guidance for impact assessment. It suggests broad areas of possible impacts rather than defining the specific parameters within the impact area which should be investigated. They are effective when the prepares are experienced in the type of action being examined. The drawbacks of this method are that it gives no assurance about compliance of all impacts, it lacks consistency in analysis and is inefficient, as it does not study the impact in detail.

**(6) Matrices:** Leopold et al. (1971) were the first to suggest the use of a matrix method for EIA. It was one of the first attempts to outline a procedure for evaluating the environmental impact of development projects. Matrices are particularly useful for EIA as they reflect the fact that impact results from the interaction of development activities and the environment.

The Leopold matrix is an environmental matrix which is primarily a checklist designed to show possible interactions between development activities and a set of environmental characteristics.

100 different types of impact and 88 environmental characteristics are identified in the system giving total of 8800 possible interactions.

Each action (in top horizontal list) which is likely to be involved in the developmental project is checked in terms of effect on environmental characteristics (on vertical axis). A slash is placed diagonally from upper right to lower left across each which represents significant interaction.

After all the boxes which represent possible interaction are marked, the most important ones are evaluated individually.

Within each box, place a number from 1 to 10 in the upper left hand corner to indicate relative magnitude of the impact (1 is the least impact 10 is the greatest). In the lower right hand corner of the box, place a number from 1 to 10 to indicate relative importance of the impact.

Magnitude is degree of the impact – based on fact

Importance is the extent of significance of the impact – based on judgement

The matrices thus give a cause and effect relationship between specific developmental activities and impacts on environmental parameters. The method may either specify which action affects which environmental parameter, or may simply list the range of possible actions (developmental activities) and environmental parameters in an open matrix which is to be then completed by the analyst.

Matrices are useful to identify the impacts and as a format for communicating results of the analysis. They are flexible in approach and can be applied with alterations for any project.

The limitation of matrices method is that guidelines for use are minimal and ambiguities are there. Moreover, the size of 8800 possible interactions is too difficult to assess overall impact by inspection. Figure 2.4 shows a Leopold Matrix

Proposed action which may cause environmental impact

Proposed action	A Modifica- tion of regime	B Land transfor- mation and construc- tion	C Resour- ces extrac- tion	D Proce- ssing	E Land alter- ation	F Resou- rce renewal	G Change in traffic	H Waste treat- ments	I Chemical treatment	J Accid- ents	K Others	Total total 11 categories
Existing environment conditions	13 Sub-categories	14 Sub-categories	7	15	6	5	11	14	5	3	2	100 sub-categories
A Physical and chemical	35 Sub-categories											
B Biological conditions	18											
C Cultural factor	36											
D Ecological relations	7											
E Others	2											
Total 5 categories	88 Sub-categories											

Magnitude of impact 1-10 degree extensiveness of the impact on a specific sector of the environment

Importance of impact significance of the impact. Particular action on environment 1-10 factor in the specific instance under analysis

**Fig. 2.4** Leopold matrix.

Source Lohani, N. Bindu - Environmental Quality Management, 1984.

**(7) Environmental Evaluation System (EES):** This method was developed by the Battelle Laboratories of Columbus for the US Bureau of land reclamation: it was specifically intended for use in the assessment of water resource projects, but is potentially applicable to other types of developmental project.

EES is based on hierarchial checklist of 78 environmental parameters. Environmental quality is scaled from O (very bad) to 1 (very good) and can be defined in a number of ways.

The limitation of this method is that the definition of environmental quality is arbitrary.

**(8) Overlays:** These methodologies rely upon a set of maps of environmental characteristics for a project area. The environmental characteristics are physical, social

**In the third step**, it is required to construct a market simulation of the ecosystem. Market prices are obtained for project development costs, construction, labour, material and other operating costs. Unpriced components will relate to the ecosystem and are the values attached to water quality, air quality, wilderness quality, biological health, species balance and hazards to species.

The unpriced components can be valued at the cost of rectification or avoidance. For example, damage to wilderness quality caused by power transmission lines from a hydroelectric scheme could be assigned the costs associated with either burying the lines underground or realigning them to minimize their impact on environment.

**The last step** is the estimation of marginal costs and marginal returns in terms of environmental quality.

- (b) **Computer based PERT Network Approach:** This is a tool for compiling and submitting an environmental impact statement.

(12) **Sound ecological principles : The New Approach to EIA:** In 1980, Fritz et. al., formulated an ecological modelling approach to EIA. Important contributions were made by Ward and Sanders et al. (1980). Concern over the status of the ecological component of EIA led to a major Canadian study to formulate guidelines to improve the ecological contribution to EIA (Beanlands and Duinkar, 1982).

## 2.18 TOOLS OF EIA

Under each methodology, different authors have worked out different methods for EIA. Thus there are 19 tools or methods of EIA as given in Table 2.3.

**Table 2.3** Tools of EIA.

<i>Sr. No.</i>	<i>Author</i>	<i>Methodology</i>	<i>Purpose</i>
1.	Adkins	Checkist	
2.	Dee 1972	Checkist	
3.	Dee 1972	Checkist-Matrix	Designed for water resources development project. 78 specific environmental parameters are defined with 4 categories of ecology, environmental pollution, aesthetics and human interests. Impacts are measured via specific indicators and formulate defined for each parameter, parameter measurements are converted to common base of environmental quality units.

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Contd...

4.	University of Georgia	Checkist	
5.	Jain/urban	Combination computer aided	
6.	Jain 1974	Matrix	
7.	Krauskoff	Overlap	
8.	Peopold	Matrix	
9.	Little	Checkist	
10.	Me Harg	Overlap	
11.	Moore	Matrix	
12.	Central New York Planning Board	Matrix	
13.	Smith	Checkist	
14.	Soreson	Network	
15.	Stover	Checkist	
16.	Bureau of Reclam	Checkist	
17.	USA COE	Checkist	This was to deal specifically with water resources development projects. Impacts are identified in 3 categories. Those which affect environmental quality, those which affect human life and those affecting economics. Limitations are lack of guidelines to measure the impact.
18.	Walton	Checkist	
19.	Western systems	AD-HOC	
<i>Source</i> Jain R.K, Urban, L.V. Environmental Assessment, 1993, p. 123			

Thus, various methodologies have evolved and been developed all over the world for effective conduction of an EIA for development projects. Each methodology offers some benefits and suffers from some disadvantages.

Mostly, by combination of different methodologies, an EIA can be carried out for the projects which helps to mitigate the adverse environmental impacts and helps in protecting and conserving the environment, in keeping with the principle of sustainable development.

#### **EIA: Framework and Guidelines**

The increasing awareness for environmental management and need to develop new methods for sustainable development, has led to the evolution of EIA.

- (iv) Exploration for oil and gas and their production, transportation and storage
  - (v) Synthetic rubber
  - (vi) Hydrocyanic acid and its derivatives
  - (vii) Primary metallurgical industries
  - (viii) Chlor alkali industry
  - (ix) Viscose, staple fibre and filament yarn.
  - (x) Storage batteries integrated with manufacture of oxides of lead and lead antimony alloy
  - (xi) Pulp, paper and newsprint
  - (xii) Cement.
2. The following industrial activities where the investment is Rs. 1 crore and above.
- (i) Pesticides (technical)
  - (ii) Bulk drugs and pharmaceuticals
  - (iii) Asbestos and Asbestos products.
  - (iv) Integrated paint complex including manufacture of resins and basic raw materials required in the manufacture of paints
  - (v) Distilleries
  - (vi) Raw skins and hides
  - (vii) Dyes
  - (viii) Foundries (individual)
  - (ix) Electroplating
3. All industrial projects to be located in any of the notified ecologically fragile/ sensitive areas.

### **Industrial licensing**

The industrial licensing mechanism of Govt. of India provides that the investor first obtains a letter of intent (LOI) for certain specific products to be manufactured. This LOI is then converted to an industrial Licence subject to certain conditions. Flow chart gives the industrial Licensing Procedure. Flow chart 2 gives the particulars of consent to operate an industrial unit.

### **2.21 ROLE OF SITING GUIDELINES**

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Ministry of Environment and Forest has also prepared 'siting guidelines'. These guidelines help an investor to obtain the clearance faster.

2. If the investment is less than Rs. 50 crore, the environmental clearance from the Central Government is not required and they can approach the concerned state government department/agencies.

**III.** A separate 'site clearance' is to be obtained from the Central Government, in case of pit head thermal power stations, which is also applicable only to those projects involving an investment of Rs. 50 crore or above.

**IV. All River Valley Projects** including hydro power, major irrigation and their combination including flood control, where the investment is Rs. 50 crore or above only need to obtain environmental clearance from the Central Government.

**V. All other projects** need to approach the concerned State Government departments/agencies only for the necessary clearance and permits.

**VI. Tourism Projects** including hotels and beach resorts:

1. All tourism projects between 200-500 metres of high tide line and at locations with an elevation of more than 1000 metres and involving an investment of Rs. 5 crore and above are required to obtain environmental clearance from the Central Government.
2. Hotels, beach resorts and tourism projects have to comply with certain conditions detailed in the Coastal Zone Regulation Notification of 19<sup>th</sup> Feb. 1991.
3. The CRZ notification stipulates that the proposed construction of hotel and beach resorts has to be 200-500 metres away from the high tide line depending on the ecological sensitivity of the area.
4. The total covered area of the above-mentioned buildings should not exceed 33% of the plot area and the maximum height should not be more than 9 metres and only two floors are permitted.

## 2.23 PREPARING DOCUMENTS FOR ENVIRONMENTAL CLEARANCE

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Flow chart 2.1 to 2.3 (As per a booklist circulated by Ministry of Environment and Forest, Govt. of India) explains stepwise process involved in environmental clearance of the projects.

A number of guidelines have also been prepared by the Ministry of each sector. Detailed questionnaires have also been prepared for submission of project proposals in different sectors. Following guidelines/required proforma have been given by the MEF.

1. Siting guidelines for industries.
2. Environmental Guidelines for Industries.
3. Composition of the expert committee for Environmental Impact Assessment.
4. List of industries which require industries licensing.
5. List of projects requiring environmental clearance from the Central Government.

6. Proforma for applying for environmental clearance of projects.
7. Application form for clearance from forest angle.
8. List of ecologically sensitive/protected areas.
9. Questionnaires for information on environmental aspects of industrial projects.
10. Specimen form of application to the Central Pollution Board for seeking – No Objection Certificate from pollution angle.
11. Consent to establish/operate for emission.

As per EIA notification, following documents are to be prepared and produced by an investor:

1. Feasibility/Project Report (one copy).
2. Site clearance (only for site specific projects as mentioned in the EIA notification). A questionnaire is to be submitted for site clearance.
3. No Objection certificate from the State Pollution Control Board and other local authorities.
4. Questionnaire on environment aspects of the projects and or/application form for environmental clearance.
5. Environmental Impact Assessment Report/Environmental Management Plan (20 copies).
6. Risk analysis/emergency preparedness plan (only in the case of projects involving hazardous substances) (20 copies).
7. Rehabilitation plan where target scale displacement of people is anticipated (more than 1000 people).
8. Commitment regarding availability of water and electricity from the component authority.
9. When a project requires both environmental clearance as well as approval under the Forest (Conservation) Act, 1980, proposals for both are required to be given simultaneously to the concerned divisions of the Ministry. The processing is done simultaneously for clearance/rejection, although separate letters may be issued. If the project does not involve diversion of the forest land, the case is processed only for environmental clearance.

As a comprehensive EIA report will normally take at least one year for its preparation, project proponents may furnish Rapid EIA report to the Impact Assessment Agency based on one season data (other than monsoon), for examination of the project and comprehensive EIA report may be submitted later if so asked for by the Impact Assessment Agency.

The requirements of EIA may be dispensed with by the impact assessment agency, in case of projects which are unlikely to cause significant impact on environment. In such cases project proponents will have to furnish full justification for such exemption, for submission of EIA, where; such exemption is granted, project proponents may be asked to furnish such additional information as may be required.

## 2.26 GUIDELINES FOR EIA OF WATER RESOURCES DEVELOPMENT PROJECTS: INTERNATIONAL SCENARIO

The UNEP has some publications of global assessment of environmental impacts of Large dams and water schemes. It provides assistance to specialized water resources training institutions, to train experts for integrated water developmental projects. It encourages construction of small dams and effective rehabilitation schemes, health impact and prevention of deforestation.

The World Bank Group has developed detailed environmental considerations and guidelines for the appraisal of projects. These guidelines are to be considered for EIA of dams and reservoirs.

Table 2.4 gives the matrix for the general impacts of a dam. The World Bank plays an active part in water resources development projects. By the end of 1991, the bank had lent over US \$ 34 billion for water projects. There has been an increase in water consumption and therefore, need to utilize water by proper planning of irrigation projects. The World Bank has adopted a new policy in water resources development projects. This policy is based on a new approach that recognizes water as a basic need and a scarce economic resource. The World Bank's Water Resources Development Policy, was approved by the Board of Directors in May 1993.

This policy seeks to balance two fundamental considerations:

- The need for a holistic management approach that gives due weightage to long-term factor and to protect the ecosystems.
- To improve the allocation of water among competing users.

**Table 2.4** Matrix for the general impacts of a dam.

	1	2	3	4	5	6	7	8	9
Proposed action →		Herbicide control and fertilizer use	Food control	Dam construction	Reservoir filling (storage)	Immigration of labour	Transmission lines	Heavy metals contamination	Relocation of inhabitants
Effect on ↓									
Water weeds									
Water contamination									
Flora & fauna									
Fishery					(+)				

Contd...