

What is EIA?

Why necessary?

How it is performed / carried?

Definition of EIA :-

The EIA has been defined (David P Lawrence, 2003, EIA Practical Solutions to Recurrent Problems) as:

- \* Determining and managing (identifying, describing, measuring, predicting, interpreting, integrating, communicating, involving and controlling) the,
- \* Potential (or real) impacts (direct and indirect, individual and cumulative, likelihood of occurrence) of,
- \* Proposed (or existing) human actions (projects, plans, programs, legislation, activities) and their alternatives on the,
- \* Environment (Physical, Chemical, biological, human health, cultural, social, economic, built and interactions)"

Environment will cover, the existing condition in or/and around the area is as much as:

- (i) Physical environment to include:
  - (a) Land and Climate: Weather conditions to include temperature (ambient), humidity, wind velocity, precipitation, land use, topography, geology and seismic considerations.
  - (b) Atmospheric conditions: Ambient air quality at the site and around specially in down wind direction
  - (c) Water bodies: Lakes, rivers, ponds and canals. Hydrology and existing quality. Ground water availability and flow regime
  - (d) Noise level
- (ii) Chemical Environment to include:
  - (a) Industrial activities, types of industries at the site and around (10 km radius), types of wastes produced and methods of treatment and disposal of effluents.
  - (b) City dumping sites, land fill sites
- (iii) Infrastructure: Public, Services, Water Supply, Waste Treatment Plants, Energy resources, distribution system, Transport system, communication, important buildings, heritage, sites etc.
- (iv) Biological environment: Vegetation, forests, flora, fauna. Natural vegetation, parks, cultivated land, crops, threatened and endangered species.

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some of the environmental clearance procedures in practice in India.

### LEARNING OBJECTIVES

After completing this Unit, you should be able to:

- discuss environmental impact assessment (EIA) as an environmental management tool;
- trace the evolution of EIA;
- discuss what forecasting of environmental changes entails;
- explain strategic environmental assessment (SEA);
- list and comply with the environmental clearance procedures in India;
- plan and carry out an environmental impact assessment study.

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### 3.1 INTRODUCTION TO EIA

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Environment assessment involves a study to determine any unique environmental attributes from endangered species to existing hazardous waste to historical significance. Environment Assessment procedure ensures consideration of environmental implications before making a final decision of assessing the environmental attribute. Process of assessment analyses the effects on environment and is useful for reporting those effects undertaking a public consultation exercise and lastly it reveals decision to public after reviewing the comment of the report. One of the main strengths of environmental assessment (EA) is its flexibility. Project planning processes can integrate EA as

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essential step giving sensitivity to the social and economic as well as environmental impacts of projects. In this way project managers can compensate shortcomings in the project planning process.

For example, a project which failed to adequately consult the community at the outset can take advantage of the Environment Assessment to involve the community in a necessary exchange of ideas and views. The EA can help establish and strengthen decision-making and communication mechanisms within a project. It can also pave the way for introducing innovations. An EA may reveal sound environmental, social or economic reasons for shifting a project's direction. In view of the primacy accorded the opinions and aspirations of local people, the EA process may also function as a project control mechanism. While the EA should not be expected to correct all the weaknesses of a flawed planning process, when properly designed and executed, it can be a valuable tool for project implementation. When the role of the EA is more restricted, the situation can work in reverse. Other project planning activities can be used to gather necessary information for the EA and to create support for the EA process. Each project manager must decide how much importance to accord each planning.

Duration for EA will hinge on [<http://www.gdrc.org/uem/e-mgmt2.html>]:

-  The size and complexity of the proposed project.
  - The extent of co-operation received from the project sponsor and third parties such as local government.
  - The level of interest and support demonstrated by the community.
  - The ability of the project team to sustain interest in the EA.

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- The EA techniques employed.

In principle, environmental assessment can be undertaken for

- Individual projects such as a **dam**, **motorway**, **airport** or **factory** and call it as 'Environmental Impact Assessment' (EIA).
- **Plans, programs and policies** and call it as '**Strategic Environmental Assessment**'(SEA).

These two sections are discussed in detail in the further sections

In recent years, there has been a remarkable growth of interest in environmental issues, sustainability and the better management of development in harmony with the environment. Associated with this growth of interest has been the introduction of new legislation, emanating from national and international agencies (e.g., the European Commission) that seek to influence the relationship between development and environment. Environmental impact assessment (EIA) is an important example. It is defined as an activity designed to identify and predict the impact of legislative proposals, policies, programmes, projects and operational procedures on the bio-geophysical environment and on the health and well being of human beings and to interpret and communicate information about the impact.

That is to say, EIA focuses on problems, conflicts or natural resource constraints that could affect the viability of a project. It also examines implications of a project that might harm people, their homeland or their livelihoods, or other nearby developments.

After predicting the problems, a EIA identifies measures to minimise the problems and outlines ways to improve the project's suitability for its proposed environment. In the last three decades,

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EIA has been recognised as the **most valuable**, **inter-disciplinary** and **objective decision-making tool** with respect to alternate routes for development, process technologies and project sites. It is considered an **ideal anticipatory mechanism** allowing measures that ensure environmental compatibility in our quest for socio-economic development.

EIA is generally wider in scope and less quantitative than other techniques, such as cost-benefit analysis. EIA has the potential to be a basis for negotiation among the developers, public interest groups and planning regulators.

#### **The Benefits of Environmental Assessment**

Most governments and donor agencies acknowledge the contribution of EA to improved project design. The weakness of EA in the past has been largely due to poor techniques and the failure to pay attention to findings at the implementation stage (ESSA Technologies 1994). A review of current environmental practices found the major benefits of the EA process for project sponsors to be (ESSA Technologies 1994: 16):

- Reduced cost and time of project implementation.
- Cost-saving modifications in project design.
- Increased project acceptance.
- Avoided impacts and violations of laws and regulations.

- Improved project performance.
- Avoided treatment/clean up costs.

The benefits to local communities from taking part in environmental assessments include:

- A healthier local environment (forests, water sources, agricultural potential, recreational potential, aesthetic values, and clean living in urban areas).

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- Improved human health.
- Maintenance of biodiversity.
- Decreased resource use.
- Fewer conflicts over natural resource use.
- Increased community skills, knowledge and pride.

### Principle of EIA

It is important to recognise that there is a general principle of assessment that applies to EIA, and to other assessment processes. There are several other processes that relate closely to the review of environmental impacts that may result from a proposed project. The following are well recognised processes:

- Social Impact Assessment
- Risk Assessment
- Life Cycle Analysis
- Energy Analysis
- Health Impact Assessment
- Regulatory Impact Assessment
- Species Impact Assessment
- Technology Assessment
- Economic Assessment
- Cumulative Impact Assessment
- Strategic Environmental Assessment
- Integrated Impact Assessment

Some, like Energy Analysis, focus on a particular part of the environment. Others, like Life Cycle Analysis, enable the consideration of all those parts of the environment that are relevant to the assessment. Also, depending on how the terms, like health, are defined for the study you may find that it is covering most of the issues that would be found in an EIA. For example a Technology Assessment does include

review of the impacts on ecosystems, air quality and the like.

Similarly, if the definition of environmental is taken broadly for an EIA, then the EIA may cover the issues of the other assessment processes; for example:

- Social aspects (such as impacts on employment, community interaction);
- Risks (such as threats to native animals, water supplies);
- Life cycle (such as the impacts at each stage of the project design through to operation and closure); and

- Energy (such as use of non-renewable energy sources, Greenhouse gas emissions), etc

So there is the potential for a lot of connections between the different forms of assessment. The essential difference between them is how the terms, or scope of assessment, are defined narrowly, or broadly. Otherwise they all follow the same general principle.

With all the assessment approaches noted above, they are designed to identify potential impacts of a development, action or project. To do this the assessor needs to use personal experience and the experiences of others (including available knowledge) to think broadly about the changes that are possible, and whether those impacts will be positive or negative.

Particular approaches emphasise specific types of impacts (i.e. on health, on social groups). All have basically the same approach, although each may have its own individual language and detailed techniques.

Most of the assessment processes also include a second step. After identifying the impacts, they also consider what may be needed to avoid or reduce adverse impacts.

### 3.1.1 Purposes of EIA

EIA is a process with several important purposes, which can be categorised as follows:

- **To facilitate decision-making:** For the decision-maker, for example the local authority, it provides a systematic examination of the environmental implications of a proposed action, and sometimes alternatives, before a decision is taken. The decision-maker along with other documentation relating to the planned activity can consider the environment impact statement (EIS).
- **To aid in the formation of development:** Many developers see EIA as another set of hurdles for them to cross in order to proceed with their various activities. They may also see the process involved in obtaining the permission from various authorities as costly and time-consuming. In reality, however, EIA can be of great benefit to them, since it can provide a framework for considering location and design issues and environmental issues in parallel. It can be an aid to the formulation of developmental actions, indicating areas where the project can be modified to minimise or eliminate altogether the adverse impacts on the environment. The consideration of environmental impacts early in the planning life of a development can lead to environmentally sensitive development; to improved relations between the developer, the planning authority and the local communities; to a smoother planning permission process and sometimes to a worthwhile financial return on the expenditure incurred.
- **To be an instrument for sustainable development:** The key characteristics of sustainable development include maintaining the overall quality of life, maintaining continuing access to natural resources and avoiding lasting environmental damage.

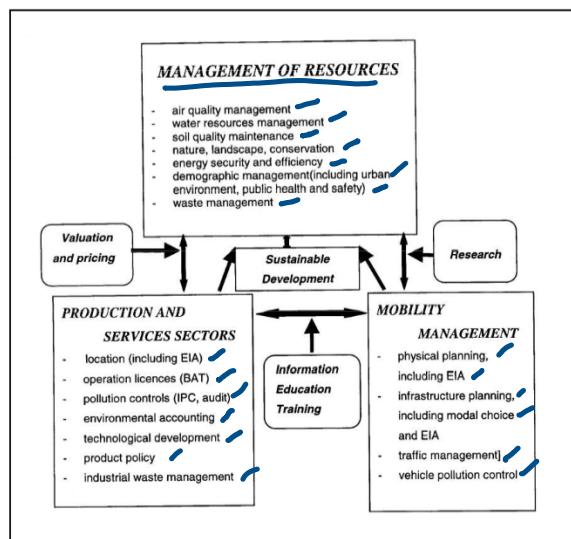
Institutional responses to sustainable development are,

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therefore, required at several levels. For example, issues of global concern, such as ozone-layer depletion, climate change, deforestation and biodiversity loss, require a global political commitment to action. The United Nations Conference on Environment and Development (UNCED) held in Rio de Janeiro in 1992 was an example of international concern and also of the problems of securing concerted action to deal with such issues. Governments have recognised the interaction of economic and social development and the ecosystems, and the reciprocal impact between human actions and the bio-geophysical world. While there are attempts to manage this interaction better, investigation reveal disquieting trends that could have devastating consequences for the quality of the environment. These trends are likely to be more pronounced in developing countries where, because of greater rates of population growth and lower current living standards, there is more pressure on environmental resources.

In short, an interaction among the resources, sectors and policies is necessary for sustainable development as illustrated in Figure 3.1 below, and EIA contributes to this process:

**Figure 3.1**  
Sustainable Development: An Illustration



### 3.1.2 Steps in EIA process \*

EIA represents a systematic process that examines the environmental consequences of the development actions, in advance. The emphasis of a EIA is on prevention and, therefore, is more proactive than reactive in nature. The EIA process involves a number of steps, some of which are listed below:

- **Project screening:** This entails the application of EIA to those projects that may have significant environmental impacts. It is quite likely, however, that screening is done partly by the EIA regulations, operating in a country at the time of assessment.
- **Scoping:** This step seeks to identify, at an early stage, the key, significant environmental issues from among a host of possible impacts of a project and all the available alternatives.

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- **Consideration of alternatives:** This seeks to ensure that the proponent has considered other feasible approaches, including alternative project locations, scales, processes, layouts, operating condition and the *no-action* option.
- **Description of the project/development action:** This step seeks to clarify the purpose and rationale of the project and understand its various characteristics, including the stages of development, location and processes.
- **Description of the environmental baseline:** This includes the establishment of both the present and future state of the environment, in the absence of the project, taking into account the changes resulting from natural events and from other human activities.
- **Identification of key impacts:** This brings together the previous steps with a view to ensuring that all potentially significant environmental impacts (adverse and beneficial) are identified and taken into account in the process.
- **The prediction of impacts:** This step aims to identify the likely magnitude of the change (i.e., impact) in the environment when the project is implemented in comparison with the situation when the project is not carried out.
- **Evaluation and assessment of significance:** This seeks to assess the relative **significance** of the predicted impacts to allow a focus on key adverse impacts. Formal definition of significance is the product of consequence and likelihood as  
$$S = C \times L$$
  
Significance = consequence X Likelihood
- **Mitigation:** This involves the introduction of measures to avoid, reduce, remedy or compensate for any significant adverse impacts.
- **Public consultation and participation:** This aims to assure the quality, comprehensiveness and effectiveness of the EIA,

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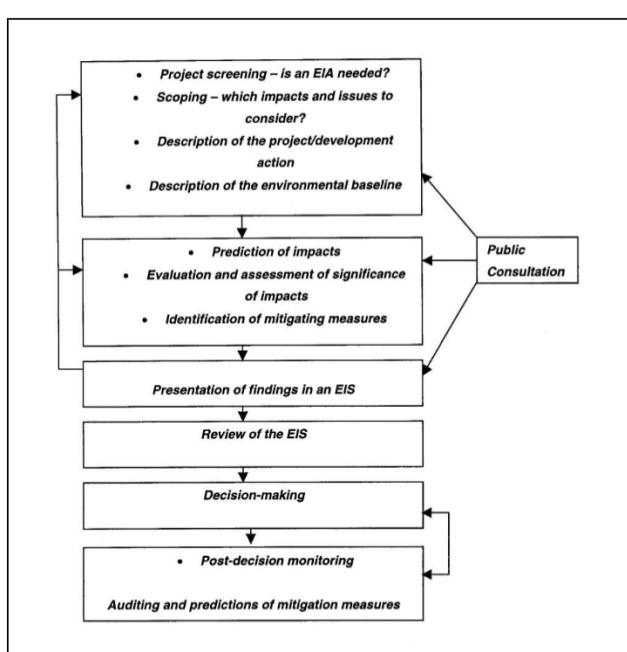
as well as to ensure that the public's views are adequately taken into consideration in the decision-making process.

- **EIS presentation:** This is a vital step in the process. If done badly, much good work in the EA may be negated.
- **Review:** This involves a systematic appraisal of the quality of the EIS, as a contribution to the decision-making process.
- **Decision-making:** At this stage, decisions are made by the relevant authority of the EIS (including consultation responses) together with other material considerations as to whether to accept, defer or reject the project.
- **Post-decision monitoring:** This involves the recording of outcomes associated with development impacts, after the decision to proceed with the project. It can contribute to effective project management.
- **Auditing:** This follows monitoring and involves comparing actual outcomes with predicted outcomes, and can be used to assess the quality of predictions and the effectiveness of mitigation. It provides a vital step in the EIA learning process.

Figure 3.2 illustrates the steps involved in the EIA process:

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Figure 3.2  
Steps in a EIA Process



Note that the actual EIA process is not so linear and sequential as Figure 3.2 seems to suggest. In other words, it is a cyclical process involving feedback and interaction among the various

 LEARNING ACTIVITY 3.1

**Q-** Define the EIA process. *and steps involved in EIA.*

**Note:**

- a) Write your answer in the space given below.
  - b) Check your answer with the one given at the end of this Unit.
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**3.1.3 Hierarchy in EIA**

The EIA studies are broadly categorised as:

- (i) **Site selection studies:** These studies involve an evaluation of the alternative sites with respect to environmental and project attributes such as proximity to raw materials, infrastructure facilities, markets, etc. These studies aim at ranking site alternatives for objective decision-making.
- (ii) **Rapid or comprehensive studies:** Rapid studies refer to the assessment based on a one-season monitoring (i.e., 3-month period), whereas comprehensive studies relate to the assessment based on a three-seasons monitoring (i.e., 9-month period) of baseline data. Rapid EIA facilitates

decision-making in situations where a fair amount of knowledge exists about the proposed site or the impacts of the proposed development. It also helps in identifying significant issues for comprehensive EIA. Essentially, rapid and comprehensive studies differ with respect to timeframes required for baseline data collection.

- (iii) **Regional studies:** These relate to the development in/of a region based on seasonal data collection and address

region based on seasonal data collection and address themselves to the analysis of assimilative capacity of air, water and land components of the environment.

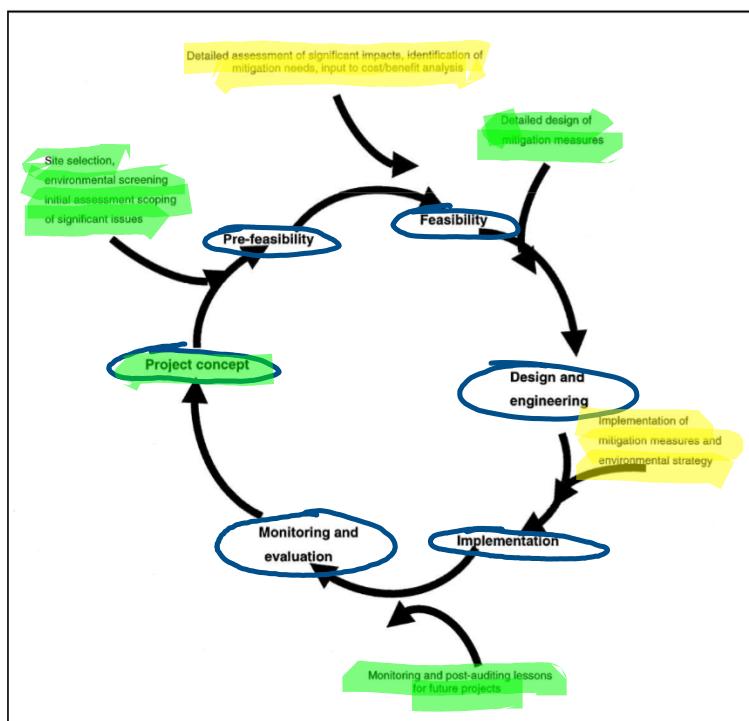
- (iv) **Carrying capacity studies:** The scope of a carrying capacity study is extended to the analysis of supportive capacity in the region with respect to resource availability/ utilisation, supply/demand, infrastructure/congestion and assimilative capacity/residuals. Carrying capacity has been discussed in detail in Unit 9.

In the last two decades, national governments and also financial institutions have realised that EIA has to be an integral part of the project life cycle: from project conceptualisation to post implementation corrective action. Figure 3.3 illustrates this cycle:

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**Figure 3.3**  
**EIA Cycle**



A EIA exercise culminates in an environmental impact statement (EIS), which we will study, next.

#### 3.1.4 Environmental impact statement (EIS)

The environmental impact statement (EIS) provides documentation of the information and estimates derived from the various steps in the EIA process. The information contained in a

EIS provides the decision-makers/regulators with valuable information that could ultimately contribute to either the abandonment or substantial modification of a proposed development action. A typical EIS contains the following three parts:

- **Part 1 – Methods and key issues:** This part deals with the statement of methods used and a summary of key issues.
- **Part 2 – Background to the proposed development:** This part deals with preliminary studies (i.e., need, planning, alternatives, site selection, etc.), site description/baseline conditions, description of proposed development and construction activities and programmes.
- **Part 3 – Environmental impact assessments on topic areas:** This part deals with land use, landscape and visual quality, geology, topography and soils, hydrology and water quality, air quality and climate, terrestrial and aquatic ecology, noise, transport, socio-economic and interrelationships between effects.

#### LEARNING ACTIVITY 3.2

Write 3 ways in which EIA will help in Business Management.

**Note:**

- Write your answer in the space given below.
- Check your answer with the one given at the end of this Unit.

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#### 3.1.5 Impact indicators

An impact indicator is an element or a parameter that provides a measure (in at least some qualitative sense) of the significance of the effect, i.e., the magnitude of an environmental impact. Some indicators such as morbidity and mortality statistics and crop yields have associated numerical scales. Other impact indicators, however, can only be ranked as 'good', 'better', 'best' or 'acceptable', 'unacceptable', etc. The selection of a set of indicators is often a crucial step in the impact assessment process, requiring input from the decision-maker. In the absence of relevant goals or policies, the assessor himself or herself may suggest some indicators and scales, but he or she should not proceed with the assessment until his or her proposals are accepted.

The most widely used impact indicators are those within statutory laws, acts, i.e., indicators such as air and water quality standards that have statutory authority. For example, the problem of designing an environmentally acceptable oil-fired generating station is simplified for the engineers, if they are given one or both of the following:

- Emission standards for various pollutants.
- Air and water quality standards.

These standards integrate the worth that a jurisdiction places on clean air and clear water. The numerical values that have been derived from examination of the available toxicological matter are data relating polluting dosages to health and vegetation effects, combined with a consideration of the best practical technology. Factors such as the displacement of arable land by industry are

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also equally important. A EIA that ignores these other components is incomplete and sometimes misleading (Munn, 1979).

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## **3.2 EVOLUTION OF EIA**

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To understand the use of EIA as a tool for environmental management, let us discuss how EIA has evolved over the years.

### **3.2.1 Evolution of EIA worldwide**

United States of America was the first country to assign mandatory status to EIA through its National Environmental Protection Act (NEPA) of 1969. A host of industrialised countries have since implemented EIA procedures. Canada, Australia, the Netherlands and Japan adopted EIA legislation in 1973, 1974, 1981 and 1984, respectively. In July 1985, the European Community (EC) issued a directive making environmental assessments mandatory for certain categories of projects (Wood, 1994).

Among the developing countries, Columbia was the first Latin American country to institute a system of EIA in 1974. In Asia and the Pacific region, Thailand and the Philippines have long established procedures for EIA. EIA was made mandatory in Sri Lanka in 1984. The EIA process in Africa is sketchy, although a number of nations including Rwanda, Botswana and Sudan have some experience of EIA (Wathern, 1988).

Bilateral and multilateral agencies have also recognised the value of EIA as a decision-making tool. The Organisation for Economic Co-Operation and Development (OECD) issued recommendations on EIA to its constituent States in 1974 and 1979, and for

development aid projects in 1986. OECD issued guidelines for good practices in EIA in 1992 (OECD, 1992). United Nations Environment Programme (UNEP) in 1980 provided guidance on EIA of the development proposals (UNEP, 1980) and supported research on EIA in developing countries (Ahmad and Swamy, 1985). UNEP, in 1987, set out goals and principles of EIA for the member countries and provided guidance on basic procedures for EIA in 1988.

The World Conservation Strategy pinpointed the need to integrate environmental considerations with development in 1980 (IUCN, 1980). EIA became an integral part of World Bank policy in 1987 which states that environmental issues must be addressed as part of overall economic policy. In 1989, the World Bank issued the Operational Directive on Environmental Assessment (O.D. 4.00), which was revised and updated in October 1991 (O.D. 4.01). Asian Development Bank in 1990 published guidelines for EIA (ADB, 1990). Importance of EIA was echoed in the Brundtland Report (WCED, 1987), and at United Nations Earth Summit on environment and development held at Rio de Janeiro in 1992 (UNCED, 1992). As foreseen by Garner and O'Riordan (1982) development of EIA, as a tool for decision-making world-over, has emerged through the following stages:

- No formal accounting, decisions made on interest group lobbying and engineering feasibility; primary emphasis on economic development.
- Conventional cost-benefit analysis; emphasis on efficiency criterion and engineering feasibility; major concern still on economic development.
- Innovative cost-benefit analysis, use of multiple objectives and discount rates, imaginative proxy pricing mechanisms; economic development as one of the objectives.

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- EIA mainly concerned with describing the repercussions of the proposals on bio-physical processes; economic development still primary objective.
- EIA with more attention paid to socio-cultural as well as bio-physical systems, economic development but not the sole objective.

The summary of evolution of EIA in various countries is presented in Table 3.1 below:

**Table 3.1  
Evolution of EIA Worldwide**

Australia	Environmental Protection (Impact of Proposals) Act 1974, Commonwealth of Australia
Bangladesh	No specific EIA legislation, however there was a Declaration that Environmental Impact Assessments should be carried out for all major development projects, 1995
China	Environmental Protection Law, 1979
USA (California)	California Environmental Quality Act (CEQA) of 1971
Canada	Federal Environmental Assessment and Review Process Guidelines Order 1984, Canada
France	Law on Protection de la Nature, 1978
India	Notifications dated May 5, 1994 under the Environment Protection Act, 1986
Japan	Principles for Implementing EIA by Environmental Agency, 1984
Malaysia	Environmental Quality (Prescribed Activity) (EIA) Order, 1987
New Zealand	Resource Management Act 1991, New Zealand
Philippines	Presidential Decree (PD) 1151 Philippines

Philippines	Presidential Decree (P.D.) 1151 Philippines Environment Policy, 1975 PD 1586 Establishing the Environmental Impact Statement (EIS), 1978 Rules and Regulations to Implement the EIS System, 1987
Sri Lanka	National Environmental Act 1980, amended in 1986
Thailand	Improvement and Conservation of National Environmental Quality Act 1975, amended in 1978
The Netherlands	EIA Policy, 1986
United States	US Environmental Policy Act, 1969
Vietnam	Environmental Protection Law, 1994
Western Australia	Environmental Protection Act 1986
West Germany	Cabinet Resolution, 1975

Let us now work out Learning Activity 3.3.

#### LEARNING ACTIVITY 3.3

List 3 Asian countries where law requires EIA and also name the relevant law.

**Note:**

- a) Write your answer in the space given below.
- b) Check your answer with the one given at the end of this Unit.

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#### 3.2.2 Evolution of EIA in India

EIA in India was started in 1976-77, when the Planning Commission asked the then Department of Science and Technology to examine the river-valley projects from the environmental angle. This was subsequently extended to cover those projects, which required approval of the Public Investment Board. These were administrative decisions, and lacked the legislative support. The Government of India enacted the Environment (Protection) Act on 23rd May 1986. To achieve the objectives of the Act, one of the decisions taken was to make EIA statutory. After following the legal procedure, a notification was issued on 27th January 1994 and subsequently amended on 4th May 1994, 10th April 1997 and 27th January 2000 making environmental impact assessment statutory for 30 activities. This is the principal piece of legislation governing EIA in India. Besides this, the Government of India under Environment (Protection) Act 1986 issued a number of notifications, which are related to

 environmentclearance.nic.in

environmental impact assessment. These are limited to specific geographical areas, and are summarised below:

- Prohibiting location of industries except those related to Tourism in a belt of 1 km from high tide mark from the Revdanda Creek up to Devgarh Point (near Shrivardhan) as well as in 1 km belt along the banks of Rajpuri Creek in Murud Janjira area in the Raigarh district of Maharashtra (6th January

1989).

- Restricting location of industries, mining operations and regulating other activities in Doon Valley (1st February 1989).
- Regulating activities in the coastal stretches of the country by classifying them as coastal regulation zone and prohibiting certain activities (19th February 1991).
- Restricting location of industries and regulating other activities in Dahanu Taluka in Maharashtra (6th June 91).
- Restricting certain activities in specified areas of Aravalli Range in the Gurgaon district of Haryana and Alwar district of Rajasthan (7th May 1992).
- Restricting industrial and other activities, which could lead to pollution and congestion in the north west of Numaligarh in Assam (July 1996).

#### LEARNING ACTIVITY 3.4

List three major developmental projects in India funded by the World Bank, which required EIA and the main aspect assessed in each of these projects.

**Note:**

- a) Write your answer in the space given below.
- b) Check your answer with the one given at the end of this Unit.

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### **3.3 FORECASTING ENVIRONMENTAL CHANGES**

A EIA should be able to, among others, predict the nature and extent of the impact of human activities on the environment. Table 3.2 gives a list of human-induced environmental changes, which can be either benign or malignant to the environment:

**Table 3.2  
Environmental Changes**

Medium	Environmental Changes	Changes and Rates of Change in
Soil	Quality (e.g., depth, structure, fertility, degree of salinisation or acidification, etc.)	Stability Area of arable land
Air	Quality	The climatic elements
Water	Quantity	

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Medium	Environmental Changes
	Changes and Rates of Change in
Biota	Seasonability Area of human-made lakes Extent of irrigation canals  Abundance/scarcity of species or genetic resources Extent of crops, ecosystems, vegetation and forests Diversity of species Extent of provision of nesting grounds, etc., for migratory species Abundance/scarcity of pests and disease organisms.

Of importance here are not only estimates of changes in environmental quality but also estimates of rate of change. A slow change may be acceptable, especially if it leads to a new stability, whereas rapid change or large fluctuations may place intolerable burdens on ecosystems. Of equal or perhaps greater importance is the degree of irreversibility of an environmental change, which will be either absolute, as in the extinction of a species, or partly absolute in that the situation can only be reversed over long periods of time or with unacceptable expenditures of money and energy, as in the case of catastrophic erosion.

A typical EIA contains information on the following three areas, as they relate to environmental effects:

- (i) A determination of the initial reference state.
- (ii) An estimate of the future state without action.
- (iii) An estimate of the future state with action.

We will describe each of these, next.

#### ***Establishment of the Initial reference state***

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An assessment of environmental change pre-supposes knowledge about the present state. It will be necessary, therefore, to select attributes that may be used to estimate this state. Some of these will be directly measurable; others will only be capable of being recorded within a series of defined categories, or ranked in ascending or descending order of approximate magnitude. Difficult decisions need to be made about the *population* (i.e., in a statistical sense), which is to be represented by the measured variables, and the extent to which the sub-division of this population into geographical regions, ecosystems, etc., is either feasible or necessary. In fact, it must be emphasised that the establishment of an initial reference state is difficult because not only are environmental systems dynamic but also they contain cyclical and random components.

#### ***Predicting the future state in the absence of action***

In order to provide a fair basis for examining the impact of human activities on the environment, a EIA must estimate the future environmental states in the absence of action. As an example, the population of a species of animal or fish may already be declining, due to over-grazing or over-fishing, even before a smelter is built. This part of analysis is largely a scientific problem, requiring skills drawn from many disciplines. The prediction will often be uncertain but the degree of uncertainty should be indicated at least in qualitative terms. For example, forecasting of droughts 2 or 3 years in advance is not yet possible, although the statistical probability that a drought (of a given severity) will occur sometime in the next hundred years can be estimated with some confidence. The decision-maker should be aware of the degree of uncertainty, which surrounds the predicted state of the environment, and have some understanding of the methods by which this uncertainty is calculated.

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***Predicting the future state in the presence of action***

For each of the proposed actions, and for admissible combinations of these actions, there will be an expected state of the environment, which is to be compared with the expected state in the absence of action. Consequently, predictions similar to those outlined above must be derived for each of the proposed alternatives.

 **LEARNING ACTIVITY 3.5**

List at least 3 adverse impacts associated with a highway, hydro-electric and thermal power projects.

**Note:**

- a) Write your answer in the space given below.
- b) Check your answer with the one given at the end of this Unit.

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Table 3.3 presents the main areas of concern that may affect human beings with regard to forecasting the environmental state in the presence of actions:

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**Table 3.3**  
**Areas of Human Concern**

Areas of human concern (impact categories)	
Economic and Occupational status	Displacement of population; relocation of population in response to employment opportunities; services and distribution patterns; property values.
Social pattern or life style	Resettlement; rural depopulation; change in population density; food; housing; material; agricultural; rural; urban.
Social amenities and relationships	Family life styles; schools; transportation; community feelings; participation vs. alienation; recreation; language.
Psychological features	Involvement; expectations; stress; frustration; Commitment.
Physical amenities (intellectual, cultural, aesthetic and sensual)	National parks; wildlife; art galleries; archaeological monuments; wilderness; clean air and water.
Health	Changes in health; medical services; medical standards.
Personal security	Freedom from molestation; freedom from natural disasters.
Regional and traditional beliefs	Symbols; taboos; values.
Technology	Security; hazards; safety measures; benefits; emission of wastes; congestion; density.
Cultural	Leisure; new values; heritage; traditional and religious rites.
Political	Authority; level and degree of involvement; priorities; structure of decision-making; responsibility and responsiveness; resource allocation; local and minority interests; defence needs.
Legal	Restructuring of administrative management; changes in taxes; public policy.
Aesthetic	Visual physical changes; moral conduct; sentimental values.
Statutory laws and acts	Air and water quality standards; safety standards; national building acts; noise-abatement by-laws.

Note that the nature of impact listed in Table 3.3 is likely to vary from place to place and from time to time, and there will be overlaps between classes (e.g., health depends in part on economic and occupational status).