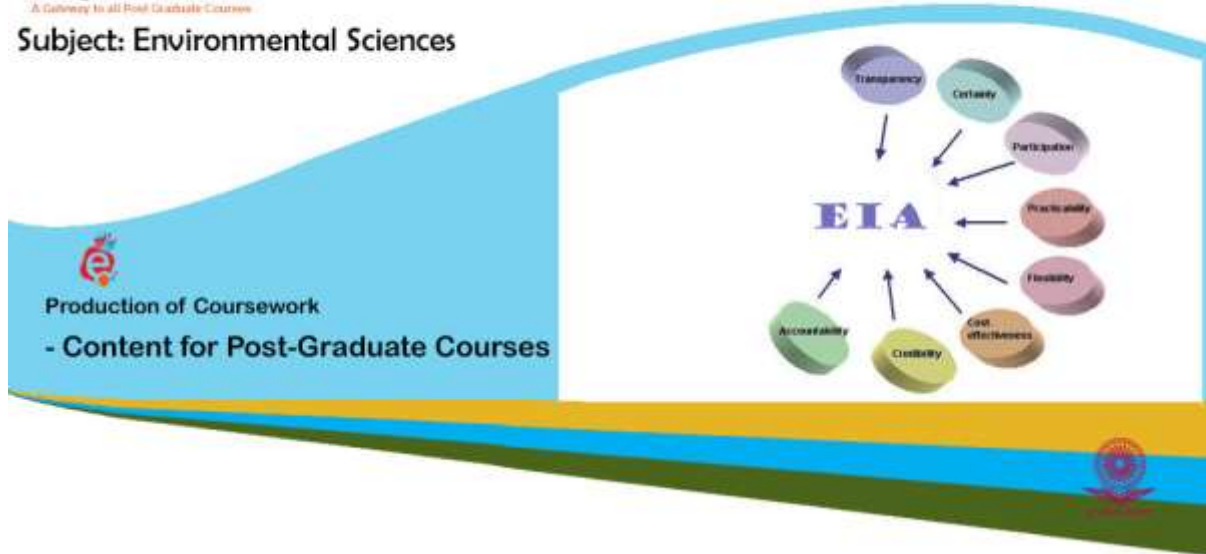


Subject: Environmental Sciences



Paper No: 12 Environmental Management

Module: 06 Introduction to Environmental Impact Assessment (EIA)



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Description of Module	
Subject Name	Environmental Sciences
Paper Name	Environmental Management
Module Name/Title	Introduction to Environmental Impact Assessment (EIA)
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Pre-requisites	
Objectives	To learn about EIA, its methods, Hierarchy and types of EIA
Keywords	EIA, social impact, economic impact

Module 06: Introduction to Environmental Impact Assessment (EIA)

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- 2. Evolution of EIA**
- 3. Definition of EIA**
- 4. Objectives of EIA**
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1. Introduction

The 20th century has been regarded as the century of revolutions and overall growth. The 20th century has witnessed highest population, industrial, agriculture growth etc. The increase in population at very rapid rates necessitated the requirements of more resources especially basic requirements of food, cloth and housing. In order to sustain the fast increasing population, the major focus of all the governments throughout the world was to increase agriculture production, setting up of industries, construction of houses and other infrastructure facilities. During the initial phases of overall growth, no importance was given to the ecological imbalance and environmental destruction. This overall growth does not come solely as blessing but took many challenges for the future generations. The major challenges for the world population are health, environment, and safety. The increased pollution due to anthropogenic activities tend to increase the human concerns about the environment and sustainable living. The matter in the mid of 20th century was of major concern for most of the developed countries. Efforts were made by various International organizations like United Nations Environment Program (UNEP), United Nations Industrial Development Organization (UNIDO) through decelerations to make some policies to decrease the load of infrastructure activities on the environment and emphasized on sustainable development. The developed countries made various policies in this regard and started the process of conducting Environment Impact Assessment studies. In consistent to developing nations, India also took various steps by various acts, notifications and policies. The process of evolution of EIA in various counties is enlisted chronologically in table-1.

2. Evolution of EIA

EIA is a formal policy innovation for environmental conservation in many countries. The process of EIA first started in USA in the early 1970s with the implementation of the National Environment Policy Act (NEPA) 1969. The other developed or high-income countries like Australia, Canada, and New Zealand also followed the footsteps of US and formally started the EIA. This was followed by other countries as well, which started EIA relatively early - Columbia (1974), Philippines (1978).

This was further strengthened by the efforts of the World Bank which adopted EIA in 1989. The World Bank made it necessary to undertake an EIA under the Bank's supervision for all major development projects funded by them. The main strength came from the Rio Earth Summit (1992). After this the consolidation and international dissemination of environmental impact assessment was officially recognized as decision-making tool for sustainable development. The three documents of Rio viz. Principle 17, Article 14, and Agenda 21 played very important role for the consolidation of EIA.

The Principle 17 of the Rio Declaration on Environment and Development states that *“Environmental impact assessment, as a national instrument, shall be undertaken for proposed activities that are likely to have a significant adverse impact on the environment and are subject to a decision of a competent national authority”*.

The Article 14 (titled *Impact Assessment and Minimizing Adverse Impacts*) of the Convention on Biological Diversity states that *“Each Contracting Party, as far as possible and as appropriate, shall: (a) Introduce appropriate procedures requiring environmental impact assessment of its proposed projects that are likely to have significant adverse effects on biological diversity with a view to avoiding or minimizing such effects and, where appropriate, allow for public participation in such procedures; (b) Introduce appropriate arrangements to ensure that the environmental consequences of its programs and policies that are likely to have significant adverse impacts on biological diversity are duly taken into account”*.

Similarly, Agenda 21 also refers about EIA in different chapters. The Chapter 8 of agenda 21 (titled *Integrating environment and development in decision-making*) recommends *“environmental impact assessment should extend beyond the project level to policies and programs”*. The Chapter 18 of agenda 21 titled *“protection of the quality and supply of freshwater resources”* discusses about application of integrated approaches to the development, management and use of water resources

Though it started in late 20th century still it has been managed to be practiced in more than 100 countries. Briefly the evolution and history of EIA is discussed in table-1.

Table 1: Evolution and history of EIA

	Development of EIA
*Pre-1970	<p>Project review based on the technical/engineering and economic analysis</p> <p>Limited consideration given to environmental consequences</p>
*Early/mid – 1970s	<p>EIA introduced by NEPA in 1970 in US</p> <p>Basic principle: Guidelines, procedures including public participation requirement instituted</p> <p>Standard methodologies for impact analysis developed (e.g. matrix, checklist and network).</p> <p>Canada, Australia and New Zealand became the first countries to follow NEPA in 1973-1974. Unlike Australia, which legislated EIA, Canada and New Zealand established administrative procedures</p> <p>Major public inquiries help shape the process's development</p>
1970	Introduced in China
*Late 1970 and early 1980s	<p>More formalized guidance</p> <p>Other industrial and developing countries introduced formal EIA requirements (France, 1976; Philippines, 1977), began to use the process informally or experimentally (Netherlands, 1978) or adopted elements, such as impact statements or reports, as part of development applications for planning permission (German states [lander], Ireland)</p> <p>Use of EA by developing countries (Brazil, Philippines, China, Indonesia)</p> <p>Strategic Environment Assessment (SEA), risk analysis included in EA processes</p> <p>Greater emphasis on ecological modeling, prediction and evaluation methods</p> <p>Provision for public involvement.</p> <p>Coordination of EA with land use planning processes</p>
1974	In Malaysia, Environmental Quality Act

*Mid 1980s to end of decade	In Europe, EC Directive on EIA establishes basic principle and procedural requirements for all member states Increasing efforts to address cumulative effects. World Bank and other leading international aid agencies establish EA requirements Spread of EIA process in Asia
*1990s	Requirement to consider trans-boundary effects under Espoo convention Increased use of GIS and other information technologies Sustainability principal and global issues receive increased attention India also adopted the EIA formally Formulation of EA legislation by many developing countries Rapid growth in EA training
1994	In India, Union Ministry of Environment and Forests (MoEF), formulated EIA notification under EPA Act 1986
1997	Environment Protection Act in Nepal
1997	Environmental Impact Assessment Ordinance in Hong Cong
1998	In Sri Lanka, The National Environmental Act
2004	In Russia, state authority responsible for conducting the State EIA in Russia
2006	In India, Ministry of Environment and Forests (MoEF) occurred major amendments in 1994 Rules
2012	Canadian Environmental Assessment Act
2015	Introduced the Federal Permitting Improvement Act for improvement of NEPA
*Source: International Study of the Effectiveness of Environmental Assessment, final report, Environmental assessment in a changing world, prepared by Barry Sadler, June 1996	

3. Definition of EIA

The International Association for Impact Assessment (IAIA) has defined environmental impact assessment as "the process of identifying, predicting, evaluating and mitigating the biophysical, social, and other relevant effects of development proposals prior to major decisions being taken and commitments made"

Environmental Impact Assessment is a stepwise process of identification, evaluation, monitoring and management of the potential impacts of proposed projects on the environment of the local area. By doing so it provides opportunities to minimize proposed environmental damage at initial stages. The main purpose of EIA is to provide information regarding the impacts of project on environmental, ecological, cultural, social and economic components of project area to the decision makers for decision making and policy transformation. It works on the principle of sustainable development i.e. to ensure that no or minimum environmental degradation is caused due to proposed project. It also takes into account the short term, midterm and long term effects on the demography, ecology and environment of the area. In simple words, EIA is a planning tool for decision making regarding the starting or denying of proposed project based on the measurable environmental and social impact of the proposed activity.

4. Objectives of EIA

The basic objectives of EIA are to

- Consider environmental factors in the decision-making process of any project
- Identify potential environmental, social and economic impacts of proposed activities
- Take steps at initial stages to minimize adverse environmental impacts
- Promote sustainable development through environmental management plan by either alternatives or mitigation measures.
- Public participation in the decision making of the establishment of proposed activity

5. Methods to carry out EIA

The methods available to carry out EIAs can be divided into General and industry specific assessment methods as described below:

- a) **Industrial products** - To identify and measure the impact of industrial products on the environment, the method used is Product environmental life cycle analysis (LCA). The method assesses the environmental impacts associated with all the stages of a product's life from raw material extraction to its final disposal or recycling. The impact assessment objectives of LCAs take into consideration of environmental concerns by:
- Making an inventory of inputs in terms of raw materials, natural resources and energy and release of pollutants in environment
 - Evaluate the environmental impacts associated with identified inputs and releases
 - Interpreting the results to help make decision

Types of LCA

Cradle to Gate: considers raw materials to finished goods but does not consider its use or end life

Cradle to Grave: Considers from harvesting of materials to final disposal of finished goods

- b) **Genetically modified plants** - The development of genetically modified plants (GMP) require strict assessment of safety and potential impact on the crops on the environment, human or animal health, in comparison to its parental or reference crop. GMP-RAM and INOVA are some specific methods for EIA of genetically modified organisms. The “GMP-RAM” is an electronic tool (software) for the evaluation of safety and potential risks related to the use of genetically modified plants. The use of this software provides a transparent process for risk assessment. Similarly, INOVA-tec System is used for Impact Assessment of Technological Innovation.
- c) **Fuzzy logic** – There are many environmental impacts which cannot be quantified and in order to measure data to estimate values of such impact indicators information from similar EIAs, community sentiment and expert judgment are used. The approximate reasoning methods used are called fuzzy logic. For example landscape quality, lifestyle quality, social acceptance etc.

6. Hierarchy in EIA

The EIA studies are mainly categorized as:

6.1 Site selection studies: These studies focus on the selection of alternative sites keeping in view of the environmental benefits and project attributes such as infrastructure facilities, markets, availability of raw materials, etc. The objective of such studies is the ranking of site alternatives for decision-making.

6.2 Rapid or comprehensive studies: when the assessment period for the baseline data is one season monitoring (i.e. 3- month period), it is called Rapid EIA. Rapid EIA is conducted when a fair amount of knowledge is available about the proposed site or the impacts of the proposed development. The rapid EIA also makes a base for the comprehensive EIA. However, When the assessment of baseline data is based on 3 seasons monitoring (i.e. 9- month period), it is called comprehensive EIA.

6.3 Regional studies: As the name indicates, these relate to a particular region. The studies are based on seasonal data collection and analysis of air, water and land components of the environment.

6.4 Carrying capacity studies: The natural resources are not infinite and are depleted at a fast pace to support the infrastructure and development activities. To achieve the objective of sustainable development, optimization of natural resources use is must. This can be achieved by considering environmental policies in the development process. Hence, carrying capacity studies are conducted to analyze the resource availability/ utilization, infrastructure/congestion, supply/demand ratio and assimilative capacity/residuals. It has often been observed that one or more natural resource(s) becomes a limiting resource in a given region thereby restrict the development activity. In the last few decades, governments of various countries have realized that EIA has to be an integral part of the project life cycle: from project conceptualization to post implementation corrective action. The Ministry of Environment, Forests and Climate change, Govt. of India, has also sponsored Carrying Capacity Studies for different regions. The studies involve:

- Inventorisation of the natural resources available
- Preparation of the existing environmental settings
- Perspective plans and their impact on natural resources through creation of "Business As Usual Scenario"

- Identification of "Hot Spots" requiring immediate remedial action to overcome air, water or land pollution
- Formulation of alternative development scenarios including a Preferred Scenarios

7. Types of EIA

Environmental assessment has been classified into four types:

7.1 Strategic environmental assessment

Strategic Environmental Assessment (S EA) is the analysis of environmental effects of developmental policies, plans and programmes. The purpose of SEA is to assist in sound environmental decision making by improvement over the Environmental Impact Assessment (EIA). SEA represents a proactive approach for integrating socioeconomic values with the environmentally viable development for higher levels of decision-making. Currently there are no government guidelines for SEA in India as it is not legally recognized here. However, due to rapid increase in infrastructure and developmental activities, there is great pressure on natural resources and environment. Hence, thus there is a need for evolving SEA in India.

7.2 Regional EIA

EIA in this context is focused on regional planning. It integrates the environmental and economic concerns of particular region due to its development planning. This approach is also referred as economic-cum-environmental (EcE) development planning. This approach allows economic management of renewable natural resources without compromising the environment.

7.3 Sectoral EIA

It refers to EIA in specific sectors like mining, airports, townships, nuclear power plants, thermal power etc. It helps in addressing specific environmental problems encountered in planning and implementing sectoral development projects. The benefit of sectoral EIA is that all the environmental, social and economic impacts of same type of sector are nearly similar and hence can play important role in better planning and decision making.

In India, the Ministry of Environment & Forests has prepared 37 EIA Manuals on major sectors of developmental projects which are listed in the Schedule to the Environmental Impact Assessment (EIA) Notification 2006. These Manuals have been prepared to serve as

Technical Guidance Manuals (TGMs) to various stakeholders involved in the environmental clearance (EC) process. The Manual for each sector includes a Model Term of Reference, technological options, processes for cleaner production, waste minimization, monitoring of environmental quality, and related regulations and procedure of obtaining EC. The Ministry assigned the work of preparation of Sectoral Manuals to two institutions, namely ASCI (prepared 10) and IL& FSS Ecosmart Ltd (prepared 27).

7.4 Project Level EIA

It refers to the environmental impacts of developmental activity in isolation. It specifically targets only one developmental activity and does not effectively integrate the cumulative effects of development in the region.

8. Steps in EIA

The EIA process involves a number of steps, some of which are listed below:

- i. **Screening:** The projects are 1st screened to know whether the project requires EIA. If yes, then under what category it falls as per norms of the respective regulatory agencies.
- ii. **Scoping:** Identification of the key issues to be addressed in an EIA. This step involves the identification of major and significant environmental issues among the possible impacts of the project and available alternatives to minimize the environmental impacts.
- iii. **Alternative Considerations:** The purpose is to ensure that the project proponent has explored other feasibilities and alternatives. These may be location of project, layouts, operating condition, techniques etc.
- iv. **Project development Plan:** This step involves the description of project like its rationale, stages of development, location, processes, techniques to be used, project cost, development timeline etc.
- v. **Environmental baseline data collection:** This involves the present state of the environment (air, water, soil, biodiversity, energy etc.) before implementation of the project. The objective of baseline data collection are to (i) understand the current environmental conditions of the area and **how the project can be implemented** under

these conditions (ii) it helps in the prediction and assessment of **possible environmental changes** that could occur during or after project implementation.

Baseline data includes-

- a. Physical- Geographical and geological characteristics, topography etc.
 - b. Quality of air, water, noise, soil etc.
 - c. Biodiversity of the area, types of flora and fauna, ecosystem types
 - d. Socioeconomic- social structure, economic conditions, demography, migration of locals, etc.
 - e. Cultural- culture, tradition, religion, customs of locals
- vi. **Identification and prediction of key impacts:** Based on the baseline data and scoping, the potentially significant impacts (adverse and beneficial) on environment of the area are identified for project during the development phase and after completion. The magnitude of the identified impacts is predicted by comparing the environmental conditions of base line data with the expected conditions after project implementation.
- vii. **Mitigation and Management of Environmental impacts:** This involves the proposal of different measures to be taken to reduce, manage, remediate or compensate for adverse impacts.
- viii. **Public hearing/consultation:** Public hearing is also part of EIA in some type of projects. The purpose of public participation is to inform the **public** about the proposed project and its impacts on the local area. The public views or objections are integral part of the decision making process.
- ix. **EIA presentation and Decision-making:** The report submitted by the Environment consultant on behalf of the project proponent is scrutinized for various documents as per EIA manuals/ laws. Any document deficiency is completed before submitting the report to regulatory/designated authorities for the purpose. The facts of the project starting from the screening to public hearing are presented before the experts. The experts may suggest additional measures to minimize the impacts. At this stage decisions are made by the relevant authority to whether to accept, defer or reject the project.

- x. **Post-decision monitoring:** This comes into picture after completion of the project. The outcomes of projects after completion are recorded. These represent the actual impacts of the project.
- xi. **Auditing:** This involves comparing actual outcomes with predicted outcomes. This can be used to assess the quality of predictions and the effectiveness of mitigation.

9. Advantages of EIA

The main advantages and benefits of EIA are:

- Improved project design
- Reduced cost and time of project implementation
- More informed decision-making
- Increased project acceptance
- More environmentally sensitive decisions
- Improved project performance and reduction in treatment/clean up costs.
- Increased accountability and transparency during the development process
- Improved integration of projects into their environmental and social setting
- Healthier local environment (forests, water sources, agricultural potential, recreational potential, aesthetic values, and clean living in urban areas)
- Reduced environmental damage
- More effective projects in terms of meeting their financial and/or socio-economic objectives.

10. EIA in India

- The foundation of EIA in India was first laid in 1976-77. The Planning Commission instructed the Department of Science and Technology (DST) to examine the river-valley projects from an environmental angle. However, this was informal and inactive.
- The first consolidated step for EIA was EIA notification 1994 by Union Ministry of Environment and Forests (MoEF), Government of India, under EPA Act 1986.
- The notification made the Environmental Clearance (EC) mandatory for any modernization activity or setting up new projects. Further, depending on the need and

to strengthen the EIA process, EIA notification 1994 was amended almost 13 times in 11 years. The major amendments came in the year 1997, 2000, 2002, 2003 and 2005 (discussed in detail in latter chapters).

- The EIA notification has been amended several times and latest notification was published in 2006. The EIA notification 2006 has been again amended several times.

