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# An overview of environment impact assessment studies in Indian industries

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## Abstract

The environmental impact assessment identifies the best combination of economic, environmental and social benefits of a proposed activity or project, and predicts the potential impact on the environment. The Indian chemical and other industries manufacture a wide variety of products using more advanced manufacturing processes. A majority of industries contribute to environmental pollution. However, it neglects the role of EIA during and after production, both pre-operational and post-operationally. As a result of rapid industrialization, several environmental issues have been posed. Commissioning of chemical plants to be more reliable, cost-efficient, safe, and environmentally sustainable if they manage environmental risks effectively. Throughout this research, the environmental measures of industrial projects in the surrounding areas are discussed. In terms of environmental impact, there are several aspects such as ecosystem impact, natural resource impact, and public impact. Quantitative and qualitative approaches are employed in this research, which means that an assessment of the environment impact assessment in the surrounding areas of the industrial sites and an explanation of its importance, as well as the Standard EIA procedures in India are provided.

**Keywords:** Environmental Impact Assessment; Ecosystem; Regeneration Limitation; Indian industries

## 1. Introduction

Environment Impact Assessment, also known as EIA, is the process of determining how proposed projects and activities would affect the environment. In order to discover the project alternative that best balances the costs and benefits on the economic and environmental fronts, the EIA considers a number of project alternatives. When conducting an environmental impact assessment, the associated socio-economic, cultural, and human health factors are taken into consideration (EIA). The EIA thoroughly examines the project's consequences, both favourable and unfavourable, and ensures that these effects are taken into account throughout project design [1]. It assists in identifying potential environmental consequences of the planned project, suggests ways to lessen negative effects, and makes predictions about whether there will still be significant negative environmental effects even after the mitigation is put in place. By taking into account the environmental consequences of the project and their mitigation early on in the project planning cycle, environmental assessment offers a number of benefits, including safeguarding the environment, maximizing resource use, and decreasing project time and expense. An EIA that has been correctly prepared also reduces disputes by promoting community engagement, educating decision-makers, and aiding in the construction of ecologically sound initiatives [4, 5]. The integration of EIA has been shown to offer advantages at every step of a project, from exploration and planning to building, operations, decommissioning, and beyond site closure. EIA is a technique used to evaluate a project's potential effects on the environment, economy, and society. In order to make decisions to lessen the negative effects, this is used to estimate the environmental implications of a project even during the pre-planning stage.

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### 1.1. Evolution & History of EIA

EIA is one of the 20th century's most effective environmental policy developments. There was no EIA 37 years ago, but it is now a formal procedure in many nations and is being used in more than 100 nations [2,3,6]. Environmental protection and finding the optimal trade-off between economic and environmental costs and benefits are the major goals of an EIA. To comprehend the development and history of environmental impact assessments, read the figure 1 below:

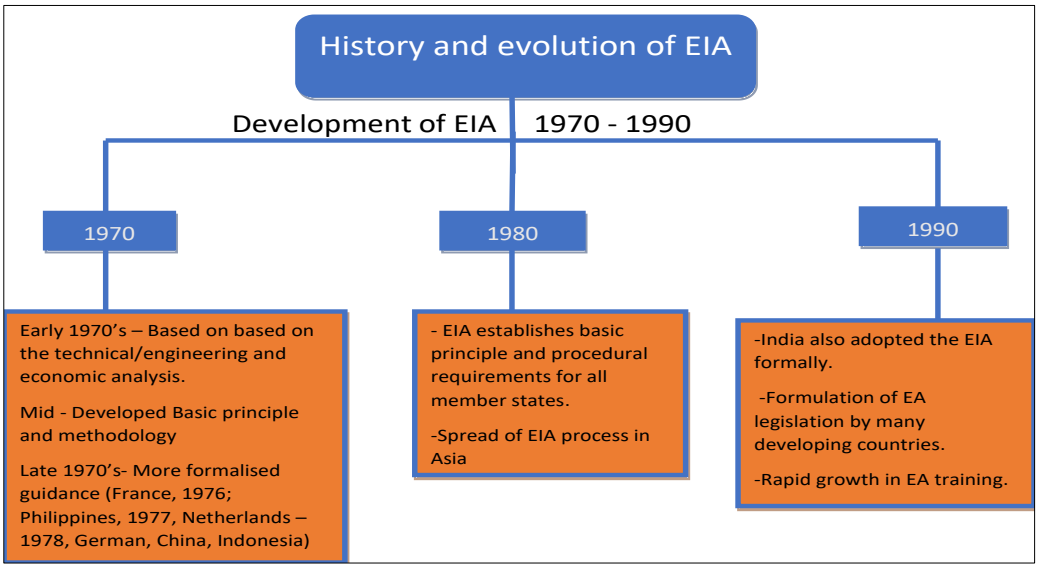


**Figure 1** Development of EIA 1970-1990

- The 1970s are when the EIA was first established. The first National Environment Policy Act (NEPA) was introduced in the USA in 1969.
- Initially used by industrialized countries, the EIA was gradually adopted by emerging countries like India.
- The first developing countries to include EIA into their policy are Columbia and the Philippines. It was introduced by Columbia in 1974 and the Philippines in 1978.
- Today, EIA is used in more than 100 nations throughout the world. About 110 nations had implemented EIA as a key environmental strategy by the middle of the 1990s.
- The World Bank designated EIA as a key development initiative in 1989.

## 2. History of EIA in India

Over 20 years ago, India first started using environmental impact assessments. When the Planning Commission requested that the Department of Science and Technology look into the river-valley projects from an environmental perspective in 1976–1977, the process got underway. This was later expanded to include projects that needed the Public Investment Board's clearance. Environmental clearance by the Central Government was an administrative choice made without statutory backing before to 1994. Under the Environmental (Protection) Act of 1986, the Union Ministry of Environment and Forests (MEF), Government of India, promulgated an EIA notification on January 27, 1994, requiring environmental clearance (EC) before expanding or modernizing any activity or initiating new projects that are listed in Schedule 1 of the notification. Twelve changes have been made to the 1994 EIA notice since then.

New EIA regulations were just announced by the MoEF in September 2006. According to the announcement, environmental permission is now needed for a variety of projects, including those involving mining, thermal power plants, river valleys, infrastructure (roads, motorways, ports, harbors, and airports), industries such very tiny electroplating or foundry units, and infrastructure (roads, highways, ports, harbors, and airports). When the Planning Commission instructed the Department of Science & Technology to evaluate the river valley projects from an environmental point of view, EIA was first conducted in India in 1976–1977. This was extended to cover all projects that needed the Public Investment Board's permission.

The Environment (Protec-tion) Act, which was passed by the government in 1986, made EIA a legal requirement. The Indian Wildlife (Protection) Act (1972), the Water Act (1974), the Air (Prevention and Control of Pollution) Act (1981), and the Biological Diversity Act are the other major laws in this area (2002).

The Environmental Information System (ENVIS) was established by the Ministry of Environment, Forest, and Climate Change in 1982 to gather, compile, store, retrieve, and disseminate data pertaining to the environmental sector. This functions as a subject-specific database distributed web network. The main goal of ENVIS is to coordinate all national initiatives to gather, store, share, and use environmental information for more effective management of environmental assessment operations.

### *The objectives of an environmental impact assessment*

- Determining, projecting, and assessing the effects of development operations on the economy, the environment, and society.
- Educating decision-makers on the effects of decisions on the environment.
- Supporting sustainable development that is ecologically friendly by locating acceptable alternatives and mitigating actions.

## 2.1. The EIA process

The eight phases that make up the environment impact assessment process are equally significant in assessing how well the project will perform overall. The EIA process often starts with screening to make sure that time and resources are focused on the proposals that matter to the environment and concludes with some kind of follow-up on the execution of the choices and actions taken as a consequence of an EIA report.

#### *2.1.1. Screening*

The proposed project's eligibility for an EIA is determined at the first stage of the process, and if so, what degree of assessment is necessary. In this step, it is chosen which projects require a full or partial assessment study.

#### *2.1.2. Scoping*

This phase highlights the main problems and effects that require additional research. Additionally, the scope and duration of the study are established at this step. At this point, it is decided which implications need to be evaluated. Legal obligations, global agreements, professional expertise, and public participation are all taken into account at this time.

#### *2.1.3. Impact analysis*

In this phase of the EIA, the project's potential environmental and social effects are identified, projected, and their importance is assessed. The planned project's environmental effects are examined, and alternatives to similar initiatives are discussed.

#### *2.1.4. Mitigation*

This EIA stage makes recommendations on how to mitigate and prevent any potential negative environmental effects of development activities.

#### *2.1.5. Reporting*

The decision-making body and other interested parties are presented with the EIA's findings during this stage in the form of a report.

#### *2.1.6. Review of EIA*

It assesses the EIA report's sufficiency and efficacy and offers the data required for making decisions.

#### *2.1.7. Decision-making*

It makes a decision on whether the proposal is accepted, rejected, or requires more changes. The project's future has been decided. Whether or whether the project will receive permission, and if it will, under what terms.

*2.1.8. Environmental Impact Statement (EIS)*

Environmental Impact Statement, or EIA Report (EIS). At this step, a non-technical overview of the project's effects is developed for the general public, as well as an environmental management plan (EMP).

*2.1.9. Post monitoring*

When the project is commissioned, this phase begins. Monitoring the occurrence of the anticipated effects and the mitigating measures in accordance with the EMP. It verifies that the project's effects don't go above the legal limits and that the mitigation measures are put in place in the way that the EIA report specifies.

### 2.2. Regulatory Authorities in India

The key regulatory authorities are the

- Ministry of Environment, Forests and Climate Change (MoEFCC).
- CPCB.
- SPCBs.
- District Level Authorities (that is, municipal corporations).

On 2 December 2020, the Indian government created a new Apex Committee for Implementation of the Paris Agreement

### 2.3. Prepare an Environmental Impact Assessment (EIA) Report

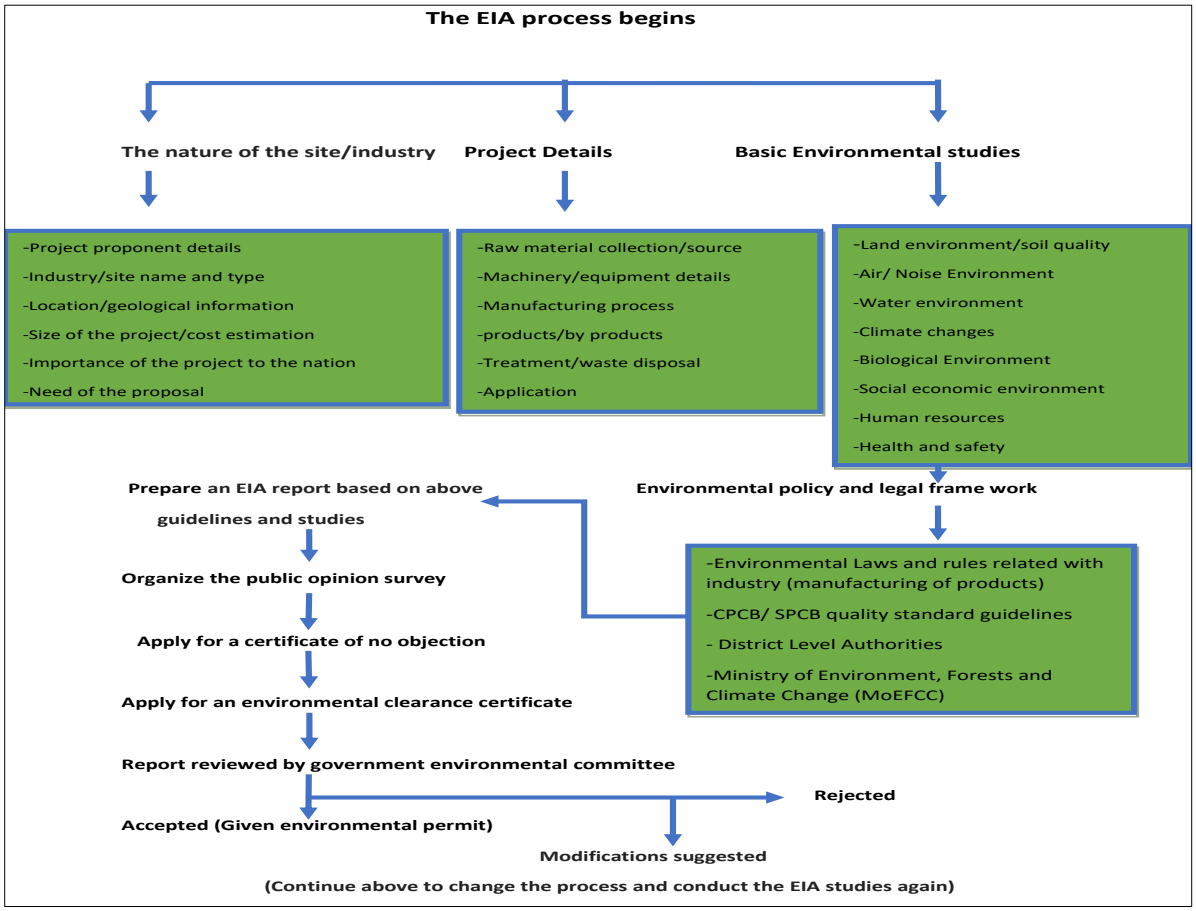


**Figure 2** The process of EIA

### 2.4. Organizations and their functions

- Ministry of Environment and Forests [7] - Environmental research, planning of environmental policies, obtaining environmental approvals for industrial and development projects, and promoting environmental education, training, and awareness

- Central Pollution Control Board [8] - Provide advice to the central government on issues relating to the prevention, control, and elimination of water and air pollution coordinate with State Boards and offer technical and research support, Set, alter, or repeal the requirements for a stream, well, and air quality
- Central Pollution Control Board - Ensure conformity with the provisions of the Environment (Protection) Act of 1986 while planning and carrying out national programs for the prevention, control, or abatement of water and air pollution.
- State Pollution Control Boards/Pollution Control Committee (for Union Territories) - Planning and carrying out state-wide initiatives for the reduction of water and air pollution, Give the State Government advice on how to avoid, regulate, and reduce water and air pollution as well as where to locate enterprises. Develop technologically sound techniques for using and disposing of wastewater, Change the yearly air and water standards.

## 3. National and International Environmental Standards and Guidelines

### 3.1. Air Environment

According to the updated National Ambient Air Quality Standard, ambient air quality has been monitored and analyzed in its current state [9]. The maximum number of sample locations have been chosen taking into account the region's sensitive receptor, population zone, and predominant downward wind direction. Wind monitors have been used to gather micro-meteorological data such as hourly wind speed and direction, temperature, relative humidity, rain fall, etc. Air modelling was carried out to anticipate the project's intended establishment's potential effects on ambient air quality.

**Table 1** Different Types of Concentration of Air

| **Pollutant** | **Time Weighted Average** | **Concentration in Ambient Air (µg/m³)** | | |
|---|---|---|---|---|
| | | **IndustrialArea** | **Residential, Rural & Other Areas** | **Sensitive Areas** |
| Sulphur dioxide($SO_2$) (µg/m³) | Annual Average* | 80 | 60 | 15 |
| | 24 Hours** | 120 | 80 | 30 |
| Oxides of Nitrogen(NOx) (µg/m³) | Annual Average* | 80 | 60 | 15 |
| | 24 Hours** | 120 | 80 | 30 |
| Suspended Particulate Matter (SPM) (µg/m³) | Annual Average* | 360 | 140 | 70 |
| | 24 Hours** | 500 | 200 | 100 |
| Respirable Particulate Matter(Size less than 10 microns) (µg/m³) | Annual Average* | 120 | 60 | 50 |
| | 24 Hours** | 150 | 100 | 75 |
| Lead (Pb) (µg/m³) | Annual Average* | 1.0 | 0.75 | 0.50 |
| | 24 Hours** | 1.5 | 1.0 | 0.75 |
| Carbon monoxide(CO) (µg/m³) | 8 Hours | 5000 | 2000 | 1000 |
| | 1 Hour** | 10000 | 4000 | 2000 |
| Ammonia | Annual | 100 | 100 | 100 |
| | 24 Hours | 400 | 400 | 400 |

The Central Pollution Control Board has since finalized the Ambient Air Qualitystandards in respect of Noise under Section 16 (2) (h) of the Air (Prevention &Control of Pollution) Act, 1981 as amended in 1987 as follows:

**Table 2** Ambient Air Quality Standards

| Area Code | Category of Area | Limits in dB (A) Leq | |
|---|---|---|---|
| | | Day time | Night time |
| A | Industrial Area | 75 | 70 |
| B | Commercial Area | 65 | 55 |
| C | Residential Area | 55 | 45 |
| D | Silence Zone | 50 | 40 |

### 3.2. Noise environment

To evaluate the current state of the noise environment, noise metres have been used to measure noise levels throughout the day and at night.

**Table 3** Different Noise Leves

| Area Code | Category of Area | Noise Levels dB(A), Leq | |
|---|---|---|---|
| | | Day time* | Night Time |
| A | Industrial Area | 75 | 70 |
| B | Commercial Area | 65 | 55 |
| C | Residential Area | 55 | 45 |
| D | Silence Zone** | 50 | 40 |

### 3.3. Noise Standards for Occupational Exposure

The Occupational Safety and Health Administration (OSHA-USA) establishes noise requirements for the workplace, and the Government of India then enforces these standards by model regulations created under the Factories Act, which are included in the table below

### 3.4. Standards for occupational exposure

**Table 4** Occupational Exposure

| Total Time of Exposure per Day in Hours (Continuous or Short term Exposure) | Sound Pressure Level in dB (A) |
|---|---|
| 8 | 90 |
| 6 | 92 |
| 4 | 95 |
| 3 | 97 |
| 2 | 100 |
| 3/2 | 102 |
| 1 | 105 |
| ¾ | 107 |
| ½ | 110 |
| ¼ | 115 |
| Never | >115 |

Note: 1. No exposure in excess of 115 dB(A) is to be permitted.

### 3.5. Land Environment

Within the impact zone, soil samples have been taken from a few strategic points and subjected to relevant parameter analysis. Studies on soil properties are conducted. The research area's geography, landscape, current land use, and drainage patterns are all examined.

**Table 5** Study of solis Properties

| S No. | Soil Test | Classification |
|---|---|---|
| 1 | pH | <4.5 Extremely acidic<br>4.51- 5.00 Very strongly acidic<br>5.01-5.50 Slightly acidic<br>5.51-6.00 moderately acidic<br>6.01-6.50 slightly acidic<br>6.51-7.30 Neutral<br>7.31-7.80 slightly alkaline<br>7.81-8.50 moderately alkaline<br>8.51-9.0 strongly alkaline<br>> 9.01 very strongly alkaline |
| 2 | Salinity Electrical Conductivity (µmhos/cm)(640 µmho/cm = 1 ppm) | Upto 1.00 Average<br>1.01-2.00 harmful to germination<br>2.01-3.00 harmful to crops (sensitive to salts) |
| 3 | Organic Carbon (%) | Upto 0.2: very less0.21-0.4: less<br>0.41-0.5 medium,<br>0.51-0.8: on an average sufficient0.81-1.00: sufficient<br>>1.0 more than sufficient |
| 4 | Nitrogen (kg/ha) | Upto 50 very less51-100 less<br>101-150 good<br>151-300 Better<br>>300 sufficient |
| 5 | Phosphorus (kg/ha) | Upto 15 very less16-30 less<br>31-50 medium,<br>51-65 on an average sufficient66-80 sufficient<br>>80 more than sufficient |
| 6 | Potash (kg/ha) | 0 -120 very less<br>120-180 less<br>181-240 medium<br>241-300 average<br>301-360 better<br>>360 more than sufficient |

### 3.6. Water environment

The Indian Council of Medical Research sets water quality guidelines, notably for drinking water. These are very similar to WHO standards. The Indian Standard Codes control the discharge of industrial effluents, and more recently, water quality criteria for marine outfalls into coastal waters have also been established. For the effluent discharges from industries such iron and steel, aluminium, pulp and paper, oil refineries, petrochemicals, and thermal power plants, in addition to the basic norms, particular standards have been devised. Earth & Surface within a 10 km radius of the project, many places have had water samples taken. Analysis is done for biological, microbiological, heavy metal, and physio-chemical characteristics. The water quality has been evaluated by comparing the results. The project

requirements and the local conditions will be taken into consideration while choosing the parameters to be analysed. The following is an example list of variables that could be of interest.

Temperature, Taste and smell colour, turbidity, and hardness pH, BOD/COD/TOC, Conductivity, dissolved solids/total solids, Chlorides/sulphates/nitrates/fluorides/phosphates-calcium/magnesium, cyanides of manganese, copper, zinc, and chromium SAR for boron/selenium, grease, Bio-indicators for the Coliform Bacterial Count.

**Table 6** Standards of industrial effluents

| **Characteristic** | **Units** | **Drinking Water Permissible limits** | **Irrigation, Industrial Cooling, Controlled Waste disposal Permissible limits** |
|---|---|---|---|
| $P_H$ | - | 6.5 – 8.5 | 5.5 - 9 |
| Colour and odour | - | Colourless and odourless | All efforts should be made to remove colour and unpleasant odour as far as practicable |
| COD | Mg/l | - | 250 |
| BOD | Mg/l | - | 30 |
| Dissolved oxygen | Mg/l | 5 | 5 or more |
| Free ammonia | Mg/l | 1.5 | 5 |
| Chloride | Mg/l | 250 | 1000 |
| Lead | Mg/l | 0.01 | 0.1 |
| cadmium | Mg/l | 0.003 | 2 |
| zinc | Mg/l | 5 | 5 |
| fluoride | Mg/l | 1 | 2 |
| Nitrate as nitrogen | Mg/l | 45 | 10 |
| Iron | Mg/l | 0.3 | 3 |
| Copper | Mg/l | 0.05 | 1.5 |

### 3.7. Ecology & Socio-Economic Environment

Secondary information on the flora and fauna was gathered via site surveys and from a variety of publications by the Forest Department. Primary data that was gathered have also been used to verify data. Gathering of socioeconomic and associated demographic information. It is also necessary to analyse the projection of anticipated changes in the socio-economic aspect as a result of project-related activities.

### 3.8. Importance of Environmental Impact Assessment

- EIA is an effective tool for responsible environmental management.
- Government regulation mandates that before project approval, each industrial project in India must have EIA clearance from the Environment Ministry.
- EIA connects the environment with development for ecologically sound and long-term growth.
- EIA offers a practical way to prevent or reduce the negative effects of development initiatives.
- Before a development project is put into action, decision-makers may analyse how development activities will affect the environment thanks to EIA.
- The inclusion of mitigation measures in the development plan is encouraged by EIA.

EIA ensures that the development plan is in line with ecosystem assimilation and regeneration limitations and is ecologically sound.

## 4. Conclusion

The report explained the phases involved in EIA processes and looked at the environmental effects for industrial locations. These studies can help with the easier creation of model EIA reports for industry. Additionally, gaining a deeper comprehension of the environmental risk levels connected to commissioning industrial units and activities may aid in the creation of mitigation strategies that improve sustainable performance and management. Organizations and managers will be able to create sustainable strategies for the future by knowing about the degrees of environmental consequences brought on by industrial initiatives.

## Compliance with ethical standards

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*Disclosure of conflict of interest*

No conflict of interest.

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