ENVIRONMENTAL IMPACT ASSESSMENT PROCESSES & ATTRIBUTES

Abstract

Environmental Impact Assessment (EIA) is a deliberate process aimed at evaluating and foreseeing a project effects. It establishes a crucial connection between development and environmental safety, promoting sustainable development practices. In India, Environmental Impact Assessment (EIA) is legally supported by the Indian polices. EIA process comprises various phases. Based on that only the project effects should be evaluated. For each project, it is essential to identify potential alternatives and evaluate their environmental characteristics. EIA have various components. Several parties are involved in the EIA process, which is organized based on their designated roles. Until environmental clearance is granted by the Central or State Governments following the procedure outlined in that notification, the Central Government plans to prohibit and restrict the expansion and modernization of any activity or new projects being undertaken in any part of India. India has ratified a number of international agreements concerning environmental management. an EIA analyst or the person in charge of creating an EIA report is faced with a large amount of unprocessed, raw data. This chapter delves into the EIA review process, exploring the tools and procedures necessary for an impartial assessment of an EIS.

Keywords: EIA, EIS, International, Indian Policies

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I. INTRODUCTION

Environmental Impact Assessment (EIA) is a deliberate process aimed at evaluating and foreseeing a project's effects on the biophysical, geological, chemical, and human health aspects of the environment. Its primary objective is to propose suitable legislative measures, programs, and operational protocols that can effectively minimize the project's impact. EIA is an essential procedure that should be conducted prior to the initiation of any significant project or undertaking to ensure that it does not pose any form of harm to the environment, whether in the short or long term. The planning and execution of any developmental endeavor necessitate a thorough examination of not only the project's economic costs, benefits, and necessity but also, critically, a comprehensive assessment of its potential consequences on the environment.

II. NEED FOR EIA

Environmental Impact Assessment (EIA) establishes a crucial connection between development and environmental safety, promoting sustainable development practices. EIA serves as a cost-effective approach to either eliminate or significantly reduce the detrimental consequences associated with developmental projects. Through EIA, decision-makers gain the ability to thoroughly assess the environmental repercussions of development activities long before the project's actual implementation. Furthermore, EIA fosters the incorporation of mitigation strategies into the development plan, ensuring that the project aligns with environmental sustainability principles and remains within the ecological system's capacity for absorption and regeneration.

III. INDIAN POLICIES

1. In India, Environmental Impact Assessment (EIA) is legally supported by the Environment Protection Act of 1986, which outlines specific provisions regarding EIA methodology and procedures.
2. The Indian involvement in Environmental Impact Assessment dates back more than two decades. The Planning Commission assigned the Department of Science and Technology the responsibility of assessing river-valley projects from an environmental standpoint in 1976–1977, which marked the beginning of the effort
3. Up until 1994, environmental clearance from the Central Government was a matter of administrative discretion and lacked legislative backing.
4. In compliance with the Environmental (Protection) Act of 1986, the Ministry of Environment and Forests published an EIA notification on January 27, 1994, requiring Environmental Clearance (EC) for any new or expanded projects listed in Schedule 1 of the notification.

   In September 2006, the Ministry of Environment, Forests, and Climate Change (MoEFCC) introduced new EIA legislation. This notification obligates various projects, including mining, thermal power plants, river valley schemes, infrastructure developments (such as roads, highways, ports, harbors, and airports), and industries, including very small electroplating or foundry units, to obtain environmental clearance. The new legislation, in contrast to the 1994 EIA Notification, assigns the state government the obligation of project clearance, contingent upon the project's size and capacity.

IV. EIA PROCESSES

The following phases comprise the Indian EIA process

- Screening
- Scoping and consideration of alternatives
- Baseline data collection
- Impact prediction
- Evaluation of substitutes, defining of mitigating actions, and environmental impact report
- Public hearing
- Decision making
- Monitoring the clearance conditions

1. **Screening:** The statutory notices state that screening is done to ascertain whether environmental clearance is required for a project. The screening criteria are based on:

   - Scales of investment
   - Type of development
   - Location of development.

   Only in cases where the terms of the EIA notification and/or one or more statutory notifications mention or cover it, does a project need statutory environmental clearance.

2. **Scoping:** The process of defining the EIA's terms of reference is known as scoping. The consultant is required to complete it after consulting with the project proponent and, if necessary, seeking direction from the Impact Assessment Agency. The important concerns that need to be covered in the EIA studies are outlined in guidelines that the Ministry of Environment and Forests has established for various industries. The socioeconomic criteria are typically used to identify the relevance of non-quantitative consequences, such as aesthetic or recreational value, whereas quantifiable impacts must be evaluated based on their amount, prevalence, frequency, and duration.

3. **Baseline Data:** The specified study area's current environmental status is described by baseline data. If secondary data is available, it should be used to supplement the site-specific primary data and keep an eye out for the factors that have been identified.

4. **Impact Prediction:** The process of "mapping" the environmental effects of the project's major components and its alternatives is known as impact prediction. Since it is impossible to forecast environmental impact with 100% accuracy, it is even more important to take into account all relevant variables and take all reasonable precautions to lower the level of uncertainty.

5. **The Project's Effects on the following should be Evaluated**

   - **Air**
     - Changes in ground-level concentrations and ambient levels brought on by the cumulative emissions of point, line, and area sources.
     - Impacts on soil, materials, vegetation, and human health

- **Noise**
  - Variations in the surrounding noise level brought on by machinery and vehicle movement.
  - Effect on fauna and human health

- **Water**
  - Availability to competing users.
  - Changes in quality.
  - Sediment transport.
  - Ingress of saline water.

- **Land**
  - Sediment transport.
  - Ingress of saline water
  - Changes inland use and drainage pattern

- **Biological**
  - Deforestation and reduction in tree cover, along with the loss of animal habitats
  - Effects on wildlife and plant life, including aquatic species if present, due to contaminants and pollutants.
  - Effects on rare and endangered species, endemic species, and the migratory pathways of animals.
  - Influence on breeding and nesting areas.

- **Socio-Economic**
  - Impact on the local community including demographic changes.
  - Impact on economic status
  - Impact on human health.
  - Impact of increased traffic.

6. Assessment of Alternatives, Delineation of Mitigation Measures and Environmental Impact Statement

- For each project, it is essential to identify potential alternatives and evaluate their environmental characteristics. These alternatives should encompass both project location and technological processes. It's also crucial to consider the "no project" option among these alternatives. A systematic ranking of these alternatives should then take place to select the most environmentally beneficial option that also maximizes economic benefits for the broader community.
- Following the evaluation of alternatives, a mitigation plan should be developed for the chosen option, accompanied by an Environmental Management Plan (EMP) that offers guidance for proactively enhancing environmental aspects. The EMP plays a vital role in overseeing compliance with clearance conditions, and it should include comprehensive details about monitoring procedures.
- Decision-makers need to be able to clearly understand three different environmental scenarios from the EIA report: one without the project, one with the project, and one with project alternatives. It's imperative that the report transparently communicates any uncertainties associated with these scenarios.

7. Public Hearing

- According to the law, it is mandatory to inform and engage the public in a consultation process regarding a proposed development once the EIA report is finalized.
- The required parties to obtain access to the EIA Executive Summary is all those who might be affected by the project under consideration.

These affected individuals may comprise:

- Resident members of the local community.
- Local associations.
- Environmental organizations actively involved in the region.
- Any other person situated at the project site or locations affected by potential displacement.
- These individuals are entitled to participate by providing oral or written feedback to the State Pollution Control Board, as outlined in Schedule IV of Annex I

8. Decision Making: To make the final decision, the Impact Assessment Authority confers with the project manager and consultant in addition to the experts, bearing in mind the Environmental Management Plan (EMP) and the Environmental Impact Assessment.

9. Monitoring the Clearance Conditions

- The various phases of implementation of the project are monitored.

V. COMPONENTS OF EIA

- The temporal scope of the data provided distinguishes Comprehensive EIA from Rapid EIA. Faster appraisal processes are the goal of rapid EIA. While all major environmental impacts and their mitigation must be included in and covered by both types of EIAs, Rapid EIA does this by collecting data within "one season" (other than the monsoon) in order to expedite the process. If the decision-making process is not compromised, then this is okay. Whether or not a thorough EIA is necessary will be determined by reviewing the Rapid EIA submissions.
- Thus, it is evident that the more effective course of action would typically be to submit a comprehensive EIA that has been expertly created in the first place.
- The EIA report should include all or some of the following elements, depending on the kind, location, and size of the project.

1. Air Environment

- Determining the impact zone (using a screening model) and establishing a monitoring network.
- Conducting monitoring of the current ambient air quality status within the affected area (approximately 7-10 km from the project site's boundaries).
- Collecting site-specific meteorological data, including information on wind speed, wind direction, humidity, ambient temperature, and the environmental lapse rate.

- Locating, measuring, and evaluating possible emissions inside the impact zone from a variety of sources (such as moving cars), as well as calculating the overall effects of all emissions.
- Evaluating the effectiveness of proposed pollution control devices in meeting standards for gaseous emissions and ambient air quality.
- Defining mitigation measures at the source, along pathways, and at the receptor points.

2. Noise Environment

- Evaluating the current noise levels in the affected area and forecasting the potential future noise levels generated by the proposed project and associated activities, including increased vehicular traffic.
- Identifying the potential impacts of anticipated noise level increases on the surrounding environment.
- Providing recommendations for mitigating noise pollution

3. Water Environment

- Analyzing the quantity and quality of the available ground and surface water resources in the project's impacted region.
- Estimating the possible effects that the project's planned water use and pumping will have on water supplies.
- Measuring and characterizing the wastewater produced by the intended activity, including any hazardous organic components.
- Assessing the efficacy of the suggested wastewater treatment and pollution prevention system and making recommendations for any adjustments that may be required.
- Assessing the feasibility of water recycling and reuse, along with outlining a comprehensive plan for implementation.

4. Land Environment

- Research on the properties of the soil, current topography, land use, and drainage systems in the affected zone
- Assessment of the project's effects on topography, drainage, hydrology, land use, and landscape
- The process of estimating and characterizing solid wastes and outlining management alternatives for waste minimization and ecologically friendly disposal.

VI. ROLES IN THE EIA PROCESS

Several parties are involved in the EIA process, which is organized based on their designated roles. The fundamental duties of several bodies are described in the section that follows:

The Sponsor of the Project
The Consultants for the Environment
The Pollution Control Committees (PCCs) and the State Pollution Control Board
The Agency for Impact Assessment

1. **The Role of the Project Proponent:** During the project planning stage, the project proponent decides on the type of project, such as new establishment, enlargement, or modernization. The Executive Summary, which includes the project details and the EIA study's results, must be submitted later by the project proponent and prepared as a Detailed Project Report or Feasibility Report to be made available to the public. In order to hold a public hearing and obtain a NOC, the proponent must speak with the relevant SPCB. The proponent applies to the IAA for environmental clearance following the public hearing.

2. **Role of Environment Consultant:** An environmental consultant needs to be knowledgeable with the current legal and procedural criteria for securing environmental clearance for a project that is being proposed. The consultant should lead the project's proponent through the preliminary screening process, determine whether EIA studies are necessary, and if so, determine the specifics of the study's scope. Additionally, the consultant needs to have all of the tools and resources needed to carry out EIA investigations. Through the proponent, the environmental consultant is in charge of providing all the environmental data that the SPCB and IAA demand. In the meeting with the IAA expert groups, the consultant must also defend the conclusions in the EIA and EMP.

3. **The Role of the State Pollution Control Board(PCB)/Pollution Control Committee (PCC):** The State PCBs/PCCs are in charge of determining whether a proposed development complies with established operational and regulatory criteria. The PCB will subsequently grant its NOC if the development complies. In accordance with the guidelines in the EIA notification, they will also hold a public hearing. IAA will be notified of the public hearing details.

4. **The Role of the Public:** In addition, the public plays a significant role in EIA. Through a press release, the interested parties will be contacted to discuss the proposed development that needs environmental clearance, study the available information, and voice any concerns.

5. **The Role of the Impact Assessment Agency (IAA):** In cases where a proponent needs to secure environmental clearance, the EIA report will be evaluated and assessed by the IAA. The project proponent will have the opportunity to propose his proposal during this procedure. In the event that a project is approved, the IAA will also draft a set of guidelines and requirements for its execution based on this evaluation.

VII. GOVERNMENT OF INDIA MINISTRY OF ENVIRONMENT AND FOREST NOTIFICATION (2000)

Until environmental clearance is granted by the Central or State Governments following the procedure outlined in that notification, the Central Government plans to prohibit and restrict the expansion and modernization of any activity or new projects being undertaken in any part of India. Conversely, a notification issued in accordance with clause (a) of sub-rule (3) of rule 5 of the Environment (Protection) Rules, 1986 requests public objections within sixty days of the notification's publication date. As SO No.80 (E) dated 28th January, 1993 and where as all objections received have been duly considered.

With the authority thus conferred by sub-section (1) and clause (v) of sub-section (2) of section 3 of the Environment (Protection) Act, 1986 (29 of 1986) in conjunction with clause (d) of sub-rule (3) of rule 5 of the Environment (Protection) Rules, 1986, the Central Government hereby orders that no new projects listed in Schedule I to this notification, nor the expansion or modernization of any activity (if the pollution load is to exceed the current one) nor the expansion of any existing activity in any part of India shall be allowed unless the Central Government grants environmental clearance in accordance with the procedures outlined in this notification.

VIII. LIST OF PROJECTS REQUIRING ENVIRONMENTAL CLEARANCE

- Nuclear power and associated initiatives, including rare earth projects, heavy water plants, and nuclear fuel complexes.
- River Valley projects that combine significant irrigation with hydropower to control flooding.
- Ports, Harbours, Airports(except minor ports and harbours).
- Petroleum Refineries including crude and product pipelines.
- Chemical Fertilizers (Nitrogenous and Phosphatic other than single superphosphate).
- Pesticides (Technical).
- Petrochemical complexes (Both Olefinic and Aromatic) and Petrochemical intermediates such as DMT, Caprolactam, LAB etc.and production of basic plastics such as LLDPE,HDPE,PP,PVC.
- Bulk drugs and pharmaceuticals.
- Searching for and producing oil and gas, as well as their storage and transportation.
- Asbestos and Asbestos products.
- Hydro cyanic acid and its derivatives.
  - Primary metallurgic industries (such as production of Iron and Steel, Aluminium, Copper, Zinc, Lead and Ferro Alloys).
  - Electric arc furnaces (Mini Steel Plants).
- Chloralkali industry.
- Integrated paint complex Including Manufacture of Resins and basic raw materials required in the manufacture of paints.
- Viscose Staple fibre and filament yarn.
- Storage batteries linked with manufacturing of oxides of lead and lead antimony alloys.
- All tourism projects between 200m to500 metres of High Water Line and at locations with an elevation of more than1000metres with investment of more than Rs.5crores.
- Thermal Power Plants.
- Mining projects (major minerals) with leases more than 5hectares.
- Projects related to highway improvement, such as enlarging and fortifying roads, coupled with the acquisition of marginal property along their current alignments, excluding those that run through environmentally sensitive regions like national parks, sanctuaries, or tiger reserves
  Reserve Forests
- Tarred Roads in the Himalayas and or Forest areas.
- Distilleries.
- Raw Skins and Hides

- Pulp, paper and news print.
- Dyes.
- Cement.
- Foundries (individual)
- Electroplating
- Metaaminophenol

IX. APPLICATION FORM

1. Name and Address of the project proposed:
2. Location of the project:
   Name of the Place:
   District, Taluk:
   Latitude/Longitude:
   Nearest Airport/Railway Station:
3. The other locations looked at and the rationale behind choosing the suggested location:
4. Does the location adhere to the local land use plan's specified land use:
   Objectives of the project:
   Land Requirement:
   Agriculture Land:
   Forest land and Density of vegetation. Other(specify):
   - Land usage in the Catchment around the proposed location, within a 10-kilometer radius:
   - The region's topography, showing altitude, aspects, and gradient:
   - The projected land's state of erodeability:
5. Pollution sources within a 10-kilometer radius and their effects on the land, water, and air quality:
6. Distance of the nearest National Park/Sanctuary/Biosphere Reserve/Monuments/heritage site/Reserve Forest:
   Rehabilitation plan for quarries/borrow areas:
   Green belt plan:
   Compensatory forestation plan:
7. Climate and Air Quality:
   - Windrose at site:
   - Max/Min/Mean annual temperature:
   - Frequency of inversion:
   - Frequency of cyclones/tornadoes/cloudburst:
   - Ambient air quality data:
   - Nature & concentration of emission of SPM, Gas(CO,CO2,NOx,CHnetc.) from the project:
8. Water balance:
   - Water balance at site:
   - Lean season water availability;
9. Water Requirement:
   - Source to be tapped with competing users (River,Lake,Ground,Publicsupply):
   - Water quality:
   - Recent observations of variations in groundwater quality and quantity, as well as

current information on charging and extraction:
- Amount of wastewater to be discharged along with treatment information:
- The amount of water quality in the receiving body both before and after solid waste is disposed of:
- The quantity and kind of land to be used for the release of waste water:

10. Details of reservoir water quality with necessary Catchment Treatment Plan:
    Command Area Development Plan:
    - Solid wastes:
      - Nature and quantity of solid wastes generated
      - Solid waste disposal method:
    - Noise and Vibrations:
      - Sources of Noise and Vibrations:
      - Ambient noise level:
      - Noise and Vibration control measures proposed:
      - Subsidence problem, if any, with control measures:
    - Power required with supply source indicated: Complete environmental information, if a captive power unit is suggested, must be provided separately:
    - Peak labour force to be deployed giving details of:
      Endemic health problems in the area due to waste water/air/soil borne diseases: Health care system existing and proposed:
      - Number of villages and population to be displaced:
      - Rehabilitation Master Plan:
    - Risk Assessment Report and Disaster Management Plan:
      - Environmental Impact Assessment
      - Environment Management Plan:
      - Detailed Feasibility Report:
      - Duly filled in questionnaire
        Report prepared as per guidelines issued by the Central Government of India.
    - Details of Environmental Management Cell:

X. COMPOSITION OF EXPERT COMMITTEE

1. The Committees will consist of experts in the following disciplines

    - Eco-system Management
    - Air/Water Pollution Control
    - Water Resource Management
    - Flora/Fauna conservation and management
    - Land Use Planning
    - Social Sciences/Rehabilitation
    - Project Appraisal
    - Ecology
    - Environmental Health
    - Subject Area Specialists
    - Representatives of NGOs/persons concerned with environmental issues.

2. The Chairman would be a superb and seasoned technical specialist, environmentalist, or ecologists with a great deal of managerial experience in the relevant development field.

3. The Impact Assessment Agency representative will serve as a Member-Secretary.
4. With the exception of individuals who have been properly designated as delegates, the Chairman and Members will each act in their individual capacities.
5. A committee's membership cannot have more than fifteen members.

XI. ECOLOGICAL SENSITIVE PLACES

Bio-fragile or eco-sensitive zones are those that are located within ten kilometers of national parks, wildlife sanctuaries, and protected regions.

The Ministry of Environment, Forests and Climate Change (MoEFCC) of the Government of India is mandated under the Environment Protection Act of 1986 to notify areas that have been declared as Eco-Sensitive Zones (ESZs).

Even areas wider than 10 km can be included in the eco-sensitive zone if they have biologically significant regions, sensitive corridors, and linkages that are essential for connecting the landscape.

The primary objective is to control specific activities in the vicinity of National Parks and Wildlife Sanctuaries in order to minimize the adverse effects of those activities on the delicate ecosystem that encompasses the protected areas.

XII. INTERNATIONAL AGREEMENTS

Participation in international treaties for environmental control has become more necessary for nation states due to the advent of progressive concepts like sustainable development and a growing global consciousness to safeguard the environment in recent decades. Preserving the ever-dwindling reserves of natural resources is of special concern, and this can be accomplished by national collaboration. India has ratified a number of international agreements concerning environmental management. Listed below are some of the key accords:

1. **The Antarctic Treaty (Washington,1959):** The Antarctic Treaty was formed with the aim of maintaining the Antarctic as a region exclusively utilized for peaceful purposes and preventing it from becoming a source of international conflict. The Antarctic Treaty territory (ATA) is the name given to the territory covered by the treaty, which lies south of 60 degrees latitude. It contains clauses pertaining to the revocation of territorial claims, the proscription of military actions in the region, scientific freedom, and international collaboration on scientific projects. India became a Consultative Party Member of the Antarctic Treaty system in 1983 (CEL, undated).

2. **Convention on International Trade in Endangered Species of wild fauna and flora (CITES), 1973:** In order to control the worldwide trade in threatened species of wild plants and animals, CITES was signed in March 1973. India ratified the agreement in July 1976, and the CITES Management Authority selected for India is the Director of Wild Life Preservation (MoEF, 2018). While CITES aims to prevent and regulate the trade in endangered species, it should not be construed as a comprehensive conservation program for endangered plant and animal species.

3. **Montreal Protocol on Substances that deplete the Ozone Layer (to the Vienna Convention for the Protection of the Ozone Layer), 1987:** Known by its common name, the Montreal Protocol, it was established in 1989 with the goal of reducing the production and use of chemicals that deplete the ozone layer. The convention also highlights the countries that contribute more than others and acknowledges that governments have a responsibility to reduce their emissions of oil and gas waste (ODS) to the extent that resources permit. India ratified the Montreal Protocol in September of 1992. The Ministry of Environment & Forests (MoEF), Government of India, has formed an Ozone Cell and a steering committee on the Montral Protocol as an addition to the protocol in order to carry out the India Country Program (World Bank, undated).

4. **Basel Convention on Trans boundary Movement of Hazardous Wastes, 1989:** The Basel Convention, as it is often known, aims to reduce the movement of hazardous waste across international borders. The Convention ensures that the least amount of hazardous waste is produced. Furthermore, it prohibits the export of hazardous waste to countries that lack the infrastructure necessary to properly dispose of it. After ratifying the Basel Convention in 1992, India included some of the provisions into The Indian Hazardous Waste Management Rules Act, 1989 (World Bank, undated).

5. **UN Framework Convention on Climate Change (UNFCCC), 1992:** In order to reduce greenhouse gas emissions to a level that can counteract the consequences of climate change and global warming, the UNFCCC seeks to control emissions through international cooperation and agreement. India joined the convention in 1992 and ratified it the following year, in 1993. According to the UNFCCC at the time, India was not required to make commitments for the mitigation of greenhouse gas emissions because it was a developing country. However, with the 2015 Paris Agreement, which obliges India to take part in multilateral talks under the UNFCCC, this has altered. India has demonstrated leadership in this regard by advancing frameworks for policy, such as the National Action Plan on Climate Change (NAPCC) and the National Environment Policy (NEP).

6. **Convention on Biological Diversity, 1992:** A legally enforceable foundation for the preservation of biodiversity, sustainable use of biological resources, and fair distribution of knowledge and benefits resulting from biological resource use is provided by the Convention on Biological Diversity (CBD). When the convention came into force in 1993, a complicated set of rules was put in place for countries to follow in order to guarantee the sustainability of natural ecosystems and biodiversity.

   The Nagoya Protocol was approved in 2010 to support the further expansion of the Convention's framework for benefit sharing and access. Article 6 of the CBD mandates that parties create national plans and initiatives for the preservation and sustainable use of biodiversity. It also integrates them into national development goals and programs (MoEF, 2018). India's Biological Diversity Act, 2002 created a legislative framework for addressing biodiversity in the nation. Following the convention, India took a number of further policy steps, such as enacting several national laws pertaining to biodiversity conservation and joining the International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA) and the Trade Related Intellectual Property Rights (TRIPS), both of which were established in 1995.

7. **Agenda 21:** The United Nations (UN) Earth Summit, which was held in Rio de Janeiro, Brazil, in 1992 produced Agenda 21, which is a non-binding action plan designed to involve all relevant parties in attaining sustainable development. Local and federal governments, corporations, foreign organizations, civic associations, and non-governmental organizations were among the stakeholders. At the World Summit on Sustainable Development, held ten years later, the international community reconnected and discussed advancements in creating multinational alliances for the execution of Agenda 21 (World Bank, undated). India has endeavored to harmonize several development infrastructure elements, such as energy, transportation, industry, water facilities, forests, biodiversity, ecosystems, land policy, agriculture, urban governance, and human resource development, since it became a signatory to Agenda 21.

8. **UN Convention on Desertification, 1994:** The 1994 UN Convention on Desertification aims to develop worldwide cooperation in the fight against desertification or in addressing policies in drought-prone areas through a bottom-up approach. In this convention, local land users and non-governmental organizations are invited to participate in policy activities linked to regulating and mitigating the consequences of desertification. Seven South Asian nations, including India, are signatories to the treaty on regional action programs.

9. **Cartagena Protocol on Bio Safety:** The Cartagena Protocol on Bio safety, an amendment to the Convention on Biological Diversity, creates an international legal framework for the safe handling, transport, and application of genetically modified organisms (LMOs), or organisms produced through biotechnology. The first-of-its-kind protocol was implemented in January 2000 (MoEF, 2018). Drafted under the Convention for Biological Diversity, the pact aims to protect against the misuses of modern biotechnology. A part of the Convention on Biological Diversity, the Cartagena Protocol on Bio safety has India as a party.

XIII. ENVIRONMENTAL ATTRIBUTES

Frequently, an EIA analyst or the person in charge of creating an EIA report is faced with a large amount of unprocessed, raw data. For this reason, each impact evaluation technique and method should have the following attributes and features:

1. It should follow a systematic approach.
2. It should be capable of structuring a large amount of diverse data.
3. It should have the ability to quantify the impacts.
4. It should be proficient in summarizing the data.
5. It should possess the capability to group the data into sets while minimizing information loss due to the grouping.
6. It should demonstrate strong predictive capabilities.
7. It should extract the most significant features.
8. It should ultimately present the raw data and the derived information in a meaningful manner.

XIV. CRITERIA FOR THE SELECTION OF EIA METHODOLOGY

1. **Simplicity:** The approach should be straightforward so that those with less background knowledge in the workforce can easily understand and implement it.

2. **Manpower time and budget constraints:** The methodology ought to be executed by a small team working under tight financial and schedule restrictions.

3. **Flexibility:** The approach ought to exhibit the requisite adaptability to allow for any necessary tweaks and revisions throughout the study.

XV. IMPACT IDENTIFICATION

1. **Comprehensiveness:** The methodology must be adequately comprehensive to encompass all potential options and alternatives, providing sufficient information about them to enable informed decision-making.

2. **Specificity***:* The process ought to identify certain parameters that are expected to undergo noteworthy effects.

3. **Isolation of project impacts***:* The methodology ought to suggest protocols for differentiating future project impacts from environmental shifts arising from other sources.

4. **Time and duration:** On a temporal scale, the approach should be able to precisely pinpoint the location and magnitude of the impacts.

XVI. IMPACT MEASUREMENT

1. **Commensurate Units:** In order to compare alternatives and criteria, the technique should have an equivalent set of units.

2. **Explicit Indicators:** Indicators that are precise and quantifiable should be recommended by the technique in order to validate impacts on pertinent environmental parameters.

3. **Magnitude:** The approach should allow for the measurement of impact magnitude, which is the extent to which the influence is large, as opposed to impact importance, which is the weighing of the impact's degree of significance.

4. **Objective criteria:** It ought to be predicated on objective standards, with clear definitions of the standards.

XVII. IMPACT INTERPRETATION &EVALUATION

1. **Significance:** The approach must to possess the ability to assess the significance of quantifiable impacts on a local, regional, and national scale.

2. **Explicit Criteria:** Clearly stating the criteria and assumptions used to estimate impact significance is important.

3. **Portrayal of "With" and Without 'Situation:** The approach must have the capacity to combine the enormous volumes of data and unprocessed input.

4. **Uncertainty:** When it comes to environmental impact assessments, uncertainty about potential effects is a serious issue. This should be a factor that the approach can account for.

5. **Risk:** Impacts with a high potential for damage and loss but a low chance of occurrence should be identified by the technique.

6. **Depth of Analysis:** The findings obtained from the process ought to offer ample depth of examination and maintain trustworthiness for the users, encompassing the wider public.

7. **Alterative Comparison:** It should offer an adequate and comprehensive comparison of the several options that are easily accessible for the project that is being studied.

8. **Public Involvement:** A technique for including the public in the understanding of the impacts and their importance should be suggested by the approach.

XVIII. IMPACT COMMUNICATION

1. **Affected Parties:** The methodology should provide a mechanism for linking impacts to specific effected geographical or social groups.

2. **Setting Description:** It should provide a description of the project setting to aid the users in developing an adequately comprehensive overall perspective.

3. **Summary Format:** It should provide the results of the impact analysis summarized in a format that will give the users, who range from the lay public to the decision makers, sufficient details to understand it and have confidence in its assessment.

4. **Key Issue:** It should provide a format for highlighting the key issues and impacts identified in the analysis.

5. **Compliance:** One of the most important factors in choosing a methodology is whether it is able to comply with the terms of referral established by the controlling agency.

XIX. ADHOC METHOD

By enumerating composite environmental factors such as flora and fauna that are likely to be impacted by the planned activity, ad hoc approaches provide a wide indication of potential impacts. Using these techniques, a group of experts who specialize in identifying impacts are put together. In this case, the impacts' natures long-term or short-term, reversible or irreversible are taken into account individually for each parameter. These techniques provide the basic areas and nature of potential impacts together with an approximate assessment of the overall impact. Using this method, the assessor bases their broad-based qualitative assessment on an intuitive approach. This approach functions as an initial evaluation and aids in the identification of significant regions, such as:

1. Endangered species
2. Natural vegetation
3. Exotic vegetation
4. Grazing
5. Social characteristics
6. Natural drainage
7. Groundwater
8. Noise
9. Airquality
10. Visual description and services
11. Open space
12. Recreation
13. Health and safety
14. Economic values
15. Public facilities
16. Wildlife

Types of Adhoc Method

Opinion poll
Expert opinion
Delphi methods

This technique is incredibly easy to use and doesn't require any prior expertise. It does not entail a cause-and-effect relationship or relative weighting. It suggests broad areas for potential consequences, but offers no guidance for impact assessments. Furthermore, it doesn't even specify the precise effects on the impacted parameters.

The drawbacks of this method are listed below:

- It does not guarantee that a comprehensive collection of all pertinent impacts has been examined.
- The analysis conducted through this approach lacks consistency because different criteria are selectively assessed by various groups.
- This is a very inefficient method that requires a lot of work to find and put together a panel for every evaluation.

XX. MATRICES METHOD

This methodology provides a framework for examining the interactions between different project activities and any possible environmental repercussions. A basic interaction matrix is produced when project actions are reported along one axis, usually vertical, and environmental effects are documented along the other. In 1971, Leopold et al. developed this technique. It lists over 100 project tasks and about 88 environmental characteristics and situations. The example of this matrix is shown below:

1. Importance of Matrices

- Matrices are tables with two dimensions.
- They make it possible to identify the effects that arise from the way that project activities interact with particular environmental elements.
- The cells within the matrix can contain qualitative or quantitative impact estimates.

Simple Matrix

Environmental Components	Project Activities								
	Plant Construction	Farming of Kenaf	Use of Pesticide Fertilizer	Transport of Raw Materials	Water Intake	Solid Waste	Effluent Discharge	Emissions	Employ-ment
Surface Water Quality			x			x	x		x
Surface Water Hydrology					x				
Air Quality				x				x	
Fisheries			x				x		
Terrestrial Wildlife Habitat	x								
Terrestrial Wildlife	x								
Land Use Pattern		x							
Highways/Railways				x					
Water Supply			x				x		
Agriculture		x							
Housing									x
Health						x	x	x	
Socioeconomic									x

2. **Leopold Matrices:** List all the activities that are included in the suggested project. If an impact is possible, make a slit at the intersection of each item on the side of the matrix under each of the suggested actions.

	a	b	c	d
a				
a				
c				

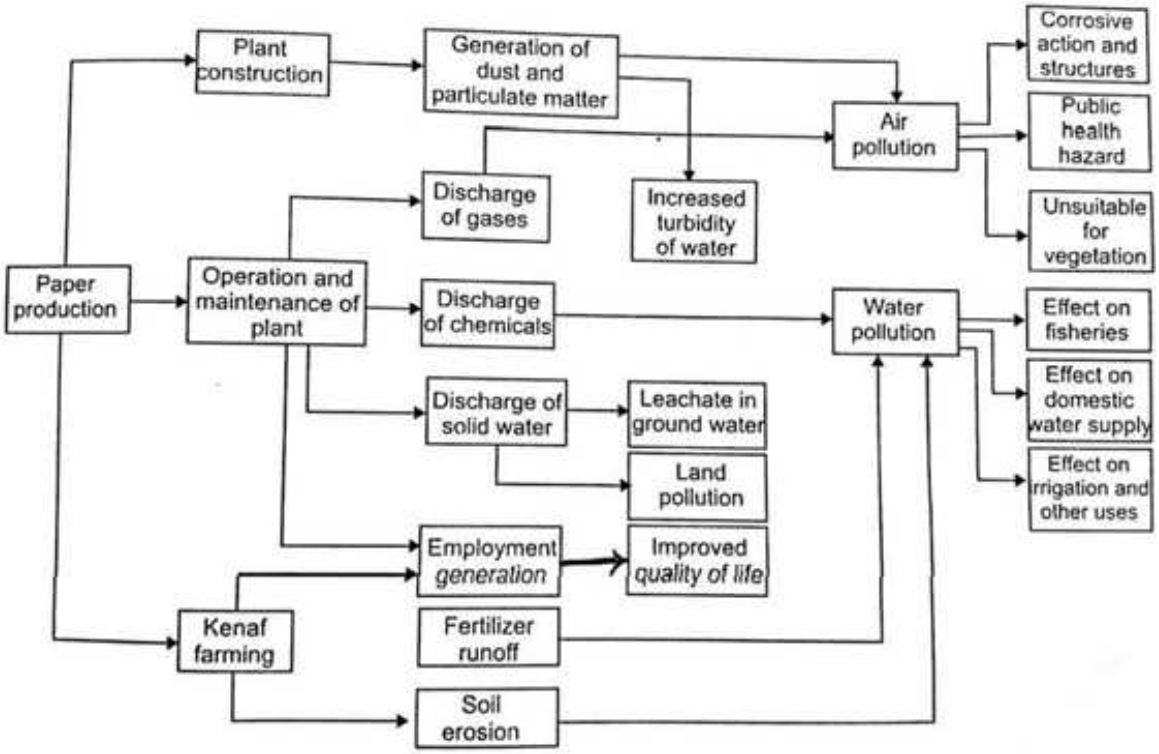
In the top left corner of each box marked with a diagonal slash, assign a number ranging from 1 to 10 to indicate the severity of the potential impact. A score of 10 signifies the most severe impact. A score of 1 represents the least severe impact (no zero scores). Precede each number with a "+" sign (if the impact would be advantageous). Place a number ranging from 1 to 10 in the box's lower right corner to indicate the potential impact's importance (e.g., regional vs. local). One denotes the least relevance (no zeroes) and ten the greatest importance.

	a	b	c	d
a	-1 / 3	+5 / 8		
b				
c				

- **Advantages**
  - With the matrix approach, action and impact are connected.
  - This is an excellent way to present the EIA results.

- **Disadvantages**
  - This strategy makes it difficult to discern between direct and indirect affects.
  - Double counting of impacts is a possibility.
  - It is qualitative in character rather than quantitative in terms of impact.

3. **Network Method:** This approach utilizes the matrix method, expanding its scope to encompass both primary and secondary consequences. It is presented in the format of a diagram referred to as an "impact tree," also known as a "reference" or "sequence" diagram. The fundamental and essential step in constructing an impact tree involves identifying immediate and indirect effects, as well as short and long-term repercussions. Utilizing the impact tree aids in pinpointing causal connections. The impact tree serves as a visual representation of these interconnections.



- **Advantages**
  - It connects the dot to the effect.
  - Checking second order implications in a reduced version is helpful.
  - It addresses both direct and indirect effects.

- **Disadvantages**
  - It is entirely qualitative in nature.
  - If utilized beyond a basic version, it becomes unduly complex.

4. Overlays Method

- To prepare for overlay methods, a set of transparent maps representing the geographical distribution of environmental attributes (such as the extent of a dense forest region) must be prepared.
- Data on a variety of variables will be gathered for the research area's conventional geographical units, and each variable will normally be shown on one of several maps.
- Three maps will be superimposed to create a composite.
- In relation to the proposed development's location, the produced composite maps describe the area's physical, social, biological, land use, and other pertinent features.
- A variety of project options can be found on the final map to analyze the degree of associated consequences, and the type and quantity of factors selected will determine the validity of the evaluation.
- Typically, a transparency map can only contain ten characteristics that can be overlaid for a certain amount of clarity.
- A lot of people use these techniques to visually evaluate how the landscape has changed both before and after an activity.
- Secondly, it can be employed to generate integrated mapping and ecological carrying capacity or sensitive area analyses.
- The spatial features of cumulative impacts may be demonstrated very clearly by these methods because they are spatially oriented.
- By superimposing these maps, a composite description of the local environment is created.
- Impacts are determined by taking note of the environmental features that are affected and fall inside the project boundaries.
- The strategy appears to be most effective when used to evaluate potential project locations or routes prior to conducting a thorough impact analysis.
- For industrial EIAs of all projects, overlays can be helpful in comparing land capacities between current and anticipated land uses, alternative routes for roads and other constraints, and different air quality levels and pollution control measures.

- **Advantages**
  - It has an excellent display
  - It is simple to use and comprehend
  - It works well for setting site selection

- **Disadvantages**
  - The overlay technique's drawback is that it is only moderately thorough because

there is no mechanism requiring evaluation of all potential implications.

- It is possible to accept both qualitative and quantitative data using the overlay approach.
- The overlay method can be useful in finding specific affects and choosing amongst them, but it is not a good way to quantify impacts and find secondary and tertiary interrelationships.
- It is not assured that all repercussions will be covered, and there is no framework for measuring and quantifying the affects.

5. **Checklist Methods:** Checklists consist of predefined lists of potential impacts associated with a particular project type. These checklist methods serve primarily to structure information and ensure that no potential impact is inadvertently omitted. They represent a more structured variation of ad hoc approaches by enumerating specific impact categories and providing guidelines for identifying and assessing these impacts. Advanced checklists can incorporate the following features: 1) scaling checklists, wherein impacts are ranked by their magnitude or severity, 2) weighting scaling checklists, which involve assigning weights to various environmental parameters through expert judgment and subsequently calculating an index for comparing different project alternatives.

   There are four general types of checklists:

   - **Simple Checklist:** a set of environmental parameters without any instructions on how to monitor or apply them.
   - **Descriptive Checklist:** comprises a list of environmental parameters and instructions on how to measure data for certain parameters.
   - **Scaling Checklist:** Further details on the subjective scale of the factors, akin to a descriptive checklist.
   - **Scaling Weighting Checklist:** Comparable to a scaling checklist, but containing more details for the subjective assessment of every parameter in relation to every other parameter.

   It takes varying degrees of knowledge and experience to create checklists. All that may be needed to use simple checklists is access to an information base and a general understanding of the environmental factors that are likely to be impacted. As an alternative, the outcomes of an EIA might be summed up using straightforward checklist techniques. Preparing scaling weighted checklists is probably going to take more experience.

   There are several major reasons for using checklists:

   - They serve as a valuable tool for condensing information, making it comprehensible to specialists in different domains or decision-makers with limited technical expertise.
   - Scaling checklists offer an initial layer of examination.
   - Weighting serves as a means to integrate insights into ecosystem functions.

XXI. EIA REVIEW

The integrity of environmental impact statements (EIS) is becoming a growing area of focus. Assessing EISs offers a crucial means of assessing documentation quality and, by extension, the efficiency of the impact assessment approach. Topic 1 initially introduced the full EIA review process concept. This topic delves into the EIA review process, exploring the tools and procedures necessary for an impartial assessment of an EIS.

XXII. BASE LINE CONDITIONS

Providing a comprehensive account of the present environmental conditions and how they might evolve in the absence of the project is of utmost significance. While certain baseline data can be derived from existing sources, additional data may necessitate collection, and it is imperative to explicitly specify the methodologies employed for data acquisition. The collection of baseline data should be conducted in a manner that allows for the assessment of the area's significance within the broader regional or surrounding context, facilitating predictions regarding the impacts of proposed alterations.

XXIII. CONSTRUCTION

Stage Impacts & Post project impacts: The approach utilized to delineate the project specifications should be explicitly described. This should encompass details regarding consultations conducted with expert organizations and the general public, as well as references to panels of experts, guidelines, checklists, matrices, and past instances of exemplary environmental assessments for similar projects. Consideration must be given to effects that can be direct or indirect, cumulative or isolated, short or long-term, permanent or transient, and positive or negative. The reasoning behind selecting the most important effects for further study and ignoring the others ought to be openly explained. An examination of the development's impact on people, animals, plants, soil, water, air, climate, landscape, material resources, cultural heritage, and any interactions with these elements should all be included in the review.