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# Environmental Impact Assessment – An overview

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***Abstract:***
*Environmental impact assessment (EIA) is an important tool to decide the viability of the project from environmental, social, economic, and sustainability angle. Majority of the countries in the world have made mandatory provisions for undertaking EIAs before setting up of designated projects. An effort has been made by the authors of the present paper to give an overview of EIA for readers to understand the concepts and complexities involved therein. An attempt has been made in the present paper to highlight the mandatory requirements, type of projects required to undertake EIA and seeking environmental clearance along with methodologies and procedures for undertaking EIAs.*

***Keywords:*** *Environment, impact assessment, mandatory requirement, methodology, procedure,*

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## I. INTRODUCTION:

Environmental Impact Assessment was adopted by various countries worldwide after it was passed and approved byUnited Nations Organizations.**[1]**The required steps taken by the developed countries regarding Environment Impact Assessment are as follows. In United States of America introduction of EIA was done in the year 1969 with the enforcement of National Environmental Policy (NEPA). The specifications of NEPA contain certain features within the EIA procedures which are not seen in the EIA system of other countries. For example, EIA can be applied not only for the approval of projects but also in legislative and other proposed activities. In case of Canada, the introduction of EIA in the year 1973 led to the passing of Canadian Environmental Assessment Act (CEAA) in the year 1992 and was implemented in 1995. The CEAA's implementation of simple assessment of projects involve class screening methods. In case of United Kingdom, the stipulation of EIA procedures involves town and country planning organization whose development and other programs are administered by the local government. In Netherlands, as per the EC Directive the Environment Management policy was enacted following the EIA system, so that the environment policy can be enacted for approval in a proper manner. Similarly, France and Italy also introduced EIA in their respective countries by passing of the environment law in the year 1976 and 1986 respectively. Similar steps were taken in Germany regarding EIA in the year 1975 which transformed into an act in the year 1990, stating "Act on Implementation of the Council Directive on the Assessment of the Effects of Certain Public and Private Projects on the Environment".**[2]**Also, the initiatives and measures taken in the developing countries are as mentioned. In Philippines, there are two regional branches as Environmental Management Bureau (EMB) and Department of Environment and Natural Resources (DENR) which are mainly responsible for environmentally critical projects or the projects which are generally located in environmentally sensitive zones and are a part of EIA.Indonesia, implemented a simplified version of EIA in the year 1993 and is named within the country as AMDAL (AnalisisMengenaiDampakLingkungan) and BAPEDAL (The Environmental Impact Management Agency) is responsible for the overall management and implementation within the country of EIA policy. Similarly, the developing countries like Srilanka and Thailand have also implemented EIA policy and have passed acts regarding this on the year 1988 and1975 respectively, it is known as National Environmental Act in Srilanka and National Environment Quality Act in Thailand.**[3][4]**

For a proper successful implementation of EIA, there are two major requirements that is needed to be fulfilled, one is that the agency who is responsible for conducting assessment should be qualified enough and the agency should be independent from any sort of bias opinions and should be non-polar in nature. **[5]** Butsadly, in India the above two mentioned conditions are not seriously considered and followed. Thus, in the coming few points the present condition of EIA methodology and its implementation in India. Integrated Environmental Impact Assessment is do not take place in India and hence the scope and contract of EIA is decided as per routine. In India, often many important effects and significant facts are being ignored while a lot unwanted and irrelevant data from the field is being collected. Most of the modelling of the impacts are not being validated or checked but rather it is being manipulated. Consultants generally do not take any long-term responsibilities but instead participate only until the clearances are being done. As per the regulations Comprehensive EIA's in India should contain data of one complete year and rapid EIA's contains data of one season only. In India the parties involved in EIA assessment are Project Proponent,EIA Consultant, Government associations which generally work to clear projects in the context of economic profits, Environmental activists, NGOs and local people and Courts.**[5]**

## II. LITERATURE REVIEW:

At UN Stockholm conference which took place in the year 1972, it was accepted by the living environment the importance of "oneness" in the environment. Although this principle contradicts the present scenario of expansion in science, where in each specialization field of science there is an exponential growth in the research works and the published works for the last 30 years. However, in the last few decades quite a number of interdisciplinary environmental institutes have been developed, but a large amount of these institutions has failed to their early expectations.**[6]**

Due to the complexity of the environment, the models designed and developed by the scientists are quite complex in nature. Although a decision maker would prefer to accept the conclusions of a simple analysis rather than the conclusions of a complex stimulation which is difficult to understand.**[7]**

Technical experts might be specialized in their own respective countries but it proves to be difficult for them to understand the character of the tropical and subtropical climate. Thus, it is very necessary to provide training on spot depending on the region or country.**[8]**

In relation to the application of modeling techniques to the EIA, projects have been funded by UNEP, IIASA, and the University of British Columbia, Vancouver in order to prepare leaders manually of EIA teams and also to prepare some technically efficient appendices for their staff members. One of the particular problems that is seen in developing countries are that the mandatory environmental standards (specially for housing, pollution, nutrition etc.) are being derived from North American and European standards, henceforth there remains very little relation to the cultural backgrounds, to the present-day scenario's responses of tropical organisms and their ecosystems leading to environmental stress.**[9]**

## III. MANADATORY REQUIREMENTS:

### 3.1.Environmental Protection Act (1986)

Environmental Protection Act (1986) was introduced with the purpose of protection and improvement of the quality of the environment. Environmental Protection Act 1986 has generally three chapters.**[10]**

1. **Chapter 1**

- It includes general title, its commencements and the various definitions involved in this act.
- This act includes the entire nation although the provisions may differ depending on different areas within the nation.
- It specifically defines the terms involved in this act including environment, the environmental pollution, the environmental pollutants, the hazardous substances and the ways of handling it by the mentioned occupiers as per the prescribed rules under the act.

2. **Chapter 2**

- It includes the various powers given to the central government under the act and also the various necessary steps that are to be taken by the government in order to protect and improve the quality of the environment.
- It also includes the various procedures involved in the appointment of the officers under the EPA and refers to the various functions of them.
- It includes the power of the officers to give orders and instructions.

3. **Chapter 3**

- It involves responsibilities of the people who are in power of industrial areas. It states that these responsibilities involve prevention of excessive discharge of environmental pollutants.
- In case of Hazardous substances of the environment, people who are handling it should follow proper safety norms and procedures related to its discharge.
- Lastly, it includes environmental laboratories, governmental analysis, reports and furnishing of final outcome and reports of samples.**[10]**

### 3.2. Environmental Impact Assessment

The basic nature of Environmental Impact Assessment is anticipatory, participatory and systematic and is reliable on various aspects which are multidisciplinary in nature. The expression Environmental Impact Assessment (EIA) is derived from section 102(2)of the National Environmental Policy Act (NEPA), 1969, USA.Although the existence of EIA in India came in the year 1978 – 79, but it was made compulsory in the year 1994 as per the Environmental Protection Act (1986).**[11]**

Under Environmental Impact Assessment, MOEF has divided 40 sectors in various categories which need environmental clearance in order to commence any sort of project activities. These categories are divided on the basis of their respective activities and its area. The EIA required sectors and its categories are as follows: -**[11]**

1. Mining of minerals including Opencast/Underground mining
2. Offshore and onshore oil and gas exploration, development & production
3. River Valley, Hydel, Drainage and Irrigation projects
4. Thermal Power Plants
5. Nuclear power projects and processing of nuclear fuel
6. Coal washeries
7. Mineral beneficiation including palletization
8. Metallurgical industries (ferrous & nonferrous) – both primary and secondary
9. Cement plants
10. Petroleum refining industry
11. Coke oven plants
12. Asbestos milling and asbestos based products
13. Chlor-alkali industry
14. Soda ash Industry
15. Leather/skin/hide processing industry
16. Chemical fertilizers
17. Pesticides industry and pesticide specific intermediates (excluding formulations)
18. Petro-chemical complexes (industries based on processing of petroleum fractions & natural gas and/or reforming to aromatics)
19. Textile – cotton and manmade fibers
20. Petrochemical based processing (processes other than cracking & reformation and not covered under the complexes)
21. Synthetic organic chemicals industry (dyes & dye intermediates; bulk drugs and intermediates excluding drug formulations; synthetic rubbers; basic organic chemicals, other synthetic organic chemicals and chemical intermediates)
22. Distilleries
23. Integrated paint industry
24. Pulp & paper industry excluding manufacturing of paper from wastepaper and manufacture of paper from ready pulp without bleaching
25. Sugar Industry
26. Induction/arc furnaces/cupola furnaces/submerged arc furnace/crucible furnace/re-heating furnace of capacity more than 5Tonne per heat
27. Oil & gas transportation pipeline (crude and refinery/ petrochemical products)**,** passing through national parks/ sanctuaries/coral reefs /ecologically sensitive areas including LNG terminal
28. Isolated storage & handling of Hazardous chemicals (As per threshold planning quantity indicated in column 3 of schedule 2 & 3 of MSIHC Rules 1989 amended 2000)
29. Air ports
30. All ship breaking yards including ship breaking units
31. Industrial estates/ parks/ complexes/areas, export processing Zones (EPZs), Special Economic Zones (SEZs), Biotech Parks, Leather Complexes
32. Common hazardous waste treatment, storage and disposal facilities (TSDFs)

33. Ports, harbors, jetties, marine terminals, break waters and dredging
34. Highways, railways, transport terminals, mass rapid transport systems
35. Aerial ropeways
36. Common Effluent Treatment Plants (CETPs)
37. Common Municipal Solid Waste Management Facility (CMSWMF)
38. Building and large construction projects including shopping malls, multiplexes, commercial complexes, housing estates, hospitals, institutions
39. Townships and Area development projects
40. Additional Sectors

- Automobile and Auto Components
- Electroplating and Metal Coating
- Electrical and Electronics including component industry
- Glass and Ceramic Industry
- Food Processing

## IV. METHODOLOGIES:

Methodologies of EIA can be distinguished in five types on a larger scale depending on the respective impacts. They are: -**[12]**

1. Adhoc methods
2. Matrices methods
3. Network methods
4. Overlays methods
5. Cost/benefit analysis

### 4.1. Adhoc Methods

Adhoc methods include areas of interests in a broader scale having probable impacts, it is done by listing down the environmental parameters which are expected to be affected by the upcoming proposed activity. The steps of adhoc methods include collection of a group of specialists who would identify the possible impacts in their respective areas of interests. These methods help assessing and give a rough idea of the overall impact that portraying the general nature and covering the broader aspects. The assessment in this case is mostly based on the intuition and results into a wider range of qualitative assessment. Adhoc methods can be distinguished into three types, Opinion poll, Expert opinion and Delphi methods. This method turns out to be quite helpful in the identification certain important areas like:-

- Wildlife
- Endangered species
- Natural vegetation
- Exotic vegetation
- Grazing
- Social characteristics
- Natural drainage
- Groundwater
- Noise
- Air quality
- Visual description and services
- Open space
- Recreation
- Health and safety
- Economic values and
- Public facilities

### 4.2. Matrices Method

This type of methodology generally works on the framework which includes the interaction in between the various types of activities within a project which leaves an impact on the environment. The Simple matrix method is performed by listing the projects on one axis (generally vertical) and its environmental impacts on the other axis. Matrices method can be of two types – Simple Matrix and Leopold Matrix.

**4.3. Network Method**

The Network Method applies the procedure of matrix method extending to both the primary and secondary impacts of it as well. It is described in the form of impact tree also known as reference or sequence diagram. One of the most important and primary step of impact tree is to identify the direct and indirect impact and long and short term impact as well. It is used for the identification of the linkages between causes and effects.

**4.4.Overlays Method**

This type of methodology involves preparing of a set of transparent maps representing the spatial distribution of various environmental features. Collection of information covers an extensive range of variables in order to consider standard geographical units**,** which combines to form a series of maps with each map for one respective variable. The overall composite maps signify the area's physical, social, land use and ecological characteristics along with other relevant features in order to imply the proposed developments of the concerned area. All the composite maps are overlaid to form a final map in order to conclude the assessment which depends on the type and parameters that are being selected. Overlays method proves to be quite useful in projects with industrial EIA, as it compares the capacity of a land that exist, projected land uses, alternative road routes, better levels of air quality along with pollution control and other alternatives.

**4.5. Cost Benefit Analysis**

Cost Benefit Analysis process is an analytical process involving identification, valuation, comparison of cost and benefits of a project. It is a standard evaluation tool used for economic and trade analysis of projects for development. This type of methodology is used to determine whether the project is feasible or not by substantiate whether its benefits exceeds its costs or not and by how much. It is also used to compare projects which involve comparison between total expected cost and total expected benefits.

## V. PROCEDURE:

Procedure of the EIA is varying from country to country.EIA in India consist of following steps **[13]**

1. Screening
2. Scoping
3. Baseline data collection
4. Impact prediction
5. Assessment of alternatives, delineation of mitigation measures and environmental impact statement
6. Public hearing
7. Environment Management Plan
8. Decision making
9. Monitoring the clearance conditions

**1) Screening**

Screening is the first step in the EIA; it determines whether the proposed project requires Environmental clearance (EC) as per the statutory project. If EC is not required then the level of assessment is necessary. This step includes which level of EIA is required. It is the important process that is done comprehensively and consistently.

Screening criteria depends on the following terms**[13]**

1) Scales of investment
2) Types of development
3) Location of development

The requirement of the particular project depends on the size of the project, Budget of the project, and site-specific information.**[14]**

**2) Scoping**

Scoping is the detailed evaluative and essential step in EIA.**[15]** This is the step which includes publics, project related all the persons. It includes all the parties related to this project and give them chance to gain an understanding of the proposed project and collaborating with the others.**[16]**

This is the process of identifying issues and its significant and non-significant impacts, Zone of impacts - all the issues and impacts should be monitored and then address them or mitigate them **[13][15]**After all the steps the detailing of terms of reference of EIA has been given by the appraisal committee.**[13]** Thisare done under the guidance of consultant with project proponent and impact assessment agency.**[15]**

**3) Baseline data**

Baseline data gives the environmental status of the proposed project, it also describes physical, chemical and socio-economic condition of the project**. [17]**The primary data containing information of the site location should be monitored and identification of parameters are done and then if available, secondary data should be expanding.**[13][15]**

**4) Impact prediction**

This step includes identification and prediction of the environmental impacts. But we have already initial identified impacts in the scoping. This initial impact is referred once and other impacts are added during the investigation in this stage **[13][15]**

Impact prediction is the "mapping" of the environmental effects of the significant aspects of the proposed project and its alternatives. Environmental impact is uncertain, it may be positive or negative, reversible (Low impact) or irreversible (high impact), permanent or temporary in quantitative and qualitative terms.**[14]**

Some of the impacts occur for the long time and some occurred for short time, which is classified as following:**[18]**

- Short-term, around 3-9 years
- Medium-term, around 10-20 years
- Long-term, beyond 20 years

The impacts which are assessed during the project is:**[13]**

- Air: Emission from the point, line, fugitive and area sources, impact on the ambient air quality and concentration of different gases in air create risk to the human health. Affect the soil material its fertility, buildings, vegetation.
- Noise: High sounds produces from the industrial machinery, equipment's, transport etc. affect the ambient level of noise and impacts on the human and animal life.
- Water: Availability of the water per person, discharged standards of the effluent water, quality of the water should be assessed.
- Land: land use patterns and classifications, disposal of the solid waste on the land, shore bank/riverbank and their stability, characteristics of the land should be assessed.
- Biological: Impact on the plants, animals, deforestation of the forest, reduction of the animal territory, rare and endangered species, endemic species, and migratory trek of the animals.
- Socio-economic: Impact on the local population including population growth, economic climate, human health etc.

**5) Assessment of alternatives, delineation of mitigation measures and environmental impact statement:**

Every proposed project has one or more available possibilities that should be identified and compared with environmental attributes.**[13]** Alternatives coverall the aspects of the projects such as location, Equipment and technologies used in process, and economical value from the small scale to large scale.**[17]**All the possible alternatives are referred and most appropriate are selected, cost effective and best option for the proposed project to mitigate the impacts. Once the option is decided, plan is made for the selected options and enlarges with the environmental management plan for the proponent for environmental improvements.**[13]**

This EIA report made for the Decision-maker and that gives the exact scenario of the project and also covers all the aspect with or without project and project alternatives.**[13]**

**6) Public hearing**

Public hearing is conducted by state pollution control board in order to know the concerns of locally affecting people. The people that are likely to be affected by the project have right to access to the summary of EIA. The affected people include Bonafide local residents, Environment related groups or NGOs, local association and other people related to the project site.**[13]**Affected people can give their suggestions in verbal or written format and state pollution control board have to consider their suggestions. In some projects which have resemblance to nation and national security are explicated from public hearing. Affected people are given 30 days for the view of proposed project.

**7) Environment management plan**

In Environment management plan, there is description of prevention and control of Environmental components, there rehabilitation and resettlement plan and their mitigation measures. There is description of monitoring scheme for compliance of condition. There is also description of implementation plan which includes resource allocation and scheduling.**[13]**

**8) Monitoring**

Monitoring is very crucial part of EIA procedure. It is used to check the changes that are happening in Environment and in its vicinity. It keeps track on the fulfillment of commitments that are made in approved EIA. It can make us sure whether the predictions made in EIA remains true or not. It helps us keep an eye and ensure that things listed in Environment management plan, mitigation measures and contingency plan are fulfilled. It should be done before and after i.e. (Moef.gov.in, 2018) during construction and operation phase.**[13][15]**

**9) Decision making**

Decision making is the process that involves consultation between project proponent and impact assessment authority. EIA and EMP are the things that are kept in mind based on procedural aspects while giving Environment clearance.**[13]**

## VI. CONCLUSION:

Environmental impact assessment is an important tool for decision making. The present paper deals with importance of EIA, its conceptual framework, mandatory requirements, methodology and procedures. Conceptually , identification and time emerging trends of existing environmental attributes within the zone of influence of the project needs to be done followed by evaluation of impacts on account of the proposed projects. The process of evaluation includes simulation techniques in the form of prediction of air pollutant concentration at various receptor points along with water pollution, noise and solid waste etc The process of assessment includes identification of negative and positive impacts through various techniques coupled with quantification as far as possible. Finally, it deals with Environmental management plans to neutralize negative impacts through control techniques, preventive measures, proper governance, active supervision, management, incentives etc. One of the important aspects is to carry out futuristic predictions on a time scale particularly on account of ancillary activities likely to be developed after the project came into existence.

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