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EIA Methodologies

EIA Methodologies developed to identify, predict and value changes of an action. The EIA methodology to be followed for a certain type of project or activity. For a specific project, the EIA methodology may also have been a matter of debate during the scoping phase, when the Terms of Reference describing the content and extent of the EIA are established. In either case, a reference to the applicable regulations or official documents should be given and their requirements briefly outlined in the EIA report. If no conditions have been imposed on the methodology, EIA practitioners may adopt an individual approach, which should be briefly described in the EIA report. The EIA methodology in general includes:

- Methodologies used for investigating the environmental baseline and the potential impacts, such as environmental sampling techniques, laboratory analysis, statistical data analysis, controlled field or laboratory experiments, computer models, etc.;
- Methodological approaches for evaluating the impacts, such as criteria for the identification of significance of impacts, for balancing the effects against each other, for evaluating the combined risk of all impacts, etc.

Ad Hoc Method: Ad hoc methods are not really methods as they do not structure the problem so it is more amenable to systematic analysis. The example of an ad hoc method is a team of experts assembled for a short time to conduct an EIA Ad hoc methods involve assembling a team of specialists to identify impacts in their area of expertise. In this method, each environmental area, such as, air, and water, is taken separately and the nature of the impacts, such as, short-term or long term, reversible or irreversible are considered. Ad hoc methods are for rough assessment of total impact giving the broad areas of possible impacts and the general nature of these possible impacts. For example, the impacts on animal and plant life may be stated as significant but beneficial.

This method serves as a preliminary assessment which helps in identifying more important areas like :

I. Wildlife

2. Endangered species

3. Natural vegetation

4. Exotic vegetation

5. Grazing
6. Social characteristics
7. Natural drainage
8. Groundwater
9. Noise
10. Air Quality.
11. Recreation,
12. Health and safety,
13. Economic values,
14. Visual description and services,
15.Open space
16.Public facilities

Limitations: This method is very easy to use, but it has also some limitations. Some of the limitations are as follows:

i. It may not encompass all the relevant impacts.
ii. The criteria used to evaluate impacts are not comparable. The relative weights of various impacts cannot be compared.
iii. it is inherently inefficient as it requires sizeable effort to identify and assemble an appropriate panel of experts for each assessment; and
iv. It provides minimal guidance for impact analysis while suggesting broad areas of possible impacts.

Matrix method of EIA: The main functions of this tool are to identify the preliminary impacts, make a comparative analysis of alternative impact assessments, and present the evaluation results. Matrix method provides a framework for interaction between project activities and their environmental impacts. A matrix of potential interactions is produced by combining two lists (placing one on the vertical axis and the other on the horizontal axis). It can evaluate degree of impacts of project activities on environmental resources. The Matrix method of impact analysis was established by Leopold et al (1971). Matrices are methodologies that incorporate a list of project activities in addition to a checklist of potentially impacted environmental characteristics.

Leopold matrix can also be employed to identify beneficial as well as detrimental impacts for various temporal phases of a project e.g., construction, operation, and post-operation phases and describe impacts associated with various spatial boundaries, namely, at the site and in the region. Impact identification is the first step of the Environmental Assessment. An impact is identified as the interaction between an activity and an environmental parameter, and when they are stacked in rows and columns, it gives rise to the EIA matrix. Wherever an impact is anticipated, the corresponding block of the matrix is marked with a diagonal line (/) to indicate the interaction. There are two type of matrices used: Simple and Stepped.

Example of a Leopold Matrix (modified) to identify impacts of a project construction works

Actions → Factors	Construction			Operation			
	Movement of land	Urban services of the project	Building works	Use of housing draft	Consumption services	Generation of waste	Maintenance works: built and green areas
Air (Quality Air System Sonic)	H	H	H	M	L	L	M
Floor (Use)	H	M	H	M	H	M	M
Surface water (Storm drain)	H	M	H	M	H	M	M
Underground water (Aquifer Level, Groundwater)	M	H	M	L	L	L	M
Flora fauna (Biotopes)	H	M	L	L	L	L	H
Empowerment	H	M	H	M	B	B	B
Sociocultural Condition (neighbours)	H	M	H	H	M	M	M
Generation Solid Waste	H		H	H	M	M	M
Management of dangerous substances (Combustibles etc.)	H	M	H	H	H	L	M
Scenery	H	M	H	H	B	B	H

Key: Significant Impact – requires assessment and establishment of measures Impacts of low or non-existent significance (rated as H = High, M = Moderate, L = Low)

Leopold Matrix: The Leopold Matrix provides a framework for the analysis and numerical weighting of probable impacts. It is a simple way to summarize & rank environmental impacts and to focus on that impact, which is considered to be greatest. Matrix method is pioneered by Leopold et al (1971), enlisted about 100 project actions and 88 environmental characteristic or

parameter. It delivers a total of 8,800 interactions. Each action and their impact potential are considered. In Leopard matrix, on horizontal axis, actions cause environmental impact and on the vertical axis, existing environmental conditions affected by actions. The horizontal axis shows most efficient way to check each significant action (listed on the horizontal axis). As on listed on vertical axis give information about that each checked action (on horizontal axis) is evaluated in terms of magnitude of effect on environmental characteristics and conditions

Advantages: Visually describe relationship between two sets of factors.

- Expanded or contracted to meet needs of the proposal being assessed.
- Identify impacts of different phases of project, construction, operation and so on
- Help separate site-specific impacts from impacts affecting region.

Disadvantages: Difficult to distinguish direct and indirect impacts.

- There is significant potential for double counting of impacts.
- They do not explicitly represent spatial or temporal considerations.
- They do not adequately address synergistic impacts.
- The cells of the matrix are filled in using subjective (expert) judgement, or by using extensive data bases.

Networks: These methodologies integrate impact causes and consequences through identifying interrelationships between casual actions and the impacted environmental factors.

Checklists: The principle of this tool is to develop a framework for EIA users so that they do not omit any relevant points. Various checklists are available, including Simple, Descriptive, and Questionnaire

The Batelle method: the principle of this tool is to split the environmental impacts into four major categories: ecology, pollution, aesthetics, and human interest [5][2], so that the EIA can be implemented with regard to any activities.