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SUBJECT : PROJECT PLANNING AND MANAGEMENT

TOPIC : ENVIRONMENTAL APPRAISAL OF PROJECTS

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TOPICS

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2. Types and Environmental Dimensions of a Project
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INTRODUCTION

The effects of actions that are not accounted for in the normal market transactions need to be considered explicitly in the decision making process on projects. These effects are to be identified, assessed, and evaluated against the economic advantages arising out of a given action. In this context, the environmental impact appraisals are considered the first step in the process because they give an opportunity to man to consider the effects of his actions on the environment.

Economic development is the result of the interaction between natural resources and technology supported by and designed for people. People are the centre for development. Therefore, it is rightly said that all human activity, be it economic, social or anything else is essentially directed at satisfying “needs” and “wants” of man through “altering” and “using” environmental resources.

TYPES AND ENVIRONMENTAL DIMENSIONS OF A PROJECT

Broadly, there are two types of projects. The first one refers to those projects that produce physical goods like cement, steel, paper, chemicals etc. These projects, in fact, convert the natural resources into saleable and exchangeable products. In fact, these projects inflict a large number of physical changes and disruptions on environment and, hence, disturb the environmental and ecological balance. Environmentalists are mostly concerned with such type of projects. The second type refers to those that produce/render various kinds of services such as health, education, transport, energy, defense, law etc. Such projects also cover actions
like land reforms, agricultural extension, services, sales promotion campaigns, etc. Projects of these types are non-physical in nature and they do not directly cause any physical changes in the environment. However, they bring about significant changes of far

-reaching consequences on values, attitudes, lifestyles, social relations, and so on. The net effect of such projects is the creation of new wants and needs in society. They ultimately promote consumerism in the society and thereby increase the number of manufacturing projects. Thus, both are interrelated.

Each project has two dimensions: (a) the intended objectives – they are also called stated goals/benefits; and (b) the unintended consequences. They are also called externalities or social costs which are unplanned, unwanted, and unanticipated. Environmental management or planning is the study of the unintended consequences of a project. Its purpose is to identify, examine, assess, and evaluate the likely and probable impacts of a proposed project on environment and, thereby, to work out the remedial action plans to minimize the incidence of adverse impacts. It is not anti-development nor is it against the projects. Its goal is development without damage or least damage.

STRESSES ON ENVIRONMENT

Environmentalists have identified four types of different stresses or pressures that are being continuously inflicted on environment. They are:

i) Atrophic Stress Refers to the release of various kinds of wastes into the river and other water bodies and their consequent drying.

ii) Exploitative Stress Refers to the exploitation of natural resources
endowment for production and consumption purposes through agriculture, industry, extraction, fishing etc. It is important to note that the rate of exploitation has a relevance to the nature's capacity to reproduce.

iii) Disruptive Stress Refers to the physical alterations in nature resulting from such activities like forest clearance, highways, railways, factory buildings and so on. These physical changes

disturb the environmental and ecological balance.
iv) Chemical and Industrial Stress results mainly from the developments in "science and technology" and their applied fields like industry, warfare and agriculture. This comprises mainly the pollutants and effluents of all types, radiation etc.

Strategies to face these threats to natural environment through pollution, destruction and over-use can be: (a) preventive or (b) regulatory. It is in this context that the environmental appraisal of projects is gaining significance with a hope of achieving sustainable development in harmony with environment.

Meaning and Scope of Environment

The word "environment" is defined to include everything external to
man/organism. It covers the region, surroundings, or circumstances in which anything exists. It is broadly divided into two components. The first one is the biotic or inorganic milieu, comprising the physical elements like land, water, atmosphere, climate, sound, odours, and tastes. They are the inanimate elements of the habitat systems. The other one is the biotic or the organic milieu consisting of animals, plants, bacteria, viruses, all other living organisms, and the social factors including aesthetics. They are the animate elements.

The is another definition particularly relevant in the context of projects. Here, the term "environment" is defined as:

The surrounding zone (the specific zone to be affected by the project), all natural resources (physical and biological), and the human resources (people, economic development and quality of life values).

This definition is comparatively more specific,

focused, and clear-cut than the earlier one, which was too general and unfocussed. This is more suited to operationalise, quantify, and measure the environmental impacts of a given action. The contentious issue in this definition is the surrounding zone or the project vicinity. However, a distinction has to be made between the “legal boundary” which is the area legally occupied by a project, and the “environmental boundary” which stretches much beyond the legal boundary. In fact, this is the area around the project that is likely to be affected environmentally by the project operations. The extent of environmental boundary for a project depends, among other things, on the diffusion factors like wind speeds and directions, elevations, etc. It varies from project to project and location to location for the same project.

There is yet another definition of environment as below:

The external, natural, physical and residential conditions which affect man directly and indirectly and which are, in turn, influenced by economic decisions and technological developments.

This definition implies a complex interactive model between man, environment, and science and technology, the outcome of which will be economic development. As a matter of fact, projects facilitate such an interaction.

Environmental management, a term encompassing environmental planning, protection, monitoring, assessment, research, education, conservation, and sustainable use of resources, is now accepted as a major guiding factor in all the economic decision making processes on development or otherwise. Subsequently, a wide network of legislation came into being. Now, environmental clearance for all the major projects on the basis of their Environmental Impact Statement (EIS) has become legally mandatory.

Environmental resources/values (ER/VS)

Since the word 'environment' is an all-inclusive concept encompassing
everything external to us, it is difficult to operationalise and applies to particular situations like the projects. For the purposes of operationalisation and practical application, the environmentalists have developed a concept called 'Environmental Resources/Values' (ER/Vs). It is defined as an aspect of environment which is of benefit to man. The environmentalists have identified and classified various components of environment (that is, ER/Vs) into four levels as below:

(a) Level – 1: Physical Resources, covering land, water and air,
(b) Level – 2: Ecological Resources, consisting of aquatic, terrestrial and endangered (rare) species (other than man).
(c) Level – 3: Human Use Values, covering transport, agriculture, water supply, recreation, mining, industry, flood control, etc.
(d) Level – 4: Quality of Life Values, covering socio-economic, cultural and aesthetic aspects.

Thus, the whole environment is decomposed into several operationally feasible components for elements. These elements can further be subdivided into several related items. Alternatively, some other environmentalists identify and classify the various elements of environment broadly under eight types, which are called Environmental Attributes (EA). They are: (a) air, (b) water, (c) land, (d) ecology,
(e) sound, (f) human aspects, (g) economics, and (h) resources. Each one can further be subdivided into different related elements.

In the context of environmental appraisal of projects, one can follow either of the classifications, viz., Environmental Resources/values (ER/Vs) or the Environmental Attributes (EA). As a mater of fact, they can be evaluated and assessed individually with respect to the impacts they receive or

the changes they undergo due to the proposed project. Since there will be a variety of types of
impacts of varying degrees from a project, the decomposition of environment unit into various quantifiable elements will enable the analyst to give focus and direction to his impact assessment analysis.

An environmental effect is considered as the effect of natural or fabricated actions, which alter environment (as measured by physical, chemical, and biological parameters). Our concern is, however, on man made actions. The nature and extent of environmental impacts including magnitude, severity, urgency, risk etc., of a project in the ultimate analysis depends upon:

(a) Nature, size and type of the project: such as manufacturing, services, agriculture, mining, logging, power, hardour, chemicals, sugar, etc.
(b) Technology.
(c) Location/eco-region: such as urban or rural areas, coastal, river valley, forest/hill areas or any of the eco-systems as described earlier.

Environmental impact assessment (EIC) and environmental impact statement (EIS)

Environmental Impact Assessment (EIA) and the Environmental Impact
Statement (EIS) are said to be the instruments through which the environmental management tries to accomplish its objective. The basic premise behind the EIS/EIA is that no one has any right to use the precious environmental resources resulting in greater loss than gain to society. From this, it follows that the aim of EIS

is to seek ways by which the project can proceed without any irreparable losses to environment and minimum losses if any, so that the net effect will be a
desirable gain.

Environmental Impact Assessment (EIA) is defined as: "An activity designed to identify, predict, interpret, and communicate information about the impact of an action on man's health and well-being (including the well-being of ecosystems on which man's survival depends). In turn, the action is defined to include any engineering project, legislative proposal, policy programme, or operational
procedure with environmental implications." An EIA, therefore, is a study of the probable changes in the various socio-economic and biophysical attributes of the environment, which may result from a proposed action.

On the other hand, Environmental Impact Statement (EIS) is defined as:

"A report, based on studies, disclosing the likely or certain environmental consequences of a proposed action, thus alerting the decision maker, the public and the government to environmental risks involved; the findings enable better informed decisions to be made, perhaps to reject or defer the proposed action or permit it subject to compliance with specific conditions."

The EIS is a document prepared by an expert agency on the environmental impacts of a proposed action/project that significantly affects the quality of environment. The EIS is used mainly as a tool for decision-making. At times, the EIA and EIS are used interchangeably as synonyms. However, both are different activities with many commonalities and with a common purpose. The basic difference between the two is that the EIA is carried out by the expert agency while the EIS as a tool is given to the

decision-makers in different formats. As a matter of fact, the EIS is the outcome of EIA. It is better to consider the environmental consequences during the project planning and design stage itself so to avoid higher costs of future remedial actions by prudent planning and early preventive measures.

Objectives of EIS: To identify and describe (in as quantified a manner as possible) the environmental resources/values (ER/Vs) or the environmental attributes (EA) which will be affected by the proposed project, under existing or "with or without project" conditions.

(a) To describe, measure, and assess the environmental effects that the proposed project will have on the ER/Vs (again, in as quantified a manner as possible), including positive effects, which enhance ER/Vs, as well as the negative effects, which impair them. Direct or indirect and short term or long term effects are to be considered. This would also include the description of the specific ways by which the project plan or design will minimize the adverse effects and maximize positive effects.

(b) To describe the alternatives to the proposed project which could accomplish the same results but with a different set of environmental effects. Energy generation by thermal, hydel, and nuclear modes would explain the case in point. Further, alternative locations are also considered.

Guidelines on the Scope and Contents of EIS/EIA: The following are the commonly accepted points to be covered in an EIA study/report:

(a) A description of the project proposed action; a statement of its purpose and a description of all relevant technical details to give a complete understanding of the proposed action, including

the kinds of materials, manpower/resources etc., involved.
(b) The relationship of the proposed action to the land-use plans, policies and controls in the affected area or the project-vicinity. It is necessary to gain a complete understanding to the affected environment. What is the nature of biophysical and socio-economic characteristics that may be changed by the action?

(c) The probable impacts of the proposed project on environment are a very important aspect to be considered in detail. It is necessary to project the project action into the future and to determine the possible impacts on the environmental attributes. The changes are to be quantities wherever possible.

(d) Alternatives to the proposed action, including those not within the existing authority/agency.

(e) Any probable adverse environmental effects that cannot be avoided and stating how each avoidable impact will be mitigated.

(f) The relationship between local short term uses of man's environment and the maintenance of an enhancement of long-term productivity.

(g) Any irreversible and irretrievable commitments of resources (including natural, cultural, labour, and materials).

(h) An indication of what other interests and considerations of governmental policy or programme are thought to offset the adverse effects identified.

As seen by its purpose, scope and contents, the EIA is a very complex exercise due to the fact that many and varied types of projects are proposed for an equally numerous and varied kinds of environmental settings. Each combination of

projects and the complex environmental settings results in a unique cause condition- effect relationships with regard to their impacts. Therefore, each
combination must be studied individually in order to accomplish a comprehensive analysis.

Methodology for Conducting an EIS Study: So far, there is no consensus on any particular procedure. This is because of the difficulties in quantifying the effects which are often intangible, complex, and imperceptible in nature. It is difficult to develop meaningful parameters to represent the effects and their quantification. The major problems in this regard are:

(i) The diffused nature of impacts both over time and space; and the lags in impacts after the cause worked.
(ii) An environmental effect is the joint product of several pollutants.
(iii) Inadequacy of techniques to estimate the impacts and their costs.
(iv) Since the impacts are imperceptible, people are not aware of the impacts.

Due to the complex problems involved in identification and quantification of effects, all attempts to develop quantitative approach to EIA (including the checklists, matrices, networks, flowchart relationships, and map overlays) have been essentially subjective with the quantification depending mostly on the background and bias of the investigator or observer.

At present, the generally accepted approach for making the EIS is an item-byitem review of effects on the individual environmental resources/values (ER/Vs), including both the identification of ER/Vs, and description and quantification of the effect to the extent possible. Then, it is possible to group these effects in a systematic manner. The following are the major

practical steps in this approach.
(a) Make a rapid or quick scanning or appraisal of the basic environmental resources viz., land, water and air, at the macro level , say at the district level in which the project is to be located. This scanning is meant to evaluate the extent of fragility and exploitation of the endowed resource-base, including the human resources. Then relate the project to the regional environmental in broad terms.
(b) Demarcate the project vicinity or the surrounding zone of the project. Maps can also be used.
(c) Identify, assess, and describe all the environmental attributes as given in a tabular form earlier; or the environmental resources/values (ER/Vs under four levels) as given earlier, endowed in the project vicinity. This would give a total description of the environment before the start of the project.
(d) Rank or prioritise the identified ER/Vs by their fragility, importance,
relevance and quality. This would help to concentrate on the very significant items rather than spreading the efforts too thinly over a large number of items of lesser significance.
(e) Carry out the item-by-item review of effects of the proposed project on the already identified individual ER/Vs embedded in the project vicinity.
(f) Arrange or group the effects in a systematic manner, preferably in a format.
(g) Prepare the remedial plans for mitigating the adverse effects. They can be: (i) Corrective; (ii) Compensatory; or (iii) Enhancing.

By following the above practical steps sequentially in that order, one can make an environmental appraisal of any type of project. Through EIS/EIA, the environmental protection planning is made compatible with the developmental perspectives.

Some Major Issues in the Preparation of EIS/EIA: The following are the major issues reported to be encountered commonly while conducing and preparing the EIS/EIA. Some of the issues cannot be resolved. In the absence of better alternatives, the analyst has to accept the issues as they are.

• Determining the Environmental Impacts This is the central theme in any EIS/EIA. It is a very complex process. At the outset, a distinction has to be made between the environmental impact and the changes in environmental attributes. Our interest is on the “impacts” and not on the ‘changes’, which normally take place even without the project. The determination of environmental impacts involves: (a) identification of impacts on environmental attributes or the ER/Vs, (b) measurement of impacts on attributes, and (c) aggregation of impacts on attributes to reflect the total impact on environment.

• With and Without the Project the environmental impacts are measurement of attributes with and without the project or activity at a given point in time. However, the changes in the attributes take place over time without the activity. Therefore, the impact must be measured in terms of “net” change in the attribute at a given point in time.

• Identifying the Impacts the number of attributes to be evaluated is practically infinite because any characteristic of the environment is considered an attribute. Therefore, they have to be reduced to

manageable numbers. Thus, duplicative, redundant, difficult to measure, and obscure attributes may be eliminated in favour of those
that are more tractable. This implies that some attributes, which are
difficult to measure or conceptualize, may remain to be examined. In
this case, bias and subjectivity are likely to be crept in.

• Characteristics of the Base Conditions Prior to the Activity: The nature of the impact is determined by the conditions of the environment existing before the project. The assessment of the characteristics of the base is a critical factor.

• Geographic Characteristics: The same activity produces different
impacts on a particular attribute; say water quality, over different geographical areas. The spatial distribution of different activities introduces one of the difficult elements in comparing one activity and
its impact with another. This issue becomes particularly critical while
making choices between projects.

• Role of Attributes Though the impacts are considered the effects on
the definite discrete attributes of the environment, the actual impacts
are not correspondingly well categoriesed. Nature does not necessarily
respect man’s discrete categories. Rather, the actual impacts may be
the effects of varying severity on a variety of interrelated attributes.

The issue is one of identifying and assessing the cause-condition effect
in order to work out the remedial measures.

• Measurement of Impact Ideally, all impacts must be translatable into
common units. However, this not possible because of the difficulty in
defining affects in common units (e.g., on income and on water quality). In addition, the quantification of some impacts may be beyond the state of the art.

• Aggregation Problem After measuring the project impacts on various
individual attributes or ER/Vs, one encounters the problem of how to
aggregate all impacts (quantitative and qualitative) thus assessed to
arrive at a single composite measure to represent the 'total activity
impact'. This would involve expressing the various impact measures
in common units, which is very difficult. Some use a weighting procedure to accomplish this, which is again subjective. There is another associated problem of summing up and comparing with the
impact of an alternative activity.

• Secondary Impacts Secondary or indirect impacts on environment
should also be considered particularly in relation to the infrastructure
investments that stimulate or induce secondary effects in the form of

associated investments and changed patterns of social and economic
activity. Such induced growth brings significant changes in the natural
conditions. Similarly, there can also be significant secondary impacts
in the biophysical environment.

• Cumulative Impacts Here, cumulation refers to the similar activities
spread over in all environmental setting like hotels, beach resorts, surface or underground mines, industrial estates, etc. A single individual activity may produce a negligible effect on environment. However, services of similar activities may produce significant cumulative effects on certain aspects of environment. This raises the
question of how to deal with these significant cumulative effects. Therefore, it is suggested to prepare an environmental impact assessment (EIA) on broad programmes rather than on a series of
component actions (e.g., industrial estates, mining sector, tourism industry, etc.). On the other hand, alternatively, one can prepare and
EIA for a particular geographical area where a series of similar activities are located (e.g., mining areas, coastal line for beach resorts, etc.).

• Reporting Findings The results should be displayed in such a way that
it makes easy and clear to comprehend the total impacts of an activity
from a brief review. It is suggested to display the impacts on a summary sheet in a matrix form.

The knowledge about the issues as explained above, however complex they are, will be useful in understanding the processes and complexities involved in preparing an EIS/EIA. Such awareness will help improve the understanding of EIS, leading to more objectives, informed and unbiased decision-making on activities/projects.

Choice of a Methodology: Many impact assessment methodologies have been developed in the western industrialized countries as a response to the various legislative control and regulatory measures as also to suit divergent environmental situations and purposes.

The choice will decide the depth of analysis to the carried out in a particular impact assessment. The choice of a methodology depends on; (a) needs of the user, (b) type of project; its size and technology, and (c) location; type of ecosystem.

Depending on these factors, one may be more useful than the other methodology. Therefore, the analyst must decide which one will best fit for a given task and situation. The following are the important considerations for making a choice on
the methodology for preparing an EIS/EIA.

• **Use:** It the EIS for a decision or for information? If it is for a decision, it required greater emphasis on identification of key issues, quantification and comparison of alternatives. If it is for information,
it requires a more comprehensive analysis and concentration on interpretation of the significance of a broad list of possible impacts.

• **Alternatives:** Are alternatives fundamentally or incrementally different?

• **Resources:** How much time, skills, money, and data are available? More in-depth and quantitative analysis requires more of everything.

• **Familiarity:** Is the analyst familiar with both the types of project proposed and the physical site?

• **Issue Significance:** How big is the issue? The bigger the issue, the
greater the need to be explicit, to quantify, and to identify key issues.

• **Administrative Constraints:** Are choices limited by governmental
procedures and format requirements? Some policy guidelines may
rule out some tools by specifying the range of impacts to be addressed.

ENVIRONMENTAL IMPACT ASSESSMENT METHODOLOGIES

The impact identification and assessment can be made through several ways. Each one represents a methodology. Besides the one already explained, there are six other different methodologies in the literature based on the way the impacts are identified and assessed. A critical overview of the methodologies is given in Figure-1.

1. **Ad Hoc:** These methodologies provide a minimum guidance for impact assessment. They merely suggest broad areas of possible impacts (e.g., impacts on lakes, forests, etc.,) rather than defining specific parameters to be investigated. This is given exogenously to the analyst.

2. Overlays: These methodologies depend upon a set of maps on the
environmental characteristics (physical, social, ecological, and aesthetic) of the proposed project's vicinity. These maps are overlaid to produce a
composite characterization of the regional environment. Noting the impacted environmental attributes within the project boundaries then identifies impacts.

3. Checklists: The methodologies present a specific list of environmental attributes to be investigated for possible. They need not necessarily attempt to establish the cause-effect links to project activities. They may or may not include guidelines about how attribute data are to be measured and interpreted.

4. Matrices: These methodologies incorporate a list of project activities with a checklist of potentially impacted environmental attributes. Then, the two lists are related in a matrix form, which identifies the cause-effect relationships between specific activities and impacts. The matrix methodologies may either specify which actions affect, which attributes, or may simply list the range of project activities and environmental attributes in an open matrix to be completed by the analyst.

5. Network: These methodologies work from a list of project activities to establish cause-condition-effect relationships. It is generally felt that a series of impacts may be triggered by a project action. They define a set of possible networks and allow the user to identify impacts by selecting and tracing out the appropriate project actions.

6. Combination Computer-aided: These methodologies use a combination of matrices, networks, analytical models, and a

computer-aided systematic approach. Since this is a combination of difficult methodologies, it is a multiple-objective approach to; (a) identify activities associated with the governmental policies and programmes; (b) identity potential environmental impacts at different levels; (c) provide guidance for abatement and mitigation techniques; (d) provide analytical models to establish cause-effect relationships and to quantitatively determine potential environmental impacts, and (e) provide a methodology and a procedure to utilize this comprehensive information in decision-making.

SUMMARY

An environmental impact assessment (EIA) must effectively deal with four key problems; (a) impact identification; (b) impact measurement; (c) impact interpretation, and (d) impact communication to users. These criteria can be used for analyzing a methodology and determining its weaknesses and strengths. It also helps in choosing methods, which are most appropriate for a particular situation. The above six methodologies display variety in conceptual framework, data formats and data requirements as well as work force, monetary and time resource requirements. An EIA team can use more than one method.

FIGURE-1 AN OVERVIEW OF EIA METHODOLOGIES

S.NO.	METHODOLOGY	AREAS OF USEFULNESS	DRAWBACKS
1.	Ad Hoc	Simple and no training/skills needed In-depth and focused analysis on few; When no expertise and resources available, this is the best Given preliminary understanding Project's effects on environment given without any weighting and cause-effect relations.	Restricts to broad areas only. Not all relevant impacts covered. Selective and biased. Lacks consistency due to different criteria to evaluate different groups of factors.
2.	Checklists	Strong in impact identification. Effective in evoking public attention. Simple and easy to understand; Measurement deficient. comprehensive. Most useful at the stage of initial Environmental examination (IEE).	Scaling and weighting subjective. Leaves interpretation to Decision makers. Measurement deficient.
3.	Matrices	Provides cause-effect relations between project activities and impacts on	Information is lost due to quantification. Scaling and weighting become

		various attributes. Graphical display of impacts given better understanding. become subjective. Strong in impact identification and their interaction is possible.	subjective.
4.	Networks	Capable of identifying both direct and. indirect effects and their interaction. Capable of incorporating mitigation and management measures at the planning stage of a project.	Less useful in considering. socio-economic environment. Display becomes large and unwidely when large Industrial complexes or regional plans are considered.
5.	Overlays	Useful in site and route selection. Effective presentation and display. Useful in transport projects and road route alternative land use planning.	Quantification and measurement weak. Not all impacts covered. Higher order impacts cannot Be identified. Social environment not considered. Subjective Self-limiting in scope.

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