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ENVIRONMENTAL IMPACT ASSESSMENT A REVIEW

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ABSTRACT

Environmental Impact Assessment (EIA), as the word suggests, is a process that has to be carried out before any project or major activity is carried out in order ensure that it will not in any way harm the environment on a short term and long term basis (Wathern, 1988; Aruna Murthy et al., 2005). The main purpose of the EIA process was to identify and evaluate the potential benefits and adverse impacts of projects on the environment, taking in account the environmental, social, cultural and aesthetic aspects. All these aspects are considered critical, while determining the viability of the project. The EIA also looks into the impact the project will have on the people, their homeland, livelihood and other development activities (Murthy and Patra, 2005). The EIA also suggests measures to minimize the impacts and suggest ways to improve the project viability. The ultimate aim of EIA is to ensure that potential impacts are identified and addressed at an early stage in the project planning and design (Murthy and Patra, 2005).

KEYWORDS : Environmental Impact , social, cultural.

INTRODUCTION

The phrase Environmental Impact Assessment originates from Sec. 102 (2) of the National Environmental Policy Act (NEPA), 1969, United States of America. The role for EIA was formally recognized at the earth summit held at Rio conference in 1992. Principle 17 of the Rio declaration states that –"*EIA as a national instrument shall be undertaken for the proposed activities that are likely*

to have significant adverse impact on the environment and are subject to a decision of a competent national authority" (Murthy and Patra, 2005).

In India, the environmental action started after the United Nation Conference on Human Environment in Stockholm in 1972 (Dutta and Bandyopadhyay, 2010). In 1980, the Tiwari Committee (Committee on Review of Legislative Measures and Administrative Measures) recommended creation of a Department of Environment as a nodal agency to ensure environmental protection. The department came into being in 1980 within the Ministry of Science and Technology (Dutta and Bandyopadhyay, 2010). In 1989 the subjects of wildlife and forestry were added to the list and a new Ministry of Environment and Forests was created. Since its inception the Department (under the Ministry) has issued guidelines on EIA for various projects (Dutta and Bandyopadhyay, 2010). The Environmental Act, 1986, led to a broad procedure which led to the institutionalizing environmental procedure, and later the Central Government issued a draft notification in 1992 laying down norms and procedure for impact assessment. This was followed by a final notification promulgated by the Union Minister of Environment and Forest (MEF) on 27th January 1994 (Cyriac and Sanjawals, 1998; Dutta and Bandyopadhyay, 2010), this notification made Environmental Clearance (EC) mandatory for expansion or modernization of any activity or for setting up new projects. Twelve amendments were added in the EIA notification of 1994, and so in 2006 and September 2009 new EIA legislation was notified. Certain activities permissible under the Coastal Regulation Zone Act, 1991 was also bought under this act (Dutta and Bandyopadhyay, 2010). Presently, almost all countries have an EIA legislature, and have made EIA mandatory before undertaking any development projects which might have an impact on the Environment.

In the field of research in EIA, the research has increased rapidly from 1973 and there was 50 times increase in annual number of publication when comparing the publication in 1973 with that of 2009. The findings suggest that the priority in assessment has changed from Environmental impact assessment to Strategic Environmental Assessment (SEA) and Plan Environmental Impact Assessment (PEIA). New technology and methods such as ,"Life Cycle Assessment (LCA)", "geographic information system (GIS)" and "modelling," etc.; "biodiversity" and "climate change" have attracted more attention and has been the emphasis of EIA; presently, the improvement in developing countries have made EIA a more popular research (Yanhua et al., 2011). Though EIA has become mandatory before any major projects, it has not been able to achieve the goal it was legislated for, mainly due to constrain of time, money, data and political influence (Beattie Robert, 1995).

DEFINITION AND SALIENT FEATURES OF EIA

An environmental impact assessment (EIA) is an analytical process that systematically examines the possible environmental consequences of the implementation of projects, programmes and policies (Glossary of Environmental). EIA was first introduced in the USA under the Environmental Policy Act (1969).

According to Aruna Murthy et al., (2005), EIA is an exercise to be carried out before any project or major activity is undertaken to ensure that it will not in any way harm the environment on a short term or long term basis. Wathern (1988) defined EIA as a process having the ultimate objective of providing decision-makers with an indication of the likely consequences of their actions.

EIA is an activity designed to identify and predict the impact of a project on bio-geo-physico-chemical environment and on human health so as to recommend appropriate legislative measures, programmes, and operational procedures to minimize the impact (Anjaneyulu and Manickam, 2010).

Environmental assessment (EA) is a systematic process that proactively examines the consequences of developmental actions and seeks to improve development by a-prior assessment (Arts et al. 2001). "EIA refers to a systematic process for predicting and analyzing the potential environmental and social consequences, both positive and negative, associated with a proposed activity. An equally important component of any EIA exercise is to recommend appropriate measures to eliminate or minimize the adverse impacts and thus, maximize positive gains resulting from that specific undertaking" (Sadar, 1996).

Environmental impact assessment (EIA) refers to a systematic procedure/exercise for predicting the nature and significance of possible impacts on the biophysical and social environments which may be attributed to a proposed activity, program or policy, and recommending appropriate measures for eliminating or minimizing adverse impacts in order to preserve environmental quality while at the same time maximizing the socio-economic benefits (Sadar1996a). Environmental assessment has been defined as a planning tool or a systematic process helping project-developers to improve their projects and authorities to improve their policies, plans, and programmes (Wathern 1988; Fischer 2007) by examining – in more detail, by identifying, estimating, and evaluating (Vanclay and Bronstein 1995) – the environmental consequences of proposed actions in advance and integrating environmental considerations into the planning process.

THE PURPOSE AND AIM OF EIA

According to Hosetti and Kumar, EIA is an aid to planners which is concerned with the identifying and assuring impacts arising from proposed activities such as policies, programmes, plans and developmental projects, which may affect the environment. The main aim of EIA is to improve decisions on development by increasing the quality and scope of the information on likely impacts presented to decision makers and members of the public group. Although, concerned with different levels of the activities EIA are mostly implemented for major development projects such as highway, Nuclear Power Stations, Major Industries, Water Related Projects and rehabilitation.

SCOPING

Scoping refers to early coordination with interested and affected agencies and the public (Anjaneyulu & Valli, 2010). Scoping is used to identify the key issues of concern at an early stage in the planning process (Ahmed & Sammy, 1987). Scoping is the first contact between the proponent of the proposal and the public (Judith Petts, 1999).

PURPOSE OF SCOPING

The purpose of scoping is meant to define the proposed action, identify what is important and what is not important, set time limit, enlist the co-operation of agencies, collect background information, identify required permits and regulatory requirements, determine the range of alternatives, etc. Scoping process should be specifically designed to suit the need of the individual project or action being proposed (Anjaneyulu and Manickam, 2010).

CLASSIFICATION AND PREDICTION OF IMPACT

Environmental impact arising from any development or policy change falls under three categories; namely Direct, Indirect and Cumulative Impact. These Impacts can either be positive or negative, can have impact over short term or long term, it can impact locally or can be spread over a

wide area, and it can be either random or predictable (Anjaneyulu and Manickam, 2010).

APPROACHES FOR USING EIA

According to Anjaneyulu and Manickam (2010), a step-by-step approach is necessary to use EIA as a planning tool. The following are the steps to be followed for making EIA of optimal value. The first stage is the environmental base map, the second step is to identify the study area, the third is to classify the environmental parameters, the fourth is the formation of the EIA team, the fifth step is the preparation of references, the sixth step is to prepare an EIA report, the seventh step is to plan for the monitoring and management of the environment, the seventh step is to prepare the draft and the eight is the preparation of the environmental impact statement, the next step is to analyze the impact, the final step is to format and state the content of the final environmental impact statement.

EIA METHODS

There are various methods to carry out an EIA, it depends on the availability of data, data formats and various level of technology and man power to classify and interpret the data. Each method has its own advantages and disadvantages and the analysis they produce have different levels of precisions and certainty. Generally, the choice of the method should be simple; it should address the man power, time, budget constraints and should be flexible enough to allow for the modification and changes through the course of the study.

ADHOC METHOD

Adhoc method is the simplest method and it can be performed without any training (Hosetti and Kumar, 1998). Adhoc methods are for rough assessment of total impact giving the broad area of possible impact and the general nature of the impact. In this method, the assessor relies on intuitive approach and makes a broad-based quantitative assessment, which can serve as a preliminary assessment (Anjaneyulu and Manickam, 2010). According to Lohani and Kan (1983), these methods is very easy to use, but have a few drawbacks, such as, it does not encompass all the relevant impacts; it lacks consistency in analysis and it is inherently insufficient as it does not study the impact in detail (Hosetti and Kumar, 1998). It gives no assurance that it encompasses a comprehensive set of all the relevant impacts (Anjaneyulu and Manickam, 2010).Environmental impact assessment usually requires the collection and analysis of considerable information about the economic, social, and bio-physical environment. Methods are needed to organize this information for analysis and presentation — ad hoc methods fail to do this in any meaningful way.

CHECKLIST METHOD

Checklist is one of the basic and strong methods for an EIA (Environmental Impact Assessment). It is one of the standard methods of listing the type of impacts, associated with a particular type of project. Checklist method, organizes information so that no potential impact is overlooked. According to Hosetti and Kumar (1998), Checklists are strong in impact analysis, identification and consistent in nature. According to Anjaneyulu and Manickam (2010), checklists in general, are strong in impact identification and are capable of bringing them to the attention and awareness of the audiences. They further remark that, Impact identification is the fundamental function of an EIA and in this respect; all types of checklists, namely, simple, descriptive, scaling and weighting checklists do equally well.

Checklists method is primarily used for organizing the information or ensuring that no potential

impact is overlooked. They comprise a list of questions based on the features of the project and the likely impact the project will have on the environment. They are generic in nature and are used as aids in assessment (Achieng, 2007). According to Canter (1999), checklist can be used for several types of decision making which evaluates the environmental impacts as well as the economic characteristic. Weighted scaling, weighted ranking and weighted rating checklist can be used as an important tool to trade off between the alternatives and their associated environmental impacts (Canter, 1999). Water Resources Assessment Methodology (WRAM) developed by the U.S. Army Corps of Engineers has used weighted Scaling Checklist for water resource project (Solomon et al. 1977). This is one of the most basic methods for an EIA. A checklist identifies the environmental characteristics that would be affected by a project activity. Different types of checklists include: simple checklists, which provides a list of parameters, with no interpretation; descriptive checklists, which provides the identification of environmental parameters and guidelines on how data on the parameters are to be measured; and scaling weighting checklists, which also gives information on the subjective scaling and evaluation of each parameter with respect to all other parameters (ESCAP, 1985). Duke et al. (1977) described a scaling checklist for the environmental quality (EQ) account for water resource projects. Establishing an evaluation guideline for each environmental factor is followed by scaling. Establishing an evaluation guideline for each environmental factor is followed by scaling.

Uses of Checklists are mainly for summarizing information, for preliminary analysis, and information on ecosystem function. The checklist methods are too general as they do not illustrate interaction between different types of effects and the number of categories to be reviewed can be immense, also these method are quantities and subjective (Westman, 1985).

MATRICES METHOD

Matrix method are generalized checklists, where one dimensions of the matrix is a list of environmental, social or economic factor likely to be affected by the project and the other dimension is the list of actions associated with development (Anjaneyulu and Manickam 2010). Matrices provide the cause effect relationship between various project activities and their impact on environmental components (Hosetti and Kumar, 1998). Matrix method provide graphical tool to the audience which can be easily comprehended. Matrices are strong in identifying impacts and can also represent higher order effects and interactions.

One of the major drawbacks of the matrix method is that, this method cannot be useful without large amount of information about the environmental components and the project. The numbering system looses a large part of information and also the assigning of weight depends on the judgment of the experts and can be arbitrary.

The Simple Interaction Matrix Developed by Leopold (1971), can examine approximately 100 specified items and 90 environmental factors. This matrix can be expanded or contracted, based on the number of items to be considered. Leopold's Matrix is important and useful for impact identification purpose and it can provide a means for impact communication by providing a visual display of the impacted items and the major action causing impacts (Anjaneyulu and Manickam, 2010). Stepped Matrix method can be used for enclosing secondary methods and tertiary impacts of initiating action.

Networks Method

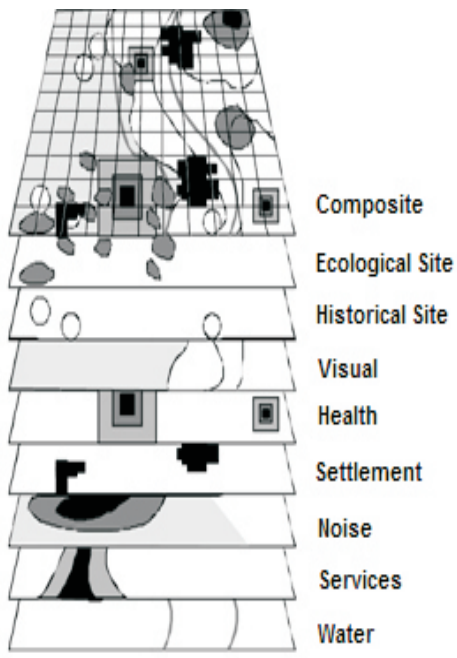
Network methods can identify direct and indirect impacts and higher order impacts. Network model shows the cause effect relationship of project activity and environmental characteristics. It is very useful in identifying and depicting the secondary impact (indirect, cumulative impacts, etc.).

Simplified networks, used in conjunction with other methods, helps to ensure that important second-order impacts are not omitted from the investigation. Very detailed networks without the use of computer programme for tasks are visually complicated and time consuming.

To develop a network, series of questions related to each project must be answered. The first step is to identify the changes in the environmental components, the second step is to identify the environmental components that will result from the first order changes and the third order changes will be identified based on the changes in the second order changes. This process should be continued till the network diagram is completed to the expert's satisfaction (Anjaneyulu and Manickam 2010) .Sorenson (1971) developed the Stepped Matrix technique for Networks and applied it to Nong Pal reservoir. Lohani and Halim (1983) used the Network analysis to assess the Impact of a Pulp Mill.

OVER LAY METHOD

An Overlay method is based on a set of transparent maps, each of which represents the spatial distribution of environmental characteristics (Anjaneyulu and Manickam 2010, Hosetti and Kumar, 1998). McHarg (1969) was credited for the development of map overlays method.



Source: Wathern (1988)

In this method, informations are recorded on a series of maps within the study area and these maps will be overlaid to produce a composite map. The composite maps characterizes the area's physical, social, ecological, land use and other relevant characteristics relative to the proposed development (Anjaneyulu and Manickam, 2010), though the use of overlays, land use possibilities and engineering feasibility are visually determined (McHarg, 1968).

Presently Geographic Information Systems (GIS) are widely used as layered overlay technique. GIS can construct real world models based on digital data, which can analyze trends, identify factors that are causing them reveal alternative paths in order to solve the given problem, and indicate the implications or consequences of decisions. According to a report of the Asian Development Bank (1991), areas that suffer most from deforestation may be identified and analyzed by overlaying soil type

data, growth and yield data, requirement of species and the impact of regular measures applicable to the area, and this can be done with the satellite data through remote sensing technique. GIS is a powerful management tool for resource managers and planners. Its applications are limited only by the quality, quantity, and coverage of data that are fed into the system. Some of the standard GIS applications are integrating maps made at different scales; overlaying different types of maps which show different attributes; and identifying required areas within a given distance from roads or rivers (Methods for Environmental Impact Assessment, 1997). This method is widely used for assessing visually the changes in the landscape before and after the activity, and they can clearly show the spatial aspects of cumulative impacts. Overlay analyses are useful when addressing questions of site and route selections. They provide a suitable and effective mode of presentation and display to their audiences, but overlay analysis cannot be the sole criteria for environmental impact assessment. The consideration in overlay analysis is purely spatial, temporal consideration being outside its scope. Social, human and economic aspects are not accorded any consideration; also higher order impact cannot be identified (Anjaneyulu and Manickam 2010).

COST/ BENEFIT / ANALYSIS

Cost benefit analysis gives the nature of profit and loss from a project in terms of economic benefit from the given project, it estimates the cost of environmental mitigating; that is the effect of the project on the environment and suggests plans to manage the mitigation plans.

Economic analysis of the environmental impact is important in project preparation. It is important because it helps to find weather the net benefit by proceeding with the project is greater than the alternative, including the non-project scenario. Cost benefit analysis should be done in the pre-screening stage of the project. In this, the main difficulty is in quantifying the effect into monetary terms which is not very easy in relation to health related impacts and industrial development (Anjaneyulu and Manickam, 2010). This system is not useful for small scale development project (Hosetti and Kumar, 1998). Cost benefit analysis helps in decision making in all EIAs (Hosetti and Kumar, 1998; Anjaneyulu and Manickam, 2010). Cost Benefit Analysis is generally recognized as a decision making tool in water related projects, specially public sector projects like flood control work (Bowers, 1997).

SIMULATIVE MODELING WORKSHOPS

System analysts have developed an approach to environmental impact assessment and management commonly referred to as Adaptive Environmental Assessment and Management (AEAM), which combines various simulation models to predict impacts (Anjaneyulu and Manickam, 2010). This method evaluates the impact in three phases, namely, the initial workshop, the secondary phase workshop, and transfer of workshop (Hosetti and Kumar, 1998). The AEAM technique cannot handle higher impacts and interactions between the impacts (Hosetti and Kumar, 1998). Another short coming of this method is that it does not involve the participation of the public (Hosetti and Kumar, 1998).

PREDICTION AND ASSESSMENT OF IMPACTS

The EIA method gives information in identifying impact pathways based on underlying conceptual models linking project activities to changes in environmental components. In application of these methods, prediction of degree of change is done through qualitative approach which is based on

the expert's judgment or quantitative approach which is based on the scientific method. The most common types of model used in EIA are Physical models, Experimental Models and Mathematical models (Anjaneyulu and Manickam, 2010).

SOIL AND GROUND WATER

The entirety of soil and ground water can be altered by a variety of physical disturbances, including the addition or removal of soil or water, compaction of soil, discharge of effluents or disposal of waste onto land or water, deposition of air pollution on land or water, change in use of land or ground cover, change in water hydrology, change in climate, change in quality of surface water, etc. The effects of these vary from first order effects of leaching into soil and ground water, to changes in ground water regime, soil structure, soil quality or temperature, or ground water quality or temperature (Anjaneyulu and Manickam, 2010).

According to Anjaneyulu and Manickam (2010), seven steps are necessary to study the soil and ground water, the first step is to delineate the study area, secondly the identification of activities of the project which will have different types of impacts on soil or ground water quality, the third step involves the preparation of the description of existing soil and ground water resource condition, followed by the procurement of relevant soil and ground water quantity and quality standards, the next step is to predict the impact for soil and ground water environment. The sixth step involves the assessment of the impact significance, and the final step relates to identification and incorporation of mitigation measures.

SURFACE WATER

According to Petts (1999), all types of development projects have an impact on the water environment, directly or indirectly, because of the inevitable citing of a development within water shed or in a tidal or coastal zone. The impact on water may be noticed by the surface water hydrology, surface water quality, sediment behaviour, change in salinity, and change in aquatic ecology (Anjaneyulu and Manickam, 2010).

According to Anjaneyulu and Manickam (2010), six steps model should be followed to systematically assess the environmental impact of a project on surface water. Step one, in the analysis process is to identify the impact of the proposed project on the surface water quality and quantity. In the second step, the existing Surface water resource condition should be described. Compilation of Water Quality and Quantity information should be the third step, whereas, Impact Prediction follow the third step, the fifth step involve the interpretation of the Significance of the Impact, and the final step involves the identification and incorporation of Mitigation Measures.

BIOLOGICAL ENVIRONMENT

Biological Environment consists of all plants and animals, the distribution and abundance of the various species and the habitat of communities. Species forming a community are usually dependent on one another, either for food or shelter, and the affect on one species can have a counter effect on the other. The alteration of physical environment also has a diverse affect on the Biological environment (Anjaneyulu and Manickam, 2010).

Biodiversity are prized as store house of genetic material, which houses untold number and quantities of food, drugs and other useful products for human survival. Availability of resources is directly linked to the abundance of species, and use of these species for mankind. Species which are

pushed to extinction by anthropological activities are gone forever, and thus, it is imperative to preserve and protect these biodiversity, and the preservation of biodiversity is a global concern, but action should be taken at the local level.

According to Hosetti and Kumar (1998), the assessment of biological environment requires description of the flora and fauna community and species, identification of rare and endangered species, past and present practices adopted for maintaining the flora and fauna, prediction of impact on biological setting and summarization of the critical impacts with all alternatives considered.

According to Anjaneyulu and Manickam (2010), six steps should be followed systematically for evaluation of biological environmental impact. Identification of Biological Impact of the Proposed Project or activity is the first step, followed by the preparation of description of existing biological conditions and considerations of endangered or threatened species and critical habitats, the third step is the procurement of relevant laws, regulations, or criteria related to impact conditions, the fourth step is to predict the impact, the fifth step involves the assessment of the significance of impact and the finals step is to identify and incorporate the mitigation measures.

AIR

Air is one of the most essential components for the survival of all organisms, but if the air is polluted, it acts like a poison and becomes the cause of mass casualty, as in the case of Bhopal Gas tragedy. It is very important to assess the impact of any development project on the quality of air in the given area, in both short term and long term.

According to Hosetti and Kumar (1998), the emission level of pollutants from different stacks should comply with the pollution control standards prescribed by the concerned government of the given region. Also, adequate control equipment should be installed for minimizing the emission of pollutants from the stack. Control measure should be adopted inside the plant, also infra-structure facility should be for monitoring and measuring the ambient air quality in the area, stack height should be maintained to minimize the added effect, added to these measures, community building and townships should be built at a distance of above one or half kilometers away from the industry and green belts should be developed as a physiographical barrier.

Anjaneyulu and Manickam (2010) put forth six steps for the Environmental Impact Assessment of a development project to be followed to assess the impact of the project on the air quality of the surrounding. First step is to evaluate and identify the source, type, and quantity of pollutants generated by the different phases of the project activities. The second step is to evaluate in detail the existing ambient air quality, meteorological conditions and natural air quality, existing in the project area. Examining of proper laws, regulation and criteria to be implemented for the maintenance of ambient air quality should be carried out in the third step. Carrying out impact assessment of project using mass balance, mathematical model or quantification prediction forms the fourth step. The fifth step is concerned with the anticipation of significant beneficial and detrimental impacts, and the final step is to suggest appropriate mitigation plans for reducing adverse impacts.

PREDICTION AND ASSESSMENT OF IMPACTS OF NOISE

Noise pollution is defined as a form of pollution that is an audible unwanted sound that poses a threat to a person's health and well-being (Goines and Hagler, 2007).According to the Organization for Economic Co-operation and Development (OECD) report, "Transport is by far the major source of noise, ahead of building or industry, with road traffic the chief offender" (OECD. 1990), Motorcycles, trucks

and buses are major contributors to traffic noise (MacKenzie et al., 1992). Noise-induced hearing loss (NIHL) is a type of sensor neural hearing loss that is second only to age induced hearing loss or presbycusis (Rabinowitz, 2000). In general, the amount of noise required to cause permanent damage from chronic exposure is anything equivalent to 10 years or more at a level of 85 decibel (dB) for more than 8 hours a day (Rabinowitz,2000; NIDCD, 2007).

Sound and noise are emitted in the environment not only from stationary sources, but also from traffic and railways, aircraft operations, blasting, etc. Thus, it becomes imperative to conduct an EIA for Impact of Noise.

To provide a basis for a noise pollution impact Anjaneyulu and Manickam (2010) provided a seven step model for the planning and conducting of impact studies. The first step is the identification of noise impact of the proposed project; the second step is to prepare a description of the existing noise environmental condition, the third step relates to the procurement of relevant noise standards and guidelines, whereas, the fourth step is concerned with the prediction of the impact, and the fifth step deals with the assessment of the significance of the impact, the identification and mitigation measure forms the sixth step, the last step is concerned with the preparation of the final environmental impact statement.

PREDICTION OF SOCIO ECONOMIC AND HUMAN HEALTH IMPACTS

According to the Preamble of the WHO (1948), Health is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity. Government or private programmes, policies and projects can cause potentially significant changes in many features of the socio-economic environment (Anjaneyulu and Manickam, 2010). Proposed projects which may involve either the commissioning or decommissioning of major industrial sector or development can have significant socio-economic consequence in terms of local or area wise decrease in jobs or revenue, decline in human population and leftover societal debts for local infrastructure and educational facilities (Grady et al., 1987). The social assessment aims to determine the social cost of the project and the degree to which the benefits of a project will be distributed in an equitable manner. By addressing the specific goals in the development projects, the government, the developers, lenders etc., can ensure the benefit of the project can be realized and negative social impact can be minimized.

The major activities involved in incorporating social dimensions into project are summarized in seven steps (Anjaneyulu and Manickam, 2010). Delineation of study area and categorization of projects having socio-economic impacts is the first step, followed by identification of potential socio-economic impacts; the third step is to prepare the description of existing socio-economic condition. Procurement of relevant standards, criteria, or guidelines forms the fourth step, the fifth step is concerned with impact prediction without project and with project condition, the assessment of the significance of socio-economic impact forms the sixth step, the seventh and the last step involves the incorporation of mitigation measures in design of the present and preparation of draft environmental impact statement.

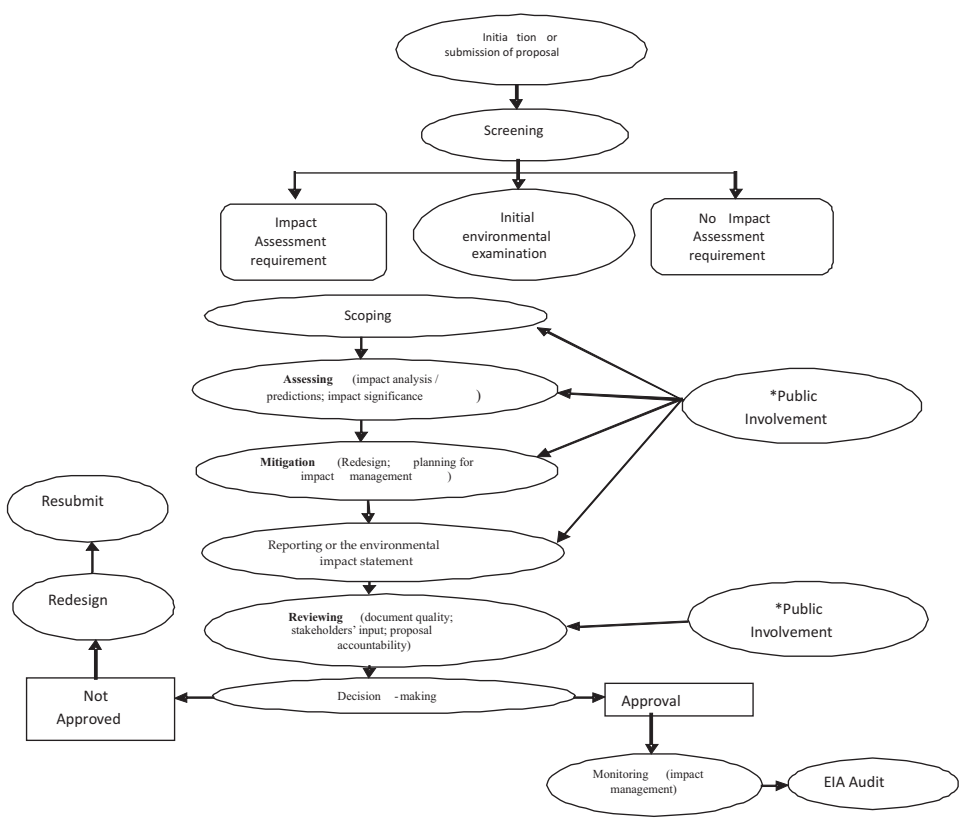
ACCURACY OF EIA

Unplanned or unexpected variations in climate, animal migration, harvest sequence, or any of the wide range of human and environmental factors can affect the accuracy of the EIA. It has been calculated that the average accuracy of quantified, critical, testable predictions in EIA for Australia is only 44 percent (Buckley, 1991), which seems to be low unfortunately.

MITIGATION

Mitigation is a phase in the EIA process wherein the EIA team recommends the action and wide range of measures to reduce, avoid and compensate the potential adverse environmental consequence of development activity. Environmental Management Plan (EMP), risk assessment report and disaster management, rehabilitation plan are prepared to suggest remedial measures. EMP should also entail aspects of Pollution prevention and Waste minimization. In addition to this, EMP must be supplied with the work plan, time schedule, place and cost of implementing the mentioned measures (Dutta and Bandyopadhyay, 2010; Murthy and Patra, 2005). The possible mitigation measures according to Murthy and Patra (2005), includes; Changing project sites, routes, processes, raw materials, operating methods, disposal methods, disposal routes or locations, timing or engineering designs; Introducing pollution controls, waste treatment monitoring, phased implementation, landscaping, personal training, special social services or public education; Offering (as compensation) restoration of damaged resources, money to affected persons, concessions on other issues, or off-site programmes to enhance some other aspects of the environment or quality of life for the community.

FLOWCHART OF KEY STEPS IN THE ENVIRONMENTAL IMPACT ASSESSMENT (UNEP/CBD/SBSTTA/7/13, NOVEMBER 2001)



The following guidelines were prepared by the Subsidiary Body on Scientific, Technical and Technological Advice (SBSTTA) for the Convention on Biological Diversity (CBD) and adopted (Decision VI/7) by CBD's Conference of the Contracting Parties at its 6th meeting (Den Haag, Netherlands, April 2002). The CBD guidelines were reviewed by Ramsar's Scientific and Technical Review Panel (STRP), which recommended that they are fully appropriate for application of impact assessment concerning wetlands in the Ramsar context (adopted as the annex to Resolution VIII.9 by the 8th Conference of the Contracting Parties, Valencia, Spain, 2002).

REPORTING

The Reporting stage gives the results of the EIA in the form of report to the decision making body and the other stake holders. The report contains straight forward answer for easy interpretation in the form of tables, graphs and summary in points, it also contains details such as, description of the proposed development project, the major environmental and natural resource issues that needed clarification, projects impacts on the environment and discussion of options for mitigating adverse impacts (Dutta and Bandyopadhyay, 2010; Murthy and Patra, 2005).

EIA IN INDIA

In India, the environmental action started after the United Nation Conference on Human Environment in Stockholm in 1972 (Dutta and Bandyopadhyay, 2010). In 1980, the Tiwari Committee (Committee on Review of Legislative Measures and Administrative Measures) recommended creation of a Department of Environment as a nodal agency to ensure environmental protection. The department came into being in 1980 within the Ministry of Science and Technology (Dutta and Bandyopadhyay, 2010). In 1989, the subjects of wildlife and forestry were added to the list and a new Ministry of Environment and Forests was created. Since its inception the Department (under the Ministry) has issued guidelines on EIA for various projects (Dutta and Bandyopadhyay, 2010). The Environmental Act, 1986, led to a broad procedure which led to the institutionalizing environmental procedure, and later the Central Government issued a draft notification in 1992 laying down norms and procedure for impact assessment. This was followed by a final notification promulgated by the Union Minister of Environment and Forest (MEF) on 27th January 1994 (Dutta and Bandyopadhyay, 2010), this notification made Environmental Clearance (EC) mandatory for expansion or modernization of any activity or for setting up new projects. Twelve amendments were added in the EIA notification of 1994, and therefore, in 2006 and September 2009 new EIA legislation was notified. Certain activities permissible under the Coastal Regulation Zone Act, 1991 was also bought under this act (Dutta and Bandyopadhyay, 2010).

RESPONSIBILITY OF PREPARATION OF EIA STATEMENT

The project proponent is responsible for the preparation of the EIA statement, with the help of external consultant or institution.

THE IMPACT ASSESSMENT AGENCY

The Ministry of Environment and Forest (MOEF) is the agency for environmental clearance. If necessary, it may consult a committee of experts with a composition specified in schedule III of notification.

TIMING OF EIA

Ideally EIA should provide information to decision makers at early stage of the project planning cycle. It should be initiated as early as possible before the commencement of projects. If the projects secure approval, EIA should include a provision to cover the audit of the project.

COST

The amount allocated and spent for preparation of EIA by the project proponents are usually abysmally low compared to the overall project costs (often less than 1 % of overall projects).

LIMITATIONS OF EIA

From the time of its inception, EIA has played an important role in evaluating developmental projects, though there have been many shortcomings in the EIA. Beattie B. Robert (1995), in his viewpoint on Environmental Impact Assessment admits the limitations of Environmental Impact Assessment. According to him EIA is not science as data gaps and simplifying assumptions are the norms under strict deadlines, EIAs are biased in parts because they cannot address the course of action that are outside their scope, EIAs will always be political because they are part a of the decision making process that has a distributional impact. In spite of the shortcomings mentioned and many more not mentioned, the author argues for the need for EIAs because they are valuable as they represent a public attempt to document and evaluate the environmental effects of projects and policies and are the best techniques devised so far, for acknowledging the inevitability of our impact on the environment. In the conclusion part, the author suggests some solution to make the EIAs more effective, for example, he pleads for self-examination, honesty and to put assumptions more explicitly on the table admitting in advance the assumptions and the values they reflect, the author also wants to involve a wide range of people in the scoping process of EIAs.

RECENT TRENDS IN EIA

Yanhua (2011) used Science Citation index and Social science Citation Index, to find the Global Environmental Impact Assessment Research Trends from the year 1973 to 2009. They analyzed 1781 reviews. From the data base, they found that most of the articles were in English and USA had the major contribution in EIA research. The research found that the research in EIA increased rapidly from 1973 and there was 50 times increase in annual number of publication when comparing the publication in 1973 with that of 2009. The findings suggest that the priority in assessment has changed from Environmental impact assessment to Strategic Environmental Assessment (SEA) and Plan Environmental Impact Assessment (PEIA). New technology and methods such as ,“life cycle assessment (LCA)”, “geographic information system (GIS)” and “modelling” etc.; “biodiversity” and “climate change” have attracted more attention and has been the emphasis of EIA; presently, the improvement in developing countries have made EIA a more popular research. Thus, it can be concluded that EIA has been evolving and it is valuable in protecting the environment and the public interest at large.

CONCLUSION

This article briefly deals with the basic concept of EIA and the various methodologies and methods adopted to carry out EIA. The definition of EIA and the need for the legislation for EIA has been also dwelled upon in this article. The history of EIA and the EIA in India has also been briefly discussed. In the later part the limitation and recent trends in EIA research has been discussed. This article gives an

insight on the basics of EIA methods and the procedure to perform an EIA along with the recent trends.

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