1. INTRODUCTION

EIA was first introduced in 1978 with regard to the various river valley projects all over the country and later expanded to include various other developmental procedures in its scope. EIA is now mandatory for over thirty classes of projects. It is carried out in a wide variety of sectors, including agriculture, manufacturing, tourism, mining and forestry. Projects requiring an EIA can be large, such as a hydroelectric dam, or small, such as a new hotel on a beach. However, the level of impact on human and environmental health rather than size of the project is the most important aspect of decision making. EIA report not only aims at finding the positive and negative effects on the environment but also involves finding solution to mitigate the negative impacts. It is extremely important to convince the affected community that the potential impacts are taken care through various mitigation measures. People's participation is an important process that helps in understanding how the community is affected by the project. These measures help in improving the viability of the project.

2. METHODOLOGY AND PROCESS

In India, The Union Ministry of Environment and Forest (MoEF), under the Environment Protection Act 1986, circulated an EIA notification during 1994 that made Environmental Clearances (EC) mandatory for all the new and expansion projects that would have a considerable impact on the environment. The MoEF released a new notification in September 2006. The rules categorize the projects into two categories- A and B on the basis of the magnitude of their scale and impact on the natural and artificial resources. The projects belonging to Category A require approval from the Ministry of Environment and Forests (MoEF) on behalf of the Central Government, for example: Construction or Expansion of Ports, harbours, airports, nuclear power, and related projects, Primary metallurgical industries (iron, steel, copper, etc), individual projects, etc. Projects and Activities falling under Category B

require the approval of a State Government, based on the advice of a State Expert Appraisal Committee (SEAC). The general methodology for executing an EIA is given in Figure 1.

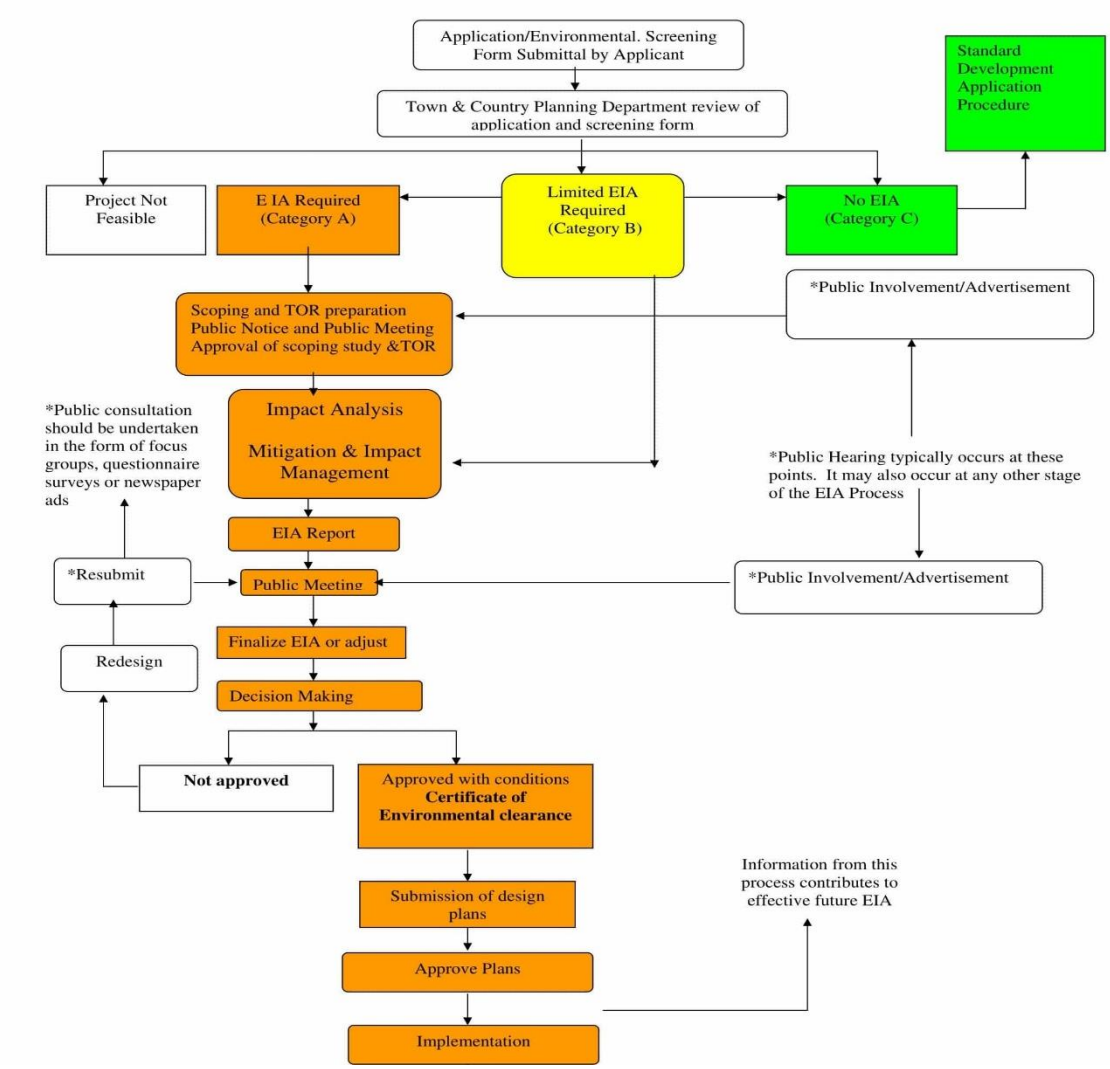

Figure 1: Generalised EIA process flow chart (Source: Drishti)

EIA studies need significant primary and secondary data as a base for predicting the impacts of a proposed project. EIA process involves screening, scoping, collection of baseline data, impact prediction, mitigation measures and report, public hearing, decision making, monitoring and implementing environmental management plan. The government decides whether a project should be given environmental clearance or not and accordingly grants or rejects the appraisal to the project.

The various traditional EIA methodologies include Ad hoc, checklist, matrix and network, each one has its own advantages and drawbacks, most of these traditional methods of EIA give large reports representing subjective judgements made by the assessors which arises as common criticism and lowers the effectiveness. The specialized topics required for completing EIAs are land use, air pollution monitoring, meteorology, water pollution monitoring, ecology and biodiversity, noise and vibration, socio- economic aspects, hydrology, ground water and water conservation, geology, soil conservation, risk and hazards management, solid and hazardous waste management, that includes municipal solid wastes.

3. CURRENT DRAWBACKS AND CHALLENGES

Generally, the information provided in the EIA report is not completely reliable. Many a times important facts regarding the area surveyed are not mentioned in the report. Sometimes the quality of these surveys is questionable as well. EIA report demands that the land in the radius of 15 km should be surveyed to check the presence of flora and fauna, water bodies, mountains and areas which are sensitive or important for ecological reasons. Misleading EIA reports have caused a lot of time delays to the proposed projects which in turn have severe effects on the overall budget of the project. Limited technical and managerial capacities to implement EIA in various projects is another threat. Generation of EIA reports which are not easily understood by decision makers and the public because of their length and technical complexity. As mentioned earlier most of the traditional methods of executing environmental assessment results in large reports representing subjective judgements made by the assessors that reduces the efficiency. EIA evaluations need to be reassessed with passage of time and the data contained should be open to scrutiny and revision as nee data become available. Completely subjective and descriptive systems are not easily capable of such revision, as they are on the expertise and experience of the original assessors. Some of above-mentioned limitations are rectified using an advanced matrix method.

4. RAPID IMPACT ASSESSMENT MATRIX (RIAM)

Pastakia (1998) [1] formulated a new tool for execution of an environmental impact assessment. The author observes that many traditional methods of EIA have produced large reports setting out the subjective judgements reached by the assessors and states that RIAM uses a structured matrix to allow for such judgements to be both subjective and those based on quantitative data. The RIAM is a tool to organize, analyse and present the results of a holistic environment impact assessment. RIAM provides a transparent and permanent record of the analysis process while at the same time organizing the EIA procedure, which in turn considerably reduces the time taken in executing EIAs. This method is based on a standard definition of important assessment criteria and specific assessment components to be defined through a process of scoping, and these environmental components fall into one of the four following categories, physical/chemical, biological/ecological, sociological/cultural and economic/operational. The simple, structured form of RIAM allows reanalysis and in-depth analysis of selected components in a rapid and accurate manner. This flexibility makes the method a powerful tool for both executing and evaluating EIAs. The RIAM method is based on a standard definition of the important assessment criteria, as well as the means by which semi-quantitative values for each of these criteria can be allotted to provide an accurate and independent score for each component. The important assessment criteria fall into two groups: Criteria that are of importance to the condition, that individually can change the score obtained (Group A). Criteria that are of value to the situation, but not individually capable of changing the score obtained (Group B). The scoring system requires simple multiplication of the scores given to each of the criteria in group A. The use of multiplier ensures that the weight of each score is expressed, whereas the scores for criteria group B is added together to ensure that the individual value scores cannot influence the overall score, but the collective importance of all the values of group B taken into account.

The sum of group B scores are then multiplied with the result of group A scores to arrive the final assessment score (ES) for that particular environmental component. The author adopted a perspective that for the subjectivity of judgement to become transparent, it is necessary to define how the analysis should be carried out and the criteria by which judgements are made, Accordingly the authors framed the methodology for analysis. They also conducted a study to test the usefulness of RIAM as a tool in projects requiring an EIA and proved the potential of RIAM.

5. STUDIES ON RIAM BASED ENVIRONMENTAL IMPACT ASSESSMENT

Next level is the application of RIAM for choosing the best choice from available alternates. El-Naqa A (2004) [2], Three alternatives were proposed - rehabilitate the landfill, construction of a biogas plant and its relocation. The RIAM analysis showed that the least negative impacts would be to relocate. Thus, the potential of RIAM based Environmental impact assessment to aid decision making was identified. Matrices and the histograms of RIAM results provide a comparative picture of positive/negative impacts between the available alternates. RIAM for assessment of hydroelectric installations on river Coa. Impacts on various environmental components were addressed in Paulo`s (2005) [3] study, that clearly brought out the positive benefits and negative impacts, proved that RIAM can even be adopted for various development projects involving huge number of components to be assessed within short period of time when compared to other traditional methods of conducting environmental assessment. Further studies portrayed the use of RIAM need not be limited to construction field but, it can be used to pick an appropriate technical solution for an environmental problem. In Shoili`s (2011) [4] study, the environmental impact of various sludge disposal options on different environmental components is studied, with positive and negative effects of each disposal option being evaluated and the most optimum one is finalized. This study helps to understand the versatile nature of RIAM method.

In India majority of research work was carried out using RIAM in EIA to compare the possible alternatives and decide the final option. A study was conducted on the environmental impact caused due to improper disposal of municipal solid waste and selection of appropriate method of disposal using RIAM. Mondal (2009) [5]. The author collected required data through questionnaire survey from local residents and municipality officials and those data were processed to get the output using RIAM which clearly mentioned the impacts of each disposal method, eventually a method having least negative impact is determined. A work related to site selection for disposal of municipal solid wastes was carried out by Suthar (2014) [6] in Uttarakhand where the research group visited the site in order to collect the baseline data of landfill sites and detailed investigation on basic features required for RIAM analysis is done. Finally, the site location causing minimum negative impact on environment is determined. Similar work was conducted in Allahabad, computation of two different scenarios of waste disposal site clearly reveals the difference between two sites for impacts of waste disposal - Nidhi (2015) [7]. The best part of RIAM based EIA is positive and negative impacts both can be analysed and quantified with respect to selected environmental components, Kumar (2010) [8] conducted RIAM based EIA for the proposed thermal power plant of capacity 2640MW in Andhra Pradesh. From the results it is concluded that project will bring economic development but it will degrade the environment. The utilization of RIAM based EIA as decision support system for existing and expansion/modernization of institutional building in Madurai city, Selvakumar (2016) [9] which again confirms the potential of RIAM in decision making. RIAM can be utilized to study the impact on any specific component of environment, for example soil, air, water etc in a particular study area. One such study was conducted by Aiswarya (2016) [10] that involves the EIA of water using RIAM in Trivandrum, Kerala, since the water resource in that particular locality gets polluted by Travancore Titanium products Ltd company.

Similar work but to a broader sense was carried out well before by Subramani (2012) [11] who conducted an EIA for a town panchayat using RIAM method and concluded that developmental activity gives rise to nearly sixty seven percent of negative impacts as a result of improper solid waste disposal, usage of plastic bags and sewage intrusion in canals and lakes. All these studies show RIAM method is compatible to carry out EIAs for different scenarios, gives a quantitative result for both positive and negative impacts thereby it helps in decision making also provides a clear picture on areas to be considered while framing the mitigation measures.

A review on various EIA methodologies like Checklist, Life Cycle Assessment (LCA), Rapid Impact Assessment Matrix (RIAM) and Data Envelopment Analysis (DEA) and their adoption has been presented by Banyal (2019) [12]. This study showed that RIAM as transparent tool that remained behind permanent record. The major advantages were, to minimize the element of subjectivity and introduced the degree of objectivity. This method has more flexibility and have minimum duration in execution of an EIA Environmental Impact Assessment.

Though RIAM method has many advantages, there are few limitations like, still the evaluation method has few subjective areas especially, choosing the environmental components, fixing the score for each component etc. This opens up the gate for future research and few attempts were also made to fill this gap. A modified version of Rapid impact assessment matrix where it is integrated with analytical hierarchy process, thereby knocking out the limitations in the existing EIA techniques Sarupria (2018) [13].

6. SUMMARY AND CONCLUSIONS

Understanding basic EIA process and drawbacks of traditional method of executing/evaluating EIA, various papers related to Rapid Impact Assessment Matrix (RIAM) method of environmental assessment has been studied. This study helps in exploring the potential of RIAM method like its ability to provide clear, transparent and permanent record of the predictions made in an EIA and throws light on grey areas that need future research. Some broad points are made here in the context of the SWOT framework for RIAM based Environmental Impact Assessment.

Strengths

1. RIAM based EIA is quick and comparatively less subjective.
2. Re-analysis is possible.
3. Results can be easily interpreted using tables and histograms.
4. It helps in decision making.

Weakness

1. Still the EIA process cannot be made objective completely.
2. It can only aid in decision making, cannot be used as a decision-making tool itself.

Opportunity

1. Increasing focus on sustainable development requires EIA communities which in turn requires new and efficient tools like RIAM results in growing opportunities.

Threat

1. As governments look to stimulate economic growth, relaxing the needs of environmental clearance may result as a threat as it lowers the real essence of EIA process.

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