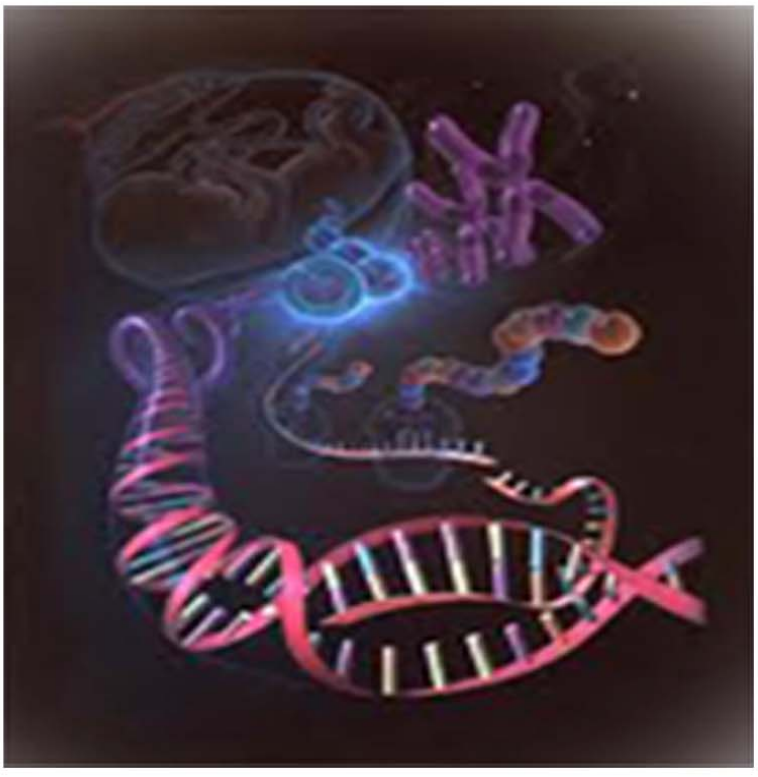
IJLBPR

ISSN 2250 - 3137
Vo1. 2, No. 2, April 2013

International Journal of

Life Sciences Biotechnology and Pharma Research



International Journal of Life Sciences Biotechnology and Pharma Research
Hyderabad, INDIA

www.ijlbpr.com

Email : editorijlbpr@gmail.com or editor@ijlbpr.com

International Journal of Life Sciences Biotechnology and Pharma Research

ISSN 2250-3137 www.ijlbpr.com
Vol. 2, No. 2, April 2013

Review Article

EIA : KEY ISSUES FOR SUSTAINABILITY

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Process industries all over the world are diversifying progressively into more capital intensive and energy intensive areas which are continuously degrading the environmental quality. In order to maintain the competitiveness in global market, the industries keep on restructuring and/ or re-engineering to ensure desired environmental quality with decreased costs of production, operational safety- cum-flexibility through innovative technology. These goals are intricately linked to waste minimization and overall environmental performance. Considering the future environmental and energy scenarios. Ecomark is now recognized as a pre-requisite for sustainable development and eco-friendly environmental management in industries. The preventive and reactive approaches do not complement each. other in the current practices of environmental pollution prevention as reflected in legislative, administrative and policy formulations. The regulatory frameworks have focussed mainly no pollution control . through end-of-the-pipe (EOP) treatment, which allows wasteful use of resources and then consume further resources to solve the environmental problems in a particular medium. However, the practice - in vogue seldom achieves industrial economy since energy intensive cleaner technologies have emerged as a hall mark of industrial production. This calls for an integrated Ecomark approach considering continuous assessment of manufacturing process vis-a-vis state of the art of cleaner technologies of industrial production. This paper addresses itself to the development of Indicators with a systems approach concept considering the possibilities of energy saving, raw material saving and water budgeting through consideration of resources of protection of environment as an integrated framework for the practical implementation.

Keywords: Ecosystem, Sustainability, Management, Tools, Proactive, Eco-generation

INTRODUCTION

Environmental Impact Assessment (EIA) is now an established aspect of project planning throughout the world. In the 27 years that have elapsed since the first formal EIA procedure was established following the National Environmental Policy Act of 1969 in the United States (US), many countries have adopted systems of project appraisal that incorporate EIA. These have variously mimicked US procedures or have developed EIA systems that accommodate the features of national decision making for major development projects. Formalised EIA systems have been adopted, for example, in the member

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states of the European Union, Canada, India, Mexico, Australia, New Zealand, Thailand and Malaysia.

Those devising EIA procedures have been faced with the need to resolve five major issues. First, it is necessary to determine which projects require EIA. It is generally accepted that EIA is, or should be, a special procedure which requires appropriate assessment commensurate with the projected level of impact. Most EIA legislation tends to identify the need to conduct EIA for projects which are likely to lead to "significant" environmental impact, without then indicating what constitutes "significance". EIA is a fairly expensive procedure. Estimates of the costs of EIA are normally expressed in terms of the capital cost of projects. Figures in the range 0.1 -2% of total project capital costs have generally been quoted. Authors go on to note that in about half of all cases, this is recouped, indeed often exceeded, in direct savings in project design and in efficiency improvements or in integrated pollution control obviating the need for more expensive retrofitting of "end-of-pipe" technology. These calculations take no account of the indirect economic benefits of reduced environmental damage, which, traditionally has been treated as an externality in project appraisal.

In view of the latter observation, there may be a case for insisting that all projects should be subject to EIA, since there are considerable potential economic as well as environmental benefits to be gained. The formal adoption of EIA for a project, however, does have resource implications, if only in terms of skilled personnel. Invariably, these will be in short supply, especially in a Less Developed Country (LDC), and it is important that this scarce resource should be concentrated where it may achieve the greatest return. While the environmental consequences of lesser projects should be given appropriate consideration, this may only necessitate a fairly simple environmental appraisal, rather than a full EIA. The issue of cumulative impact of a number of minor projects is an important issue, however, and is considered elsewhere.

The second feature is to confront a recurrent danger in Environmental Impact Statements (EISs), or EIA reports as they are known under some EIA systems, namely the risk of obfuscation. The inclusion of vast quantities of data, often obscures the salient features of a project, the ones on which decision makers should focus their attention. Clearly, there is a limit to the amount of information that a decision maker can assimilate and the importance of different issues may vary considerably between projects. Generally, a decision on a particular development project will turn on a restricted range of key issues and it is important that the EIA system delivers the appropriate information into the decision making process and delineates what information should be included in an EIS.

Thirdly, the EIA system must operate over a time scale that allows the findings of EIA studies to influence project design and implementation. It can be seen that EIA has a great potential to be a component of preventative environmental management, rather than a reactive planning tool. EIA, however, is generally seen as part of the decision making process, that is a hurdle to be cleared in order to obtain authorisation for the desired and, often, already designed development project. Rather, EIA should be seen as part of the project planning process, as an environmental evaluation tool in project design, with the result that solutions to environmental issues are incorporated into the

project as it is being formulated.

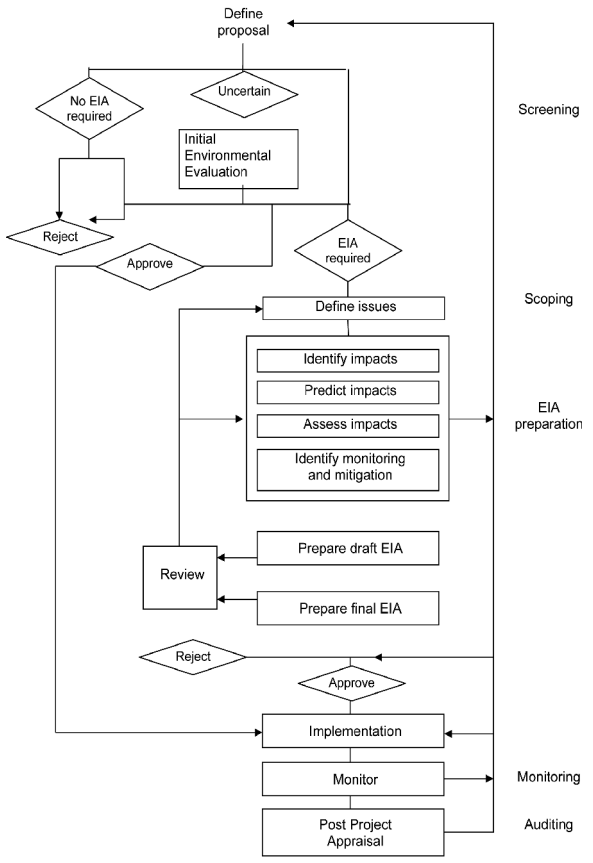
The quality of EISs, especially with respect to bias, has long been a concern. Ultimately, developers are concerned about obtaining authorisation for their projects. Rarely are they concerned about environmental protection *per se.* Clearly, it is not in the interest of a developer to see a proposed project described with respect to its environmental implications in denigratory terms within an EIS. This has presented those formulating EIA systems with their fourth concern, namely the dilemma over who should prepare EISs. For the "polluter pays principle" to operate in EIA, the potential beneficiary of authorisation for a project, the developer, should be responsible for producing the EIS. Yet, few developers have the technical capability or the disinterest and independence to produce an unbiased EIA. Independent assessors, on the other hand, would lack bias and have no vested interest in the outcome of a decision. However, few would advocate the resource burden of producing EISs being placed on the public sector. In practice, therefore, the financial obligation for EIA lends to rest with the developer. Normally, this is delegated to commercial consultants. Even these cannot be regarded as disinterested in the outcome. Indeed, many are paid a bonus on their fees if the project is authorised on the basis of the EIS. Clearly, the fourth requirement of an EIA system is to ensure that EISs are not biased, but produce an objective assessment of the likely consequences of a project.

The final issue is a technical one, namely, how should the EIA be carried out and the EIS produced. This encompasses identifying; the appropriate data; appropriate methods to collect this information, appropriate techniques to predict change in environmental systems, and appropriate standards against which to evaluate baseline conditions and predicted change.

THE EIS PROCESS

Not every country that has adopted an EIA procedure has successfully resolved each of the five issues discussed above Resolution of them all, however, is accomplished within the idealized EIA process illustrated in Figure 1. The various approaches that have been adopted to deal with screening, scoping, EIA preparation, the EIA report

Figure 1: Idealised EIA Process



and the review of the quality of reports are discussed individual in the following sections.

Screening

Screening is the solution to the problem "which projects require EIA?". Most countries have lists of project categories for which EIA is required. There would be a unanimity of view that many types of development project invariably lead to significant environmental impact and, as a consequence, always require EIA. Such projects include nuclear and thermal power stations, reservoirs, major roads, opencast mines, deep mines, cement works, ports and steel works. For others, however, significance is not predetermined, as a particular project may or may not lead to significant impacts. This will depend not only upon the nature of the project, but also upon its size and the characteristics of the local environment in which it would be situated. Such projects include new settlements, manufacturing, chemical industries, metal processing, irrigation projects and forestry. The triggers that determine whether EIA is carried out for such projects are often specified in terms of the size or value of a project. These threshold values are not without criticism, as projects immediately above and below the threshold probably differ very little in the significance of their environmental impact. Negative lists indicating projects which are exempt from the requirement for EIA in all situations, so-called categorical exclusions, have also been adopted in some countries. Typical examples include emergency works and projects carried out for purposes of national security.

The decision as to whether EIA is required may not necessarily be immediately evident. In some instances there may be insufficient information to determine whether the impacts of a project are significant. In such cases, preliminary investigations, referred to as Initial Environmental Evaluations (IEEs) may be undertaken.

There has been a tendency to consider only the operational phase of a development project when determining the significance of its impacts. It is clear that this is an unnecessarily restrictive perspective. For many projects, construction is a far more disruptive phase, especially for local people. Similarly, the decommissioning of a site and its after use may generate substantial impacts. However, for projects which have a long lead time, planning may take up to five to seven years for really major development projects, the period may be characterised by rumour, property speculation, escalating land values, rising migrant populations, rising expectations and a whole range of other direct and indirect social impacts which may, in themselves, be significant.

Scoping

Those carrying out an EIA need to be given clear guidance on what should be covered during the assessment. Some countries, such as India, provide an extensive proforma of issues that must be covered. This is a standard, centralized proforma for each sector. Alternatively, as in Malaysia, a series of official sector guidelines, a looser specification to the proforma (questionnaire) concept adopted in India, have been issued In other systems, the remit for the proposed EIA, often in the form of a project specification brief tender document, will be issued for a project on an individual basis, either by some central agency or by the developer. This approach has the advan-tage of flexibility in being able to accommodate particular issues that arise with individual development projects. The process by which appropriate issues are identified is known as scoping.

With the latter flexible approach, there should be a number of inputs into the identification of issues. Scoping, conceptually, can be divided into two distinct components. Technical scoping is concerned with identifying issues generated by technical and scientific aspects of the project and the environment. Sources of information on such aspects include the developer, the decision making authority, governmental and public sector agencies, Non-Governmental Organisations (NGOs) and the public. Similarly, it is necessary to consider issues that are of concern to local people. These (Table 1) may or may not have a technical or scientific rationale, but reflect the perceptions of the public. Information on such issues should emerge from discussions with the public, but input from the decision making authorities and NGOs may also be valuable in this, so-called, social scoping.

Table 1: Scoping: Public Perceptions of Concerns

- Health and safety
- Threats to livelihood
- Life-style modifications
- Recreational, aesthetic, educational scientific and historic features preservation of natural areas
- Land-use conflict
- Imbalances in resource supply and demand

Implicit in the need to scope a project, that is reducing EIA for a particular project to the subset of key issues, is a need for the early involvement of a number of agencies, organizations, groups and individuals. This requirement sits uneasily with the dominant culture amongst developers, namely an emphasis on secrecy.

EIA Preparation

Once the key issues have been identified, EIA becomes a technical exercise. A whole range of techniques are available to predict the impacts of a development project. In the first instance, baseline data which describe the existing local environment are required. In a rapidly changing environment, as a result of natural processes or human activities, the collection of such data is fraught with difficulties, not least concerning the precise timescale over which such data must be collected. Where development is rapid, such as occurs locally in some development “hot spots” in LDCs, data describing the local environment collected during an EIA to describe the baseline situation may bear little relationship to the “true” baseline situation when the project is actually implemented, perhaps as little as one or two years later.

Baseline data should give a clear indication of not only the spatial distribution of particular features and the rate at which they are changing within an area, temporal information, but also functional information concerning causal factors that determine change. In general, spatial data are of better quality than temporal data, withfunctional understanding lacking for many systems. In general, also, there is decreasing quality of information following the sequence; meteorology, atmosphere, hydrology, geology, soils, land use, landscape, geomorphology and ecology. Social systems, in many respects, are even more poorly understood and documented.

In addition, projections concerning the likely characteristics of an area if the project is implemented must be made. Some predictions will be quantitative determinations of likely change, based upon widely accepted mathematical models. For example, diffusion models are available for determining ground level concentrations of gases and participates from point, linear and area

wide sources. Surface water models are available for determining flow rates in rivers and estuaries. Surface water quality can be modelled for thermal pollution, bacteria from sewage discharges, non conservative pollutants such as BOD, and for conservative pollutants such as chloride ions. Groundwater flow can be modelled as can groundwater pollution under conditions of flow or diffusion. Noise and its attenuation can be modelled for static equipment as well as for mobile plant, while traffic noise can be predicted using standard models based upon the likely traffic profile and the characteristics of the new road. The impact of blast and vibration effects can be predicted mathematically when the characteristics of the underlying geological strata are known. Stochastic analyses of catastrophic risk, for example, from plant failure can be undertaken if the probability of events and their likely consequences is known. Recently, a range of fairly sophisticated software has become available to enable the visual effects of development projects to be determined. Thus, the visual envelope, the area over which a project can be seen (alternatively known as the zone of visual influence) can be calculated if topographic data are available. Similarly, visual representations of the proposed development, *in situ*, can be produced using photomontage techniques.

Even within the socioeconomic sector, impacts can be predicted numerically. First, revenue generation within an area from cons-truction and operation of a project can be calculated based upon a knowledge of regional multipliers. Similarly, infrastructure requirements can be determined in terms of medical, edu-cational, housing, and emergency service requi-rements within an area to meet the demands imposed by the new development and its labor force.

Many socio-cultural impacts, however, cannot be determined in numerical terms. This does not mean that no attempt should be made to consider such potential impacts of a development project. Rather, it means that the predictions will be based upon more qualitative assessments in the light of especially, expert opinion. How development, particularly when this involves the influx of people with different life styles into an area, will affect the social structure, authority systems, beliefs, kinship structures, life styles, gender roles and social norms, may be some of the most important effects of a project. Clearly, it is essential that such issues are appraised, at least to the level of current understanding of the particular group of people.

Similar problems are encountered in the prediction of ecological impacts. There is no general theory of development impact which can be translated into a practical aid for predicting impacts on ecological systems. For some systems, general statements concerning the effects of development-induced change on the composition of particular groups of organisms can be made. For many others, even these broad generalisations cannot be made. In terms of the impact of environmental change on the functioning of many ecological systems, even less can be said with certainty.

In practice, however, the use of prediction techniques across almost all of the environmental media is predominantly qualitative. Many prediction techniques which are available are simply not used (Table 2). Similarly, subjective assessments of the significance of environmental impacts abound (Table 3). For many parameters, however, significance can be evaluated with respect to defined criteria including international standards, such as those adopted by WHO, or

Table 2: Use of Information in Impact Prediction

	Description	Map/Photo	Quantif	Expert Opinion	Modelling
Climate	2				
Air Quality	4			2	
Hydrology	4				1
Water Quality	4				
Soil/Geology	4				
Flora/Fauna	11		3	2	
Landscape	6	8			
Land Use	5		1	1	
Recreation	1		1		
Social	2		2		
Cultural	1				
Archaeology	1			1	
Noise	4		2		2
Traffic	4		2	1	

Table 3: Types of Impact Evaluation

	Description	Expert Opinion	Comparison	Standards
Climate				
Air Quality				4
Hydrology				
Water Quality	1			4
Soil Geology	1			
Flora/Fauna	4	1	1	5
Landscape	6			
Land Use				
Recreation				
Social				
Cultural				
Archaeology				
Noise				6
Traffic	2			

national standards, implemented, for example, by the Central Pollution Control Board.

The EIA Report

From most EIAs a document, or series of documents, will emerge. These fulfill a number of functions within different EIA administrative systems. There is a paradox in that they are, in effect, technical analyses of, often, much complex environmental change. On the other hand, they are also decision making documents which must provide information in a form which can be easily read and understood. EIA reports, therefore, are difficult and complex documents to produce. The content of an EIA report will be dictated, to a large measure, by the requirements of the EIA procedures within the particular country. The net result of adhering to these "minimum" requirements is that important components may be missing. In Malaysia, for example, there will be no discussion of outcomes with the public, as this is not required under present procedures. Similarly, adherence to the EIA regulations in the UK means that alternatives are rarely considered. In India, the effect of the questionnaire constrains many EIA reports to little more than a consideration of pollution issues. These are, after all, only minimum requirements and good quality EIA reports are produced in all three countries, when developers and their consultants take a more expansive view and adopt best practice.

Best practice can also be used as the model for determining the composition of an EIA report (Table 4) indicates the composition of EIA reports for water-related projects. A key element that should always be included in an EIS is a non-technical summary. This should be self contained and provide sufficient information, presented in an accessible way, to enable any interested person to understand the nature of the project and its likely environmental consequences if implemented.

Table 4: Recommended Content of The EIS for Water Projects

- Title page: project, author, date
- Non-technical summary
- Purpose of project
- Statement of need
- Methods of assessment consultations, ElA methodology
- Alternatives
- Proposed project description
- Local environment description
- Site description
- Predicted impacts: prediction techniques
- Mitigation
- Residual impacts
- Monitoring requirements
- Enhancements

Review

Bias will only be eliminated from current EIA practice when such EIA reports are returned to the developer as unsatisfactory. Thus, review should be an integral part of the EIA process. Given the nature and function of the EIA report, a number of issues need to be addressed during the review of EIA documents. First, it is necessary to check that sufficient information which adequately describes the proposed development, the local environment and baseline conditions at the site is present. This will make the nature of the project and its environmental setting evident. Secondly, key impacts should be clearly identified and evaluated. Thirdly, the extent to which the impact of the development project could be mitigated by the choice of an alternative site, processes, technology and management

practices or by the adoption of compensatory environmental enhancements should be clearly stated. Finally, the information in the EIA report should be communicated in an effective, accessible and efficient manner. Thus, EIA review should address these issues (Table 5). Such reviews, often described as procedural reviews, are undertaken in many countries as a matter of routine. This does not ensure that the science base of the EIA report, however, is sound. There is also a need for technical review to ensure that the most appropriate prediction techniques have been employed, in a valid way, in a correct geographical context. Simply importing a computer model from one geographical location without prior validation is not good science and is not good EIA. Clearly, such technical reviews require technical expertise, which may not be necessary for procedural review.

Table 5: Lee and Colley Review Criteria Main Category Headings

- Description of the development, the local environment and baseline.
- Identification and evaluation of key impacts.
- Alternatives, mitigations and enhancements.
- Communication of results.

EVALUATING THE QUALITY OF THE EIA PROCESS

Various studies concerning the quality of EIA reports have been carried out. There is a general consensus that during the early days after adoption of an EIA procedure, the quality of EIA reports is low. Over time, with increasing maturity of the procedures and experience of developers, consultants, agencies and NGOs, quality improves. EIA reports have been the natural focus of attention as they are the one tangible output from the EIA process. Analyses of the effectiveness of the EIA process are much more difficult to carry out. They can only be done retrospectively and based upon consultations with all of those involved in the EIA for a particular project. As such, there are no objective criteria that can be measured, rather only opinions as to how effective the EIA is perceived to have been by those involved in the EIA. Triangulation, that is comparing the perceptions of two or more people on a particular issue, provides some rudimentary verification procedure. In addition, analysing anumber of EIAs provides an opportunity to look for generic strengths and weaknesses, not just a post-mortem on individual projects.

The main focus is, in effect, the nature of project management. The nature of the EIA team is one key issue that overrides all others, for a good, well-qualified, experienced, diverse and balanced process. EIA team is more likely to carry out a

Table 6: Process Audit Issues

- "History" of project
- Mechanisms for working to client
- Personnel involved
- External consultees
- Interests, constituencies, agendas
- Who did what, when
- Nature of project management
- Internal working procedures
- Internal working practices
- How EIS compiled
- Degree of formality
- Perceived reasons for approval/rejection of project
- How EIS dealt with after project authorisation
- How project implemented

good asse-ssment than one that lacks these qualities. Even the effectiveness of a good EIA team, however, can be compromised by poor project mana-gement. The issues that EIA process audit seeks to establish are shown in (Table 6).

It is often said that it is not the EIA report which causes environmental impacts, rather it is implementation of the projects to which they refer. Hence the objective of EIA "is not to produce paperwork, even excellent paperwork, but excellent projects". Thus, in a process audit study of EI As within the water industry in the UK, two issues emerged as being of particular importance. First, how the EIS was dealt with after the project had been authorised. The second concerned how the project was implemented.

Once completed, most EIA reports merely sit on the shelves of the developer, their consultants and decision making authorities. Rarely is the information on environmental impact identified in the report conveyed to those on site. Even decision makers will tend to neglect the EIA report in favor of the document detailing conditions of approval when carrying out compliance monitoring. The incorporation of environmental protection into a project implementation plan is at a rudimentary stage of development in the UK, as the EIA procedures have no requirement for the production of an Environmental Management Plan (EMP). This is in marked contrast to, for example, India where EMPs must be produced for all projects.

It seems self evident to say that it is necessary to appoint appropriate contractors. However, most contracting around the world is done on the basis of competitive tendering with the lowest being accepted unless some other overwhelming reason exists for awarding the contract to a higher tender. While this may be the case, for example, to secure the services of a consultant who has a reputation for high quality EIA reports, this is hardly likely to be the case in appointing contractors to excavate a site or construct the project, where a high environmental profile is not perceived to be necessary. Increasingly in the UK, site environmental managers are being appointed to major development projects. Their function is to provide an environmental response to any civil engineering issue which may arise in the day to day operation of the site. It is a salutary finding from research in the UK, that more than a third of all major projects constructed differ significantly from the development as detailed in the EIA report. In half of these cases, the modifications to the project are deemed to be worsefrom an environmental point of view.

In general, process audits reveal that good EIA results when everyone involved is aware of the objectives of the EIA process, leading to increased efficiency. It is also promoted when EIA is initiated early in the development planning process. This early integration ensures that EIA is proactive in project design, not simply reacting to a development which is presented with all of its essential features already decided. Sign posted audit trails throughout the EIA process, that is clear organizational structures and good record keeping, correlates well with high quality EIA. This is not a causal relationship, as these features merely indicate good project management. In detail, the key features of quality project management are always evident in cases of good EIA. These encompass: the early establishment of clear sequencing and timetables; full and early consultation with outside agencies and the developer; agreed and realistic response times over all consultations; good and well briefed staff,

especially new staff; good liaison over design modifications with rapid feedback to the EIA process.

CONCLUSION

It is clear that sufficient understanding to identify the major weaknesses in EIA procedures exists. The EIA procedures that have forced EIA to be carried out on such a vast scale collectively around the world have been a major influence in revealing these weakness, being enshrined in legislation and regulation, will be difficult to modify in the short term with the result that they may now be a major factor perpetuating these weaknesses.

There is not doubt that developers have become adept atoperating EIA procedures in order to comply with the letter, rather than the spirit of the law. It is of note, for example, that public interest litigation NGOs, no longer use EPA to contest contentious development projects in the courts. Such litigation, these days, tends to fail as developer agencies invariably comply with the procedural requirements of the Act. Rather, these NGOs use other laws, especially endangered species legislation, when they wish to attack projects from a substantive perspective.

In all probability, therefore, amendments to legislation represent only a long-term solution to the inadequacies of current EIA practice. Minimum provisions, therefore, will continue to encourage a minimalist approach to EIA. The adoption of best practice seems to be the only way forward, but it does not seem to be in the developers interest to go beyond what is merely adequate. Yet, the main arguments in favor of good EIA practice is not simply to comply with the law. Rather, it is the fostering of cost-effective planning. EIA process audits reveal the need to initiate EAI early in the project planning cycle. If developers can be persuaded to initiate EIA early, they should reap considerable benefits from a smoothed and more rapid decision-making process, in addition, there may well be significant economic benefits from the better designed and managed project which is likely to emerge. The net result should be not just better paperwork, but also much better projects.

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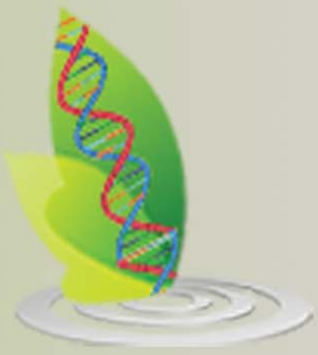

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ISSN 2250-3137
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