


The method, rights and resources model for evaluation of the effectiveness of environmental impact assessment systems

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Background: The need to measure the effectiveness of environmental impact assessment (EIA) systems has been fuelled by the debate over the relevance of EIA systems as environmental management tools. Researchers have developed different models for evaluating the effectiveness of EIA systems. However, the models face the challenges related to objectivity and the quantification of environmental impacts which have restricted the measurement of the effectiveness to procedural evaluation.

Objectives: The purpose of this article is to propose and discuss an alternative conceptual and practical model to evaluating the effectiveness of EIA systems.

Method: This article reviewed the objectives of EIA systems as enshrined in the Rio Declaration and the Local Agenda 21 to derive the theoretical framework. The concepts of compliance, participation and capacity were identified as important elements of a framework for evaluating both procedural and substantive EIA system effectiveness.

Results: Through literature review, the article identified and critiqued models for evaluating EIA systems in terms of objectivity and substantiveness.

The method, rights and resources (MRR) model focussed on substantive and procedural effectiveness, objectivity of EIA system effectiveness evaluation and provided a theoretical framework. The MRR model was conceptualised as an indicator-based model.

Conclusion: The MRR model introduces a divergence from previous models in that objective evaluation of the effectiveness of EIA systems is built into the EIA system rather than applied externally on the EIA system.

Background

The concept of environmental impact assessment (EIA) was developed in USA around 1960 in the so-called 'ecological awakening' era (Thomas 2001). From there, the concept quickly spread across the world, especially after 1992. The post-1992 rapid adoption of EIA as a national decision-making tool in most countries was undoubtedly influenced by the Rio Summit. The impact assessment concept was firmly anchored in two documents from the United Nations Conference on Environment and Development (UNCED) of 1992 *vis-à-vis* the Rio Declaration on Environment and Development and the Local Agenda 21 (United Nations 1992a).

The aim of the EIA system is to ensure that environmental issues are taken account of when new projects are implemented. From this point of view, EIA is largely a decision-making tool which is executed via a series of basic steps. However, there is a question about how much environmental protection is actually achieved through implementation of the EIA systems. The actual protection of the environment could be considered the ultimate objective and benefit of the EIA systems.

To go through the EIA steps, the proponent of the project has to meet costs and sometimes time delays. Governments and other stakeholders also commit resources to implement their EIA system commitments. For this reason, it is necessary to consider whether EIA is worth the effort made, that is, is it effective in achieving the intended outcomes.

The effectiveness of the EIA process is a growing subject of scholarly research (Morrison-Saunders et al. 2015; Pope et al. 2013). The major question that remains partly unanswered is whether EIA is achieving environmental protection. From this question arises another question which is the focus of this article: how can the effectiveness of an EIA system be measured? To place this

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question in perspective, what could a jurisdiction or company that has implemented EIA since 1992 show as evidence that EIA resulted in protection of the environment? Can an indicator-based evaluation approach help to address some of the EIA evaluation challenges?

There are several models for measuring the effectiveness of the EIA system, of which some key ones will be analysed in this article.

Objective

Evaluating the effectiveness of an EIA system is not straightforward. This is because of at least two reasons. The first is that although there may be a general consensus of what the concept of EIA entails, in practice, there are differences in the conceptualisation of EIA. When conceptualised as a planning tool for effective decision-making, EIA systems are considered effective when the recommendations from an EIA study are incorporated into the overall project plan of the particular project. However, when conceptualised as a tool for protecting the environment, EIA can only be effective when evidence of the protection achieved is documented.

The second reason is that if EIA is conceptualised as a method of achieving environmental protection, there is need, at best, for empirical measurement of the environmental protection achieved through the mitigation or avoidance of impacts. This measurement of environmental impacts remains largely difficult to achieve (Morrison-Saunders et al. 2015).

Because there are existing methods answering to the question of how EIA effectiveness can be evaluated, this article focuses on contributing an alternative approach to the existing ones. The purpose of this article is to propose and discuss an alternative conceptual and practical model to evaluating the effectiveness of EIA systems. The article demonstrates that both procedural and substantive measures can be incorporated into a model of measuring EIA system effectiveness. The article proposes building indicators for evaluating effectiveness into the EIA system itself and placing the proponents at the centre of information collection.

Methodology

This article surveyed relevant literature sources to identify existing methods and techniques that have been used by various authors to evaluate the effectiveness of EIA systems, especially since 1992. The article investigated how these EIA system review or evaluation methods were applied by other researchers and their major focus to understand whether the methods are procedural or substantive. In Section 4, the article critically discusses how the methods perform with respect to achieving substantive or procedural evaluation of EIA systems.

On the contrary, this article reviewed the output documents of the Rio Summit to establish the principles on which EIA

systems are built. The rationale is that the Rio Declaration and the accompanying reports (agreements) are the first attempt to globalise the EIA concept. The author traced the discussion of EIA in these documents to understand the intended aim and the core pillars or principles of EIA as internationally understood by stakeholders. These principles form the basis of a theoretical framework for the article as discussed in the proposed model.

Based on this framework, the article introduces the method, rights and resources (MRR) model and justifies its incorporation of procedural and substantive aspects of EIA system evaluation. Finally, the article proposes rudimentary and generic indicators for the application of the MRR model.

Results and discussion

This section will present a discussion of existing EIA evaluation models or methods and critique their relevance to substantive and procedural effectiveness. After that, this section will discuss some of the challenges faced in the process of evaluating EIA systems. Lastly, this section will derive the theoretical framework of the proposed MRR model.

Existing environmental impact assessment system evaluation models

The different EIA system evaluation methods can be classified into categories according to their focus. For example, there is a group of review methods whose primary purpose is to assess the compliance and content of EIA reports or statements. Examples of these are the Lee and Colley review package (Lee & Colley 1992), the European Commission Guidelines on environmental impact statement (EIS) Review (European Union 2001), the Oxford Brookes University EIS review package (Talime 2011) and similar guidelines. These are outside the scope of this article because this article is concerned about evaluating effectiveness of the entire EIA system.

The other category of EIA evaluation models are what could be called the first generation models whose primary focus was to test whether the prerequisites for implementing EIA systems are present. These include the systemic and foundation model by Ahmad and Wood (2002) and the EIA evaluation criteria by Wood (2003).

Ahmad and Wood (2002) developed a review model of systemic and foundation measures which has been used by various other researchers. According to El-Sayed (2009:194), 'systemic measures refer to features of EIA (system) that are designed to deliver quality assurance in both practice and the administration of EIA (system)', whereas 'foundation measures are defined as actions undertaken to improve the effectiveness of the EIA system and ensure successful application of the systemic measures'.

The EIA evaluation criteria developed by Wood (2003) which consists of 18 questions grouped into three categories,

namely institutional aspects of the EIA system, EIA process and other requirements of the EIA system have been widely used (Ruffeis & Loiskandl 2010; Zeremariam & Quinn 2007).

It could be argued that the question of the effectiveness of the EIA system itself was not a focus of this first generation EIA system evaluation models. The focus was on the existence of the prerequisites for EIA system implementation. These prerequisites included legislation, institutions and processes. This focus on rudimentary elements of EIA systems was logical at that time given that many countries may not have developed robust EIA systems.

When Cashmore et al. (2004) introduced the distinction between the procedural and the substantive effectiveness, a new frontier of scholarly research and debate focussing on substantive effectiveness was opened.

Procedural effectiveness focuses on whether the EIA system is adhering to the methods or steps that are stipulated. This model suggests that if the EIA is carried out in a certain way, its objectives will be achieved. Hence, procedural effectiveness emphasises on assessing how well the information is being gathered and used for decision-making and much less on whether the environmental stewardship is being achieved. For example, 'democratisation of governmental decision-making processes' suggested by Macintosh (2010:177) could be considered a procedural measure of effectiveness. In this case, the EIA system would achieve its outcomes simply by ensuring that affected stakeholders have a say in the decision-making process.

Procedural EIA system evaluation is the easiest to perform because the focus is on whether specific procedural steps have been complied with. There are many procedural EIA evaluation models that have been developed.

The greatest limitation of procedural effectiveness is that it does not go as far as measuring the ultimate goal of EIA system which measuring whether protection of the environment has been achieved. Procedural effectiveness only measures whether the expected processes, institutions and mechanisms are present and being implemented.

Substantive effectiveness focuses on whether EIA systems are actually achieving the tangible outcomes, the ultimate tangible outcome being the protection of the environment. It could be considered logically inadequate if EIA systems simply achieved a thorough implementation of the EIA process while the environment itself is not protected. Hence, it is logically pertinent to desire to understand if EIA systems result in the actual protection of the environment.

A new generation of EIA effectiveness models is being tried using different methods to try to overcome the inherent challenge of quantifying environmental impact by seeking ways by which value could be attached to environmental goods and services. Methods borrowed from the field of

economics have been used including, the cost benefit analysis (CBA) and the cost effectiveness analysis (CEA).

The CBA is a robust method which can be applied in diverse circumstances using diverse models. CBA was mooted as an economic analysis tool empirically comparing the social benefits and social costs of a development activity (Organisation for Economic Co-Operation and Development 2006). Hence, it was a formative evaluation tool and it involved monetising benefits and costs (Vega & Alpizar 2011). Within the CBA toolset are different techniques used to quantify impacts. These techniques work very well with social impacts using techniques such as a survey of perceptions or the economic value of benefit from a utility point of view. However, when it comes to ecological goods and services, the challenge still remains as to how the economic value can be calculated.

In EIA system review, CBA can be used to estimate (both ex-ante and ex-post) the value of impacts caused by implementation of a project. However, hypothetical scenarios will have to be employed to estimate the non-use values of impacts (Vega & Alpizar 2011).

Cost effectiveness analysis is similar to CBA except that CEA monetises costs but circumvents monetisation of benefits. According to Staib (2005), CEA is used to identify the least costly way to an agreed objective, for example, provision of water. One can therefore envisage a situation where CEA is used to establish whether the least costly way to avoid environmental impacts was used.

Nevertheless, CBA and CEA are the closest there is to substantive effectiveness evaluation. However, both CBA and CEA are most useful as formative evaluation tools and are most effective at project level rather than at EIA system level.

Challenges to evaluating substantive effectiveness

The multiplicity of procedural effectiveness evaluation methods contrasted against the lack of substantive procedural effectiveness evaluation methods testify to the relative ease of applying the former. Hence, this section will focus on the challenges that affect evaluation or measurement of substantive effectiveness. This is necessary to show how the proposed method in this article attempts to address some of these challenges.

Substantive models of EIA system evaluation are much more challenging for two reasons. Firstly, there is no standard method of quantifying environmental goods and services in order to measure environmental damage avoided through the EIA system. Secondly, even if there was such a method, the attribution gap could be impossible to objectively account for. The attribution gap theory acknowledges that change within the environment is most likely as a result of more than one activity or factor. For example, if positive change is

realised with respect to air quality around a specific area, the outcome may be as much about positive actions of a project in that area as it is about the effectiveness of public environmental awareness campaigns in the same area.

It is important to observe that substantive effectiveness can be relatively more easily measured at a project level than at a national level. At project level, impacts caused by implementation of a project over a determined period of time can be assessed against the baseline established before the project started. For example, if ground water quality baseline established before a project commences, future ground water quality measurement will show whether the ground water quality is improving or deteriorating.

By design, EIA systems lack inherent evaluation mechanisms both at policy and project levels. EIA was first mooted as a response to political pressure from concerned US citizens over the escalating degradation of the natural environment. For this reason, EIA has tended to be more clearly defined in the pre-certification phase (where procedures were put in place to show that environmental protection is being given attention) than in the post-certification phase (where the actual implementation takes place). Another characteristic of its political origins is that the EIA steps did not include a clear path to evaluate its success, that is, elaborating the cause and effect path was not a priority, but was rather assumed. Only later, after implementing EIA for many years, have questions begun to arise as to whether EIA is as effective as anticipated.

Hence, we see that there is generally no built-in mechanism to evaluate its effectiveness. Lessons can be learnt from policy interventions such as those planned using the logical framework analysis (LFA). Using the LFA, development policy interventions build in specific indicators from the onset which are then used to measure outputs, outcomes and impacts of an intervention at specified intervals.

Another challenge (partially discussed before) is about quantifying environmental impact. For EIA to be considered effective substantively, the question of how much of the environment has been saved by implementing the EIA needs to be answered. To answer that question, there is need for methods of quantifying environmental damage or lack thereof. This can be achieved to a reasonable extent at project level by setting an empirical baseline against which future changes can be measured.

However, some stakeholders may emphasise on monetary value of the impacts so that they can offset against the cost of implementing the EIA. Unfortunately, to date there is still much debate on an appropriate scientific measure which can monetise environmental goods and services, especially to take account of non-use value such as bequeathing to future generations. Morrison-Saunders et al. (2015) noted that attribution and quantification are major challenges. According to them, it is 'less clear whether the benefits of doing impact assessment will ever be present in the same

[financial] terms' (p. 4) as the financial costs of doing impact assessment. Hence, this challenge currently continues to exist.

Another challenge is that of the attribution gap. Evaluating whether an intervention such as a policy, plan, programme or project has achieved tangible results is also subject to attribution challenges. The attribution gap requires the evaluation to account for the unplanned changes that may not be because of the intervention itself. Attribution gap requires clarity of the cause and effect path as well as unforeseen causes and effects. For example, other contemporary interventions may produce the same impacts as the intervention in question or even just enhance or demote them. Thus, whether the EIA policy is achieving its intended objectives or not is affected by a host of other activities which were not planned within the scope of the EIA implementation itself but may be happening simultaneously. Such other activities may include environmental awareness campaigns affecting the attitude of citizens towards environmental issues in general and other local authority policies such as local environmental action plans and waste management plans.

Theoretical framework

The theoretical framework for the MRR model is derived from the outcomes of the Rio Summit of 1992. The MRR model recognises that the EIA system is enshrined in the outcomes of the Rio Summit and national policy and legal documents. Therefore, the MRR attempts to identify what these documents intended to be the elements of the EIA system. Three elements are identified which form the basis of the MRR EIA system evaluation *vis-à-vis* method, rights and resources.

The Rio Declaration on Environment and Development contains 27 principles that the world agreed on to guide them towards sustainable development. Principle 17 advocates for EIA 'as a national instrument' for decision-making for proposed activities with possible negative impacts on the environment (United Nations 1992a). Principle 15 advanced the precautionary principle which is the basis of the anticipatory approach to environmental management enshrined in EIA (United Nations 1992a).

Further to advancing the EIA as a decision-making tool, the Rio Summit also presented basic mechanisms for implementation of sustainable development initiatives. Three elements necessary for the implementation of EIA can be traced back to the outcomes of the Rio Summit. The first is the need for procedures outlined in Section 8.3 (d) of the Local Agenda 21 (United Nations 1992b). The second is the need to observe the rights of the affected stakeholders Principle 10 of the Rio Declaration and Section 22 of the Local Agenda 21 (United Nations 1992a). Lastly, Section 8.11 of the Local Agenda 21 (among others) advocates for resources to strengthen national capacity to integrate environmental issues into development activities (United Nations 1992b).

We can therefore say that compliance (with methods or procedures), participation (based on rights) and capacity (or resources) to implement are key elements of the EIA system by design which can be used to evaluate whether an EIA system is achieving its intended objectives. In this article, these three are presented as method, rights and resources, respectively.

It is acknowledged that what determines compliance, participation and capacity in different settings may be different. Hence, once again, it is emphasised that this article does not intend to provide a universal set of indicators, but a model or approach which can be adapted in different settings.

The proposed MRR model

This article proposes the MRR which is more flexible and all-encompassing while involving less of subjective assessment of the researcher. This model proposes that the entire EIA system of any country can be broken down into three elements, namely method, rights and resources. The rationale of this article is that the foundational prerequisites of the EIA system are the best basis for evaluating the successes or failures thereof. Hence, the evaluation theory is pivotal to the MRR approach.

Method

Method refers to the procedures or process for implementing the EIA policy objective. The key issue is that the procedures are established to ensure that decision-making incorporates environmental concerns associated with a project and that the resulting mitigation or enhancement measures are implemented. In most countries, EIA procedures are laid out in the form of step-by-step guidelines often called the EIA process. In general, the EIA process can be split into two phases, *vis-à-vis* the pre-certification and the post-certification.

The pre-certification phases deal with all the steps of the process that must be implemented in order to produce an EIA report used for decision-making by the competent regulatory authority. In the pre-certification phase, the environmental issues are incorporated into the project plans. Screening followed by scoping, baselines, EIA studies, stakeholder participation, impact identification, impact analysis, mitigation or enhancement measures, environmental management plan (EMP) and impact monitoring plan (IMP) are the main steps of the pre-certification phase.

The post-certification phase deals with implementation of the EMP and IMP together with the project activities by the proponent. Often, the proponent is required to submit reports about the progress of implementation of the EMPs and IMPs to be submitted to the regulatory authority.

The evaluation of the effectiveness of EIA systems must inevitably measure the degree of *compliance* with laid down procedures for integrating environmental issues into both decision-making and implementation. Assuming the

procedures are appropriate for the purpose, lack of strict adherence to them makes integration itself an uncertainty. Therefore, the method through which EIA is implemented gives rise to need for compliance.

Rights

A healthy environment is a recognised human right; therefore, citizens must protect their own rights through effective *participation* in decision-making of matters affecting them. Hence, effective participation of all stakeholders is a key element on which to measure the effectiveness of an EIA system. The EIA system should provide both the information necessary for stakeholders to participate and the opportunity to do so.

While some stakeholders participate because of their rights, others participate because of their mandates. For example, affected members of the public participate to police their right to a safe environment. On the other hand, a ministry of the government or other organisation such as a non-government organisation may participate to fulfil its mandate for its existence. Environmental associations may also have a say on the mandate given to them by their membership. Hence a wide array of stakeholders may participate in an EIA process where their interests may be at stake.

Resources

The need for resources to implement any policy cannot be overemphasised. Resources determine the capacity of the EIA system as a whole and the individual stakeholders to fulfil their roles within the EIA system. Resources involve the financial, material, human, institutional and legal resources that are required to implement the EIA system. The Local Agenda 21 report constantly emphasises the need for 'means of implementation' which imply *capacity* required to implement the dictates of the declaration. It is at this level that monetisation is easiest because this pillar deals with quantifiable resources.

Therefore, the MRR model is about measuring the level of compliance, participation and capacity in the EIA system which gives the measure of the effectiveness of the EIA system.

Justification of the MRR model

The first justification of the MRR model is with respect to building evaluation into the EIA system. There are several other similar systems from which EIA can borrow, especially with respect to placing the proponent at the centre of the monitoring and evaluation process, for example, the work health and safety sector. It is proposed here that the proponents themselves can be at the centre of collecting and reporting data for monitoring and evaluation based in specific indicators. This information can be aggregated at national level to provide a reasonably sound picture of the substantive effectiveness of EIA systems. This is more

important given that EIA tends to be lagging in the most crucial stage, that is, the post-certification stage. It is argued that if proponents could collect information within this stage, the information could be very valuable not just for measuring effectiveness, but for informing policy evaluation.

The second idea of the MRR model is to provide an alternative focus to quantification of environmental impacts. Although it is commendable that researchers continue to develop better ways of quantifying environmental impacts with a view to establish substantive effectiveness, this approach suggests that substantive effectiveness can be measured using proxy indicators. It is argued that mitigating and avoiding impacts on the environment is itself a matter of compliance. For example, if the water quality which could be impacted by a project is compared against a baseline, it can be determined whether the project has impacted the water quality negatively or positively. Therefore, this can be recorded as a matter of compliance with the prescribed impact mitigation. Hence, a project can report the percentage of mitigation measures that are effective, which is a proxy for substantive effectiveness.

Lastly, with respect to the attribution problem, researchers have placed the attribution problem at the centre of the evaluation theory (Leeuw & Vaessen 2009), probably because there is again no fool-proof way to eliminate the problem. The MRR approach as presented does not apply the various antidotes for attribution problems. The major reason is to keep the model simple and practical for the practitioners to implement. However, there is scope to apply techniques such as counterfactuals and contribution analysis.

Application of the MRR model

This section provides a summarised overview of the MRR model. The basis of applying the MRR model is to develop specific indicators which can be used to evaluate the effectiveness of the EIA system at all levels from the project level upwards. The idea is that both substantive and

procedural indicators can be formulated for this purpose based on the three parameters, that is, compliance, participation and capacity.

The MRR model is made up of sets of indicators categorised according to the three parameters of the EIA system, namely compliance, participation and capacity. The proposed indicators in Table 1 below are not exhaustive. In addition, some indicators will apply to the project level better than the national policy level and vice versa. Further to that, the indicators can be categorised into pre- and post-certification indicators if necessary.

The rationale is that the indicators will individually or collectively enable the achievement of the effectiveness of the EIA system to be measured under each of the three pillars. The rationale further emphasises that if compliance, participation and capacity are effective, the objectives of the EIA system are being achieved. The objectives may be process objectives or substantive objectives.

The first step was to design the indicators, making sure that aspects of the entire EIA system are taken account of. This process is much easier where the EIA process is clearly defined within EIA Guidelines which dictate the step-by-step process that eligible projects should go through. Emphasis is placed on indicators which measured the implementation of the EMP and IMP, that is, implementation of mitigation measures and monitoring of impacts.

The next step is data collection. When carrying out an external evaluation of the EIA system, data were collected at once to provide a cross-sectional view. However, it is suggested that if the indicators are built into the EIA process itself, data can be gathered continually and reported by the proponents. For illustration sake, we will use one of the post-certification indicators, namely ‘% of negative impacts realised’. In some jurisdictions, these data can be reported by the proponent on a quarterly basis.

TABLE 1: Examples of indicators (non-exhaustive).

Compliance indicators	Participation indicators	Capacity indicators
Percentage of steps complied with in the pre-certification stage	No. or percentage of stakeholders consulted	Capacity to monitor EMP implementation
Percentage impact monitored	No or percentage of recommendations integrated	Capacity to enforce EIA conditions
Percentage negative impacts realised	Number of consultation methods used	Capacity to produce EIA reports
Percentage positive impacts realised	Involvement of other departments in the EIA review stage	Capacity to model impacts
Percentage EMP monitoring reports submitted	Involvement of other departments in impact monitoring	Capacity to review EIA reports
Percentage of projects monitored	Availability of information or feedback to stakeholders before certification	Stakeholder capacity to contribute to EIA process
Percentage projects stalled before certification	Availability of information or feedback after certification	Capacity to measure the baseline
Percentage projects stalled because of non-compliance after certification	Availability of legal complaint systems	Capacity to identify and analyse impacts
Percentage projects approved within prescribed timeframe		Availability of baseline information
Length of EIA process, from referral or prospectus or scoping to certification		Availability of competent experts
Length of approval or review process		Capacity to meet EIA study costs
Integration of EMP and EMS		Capacity to meet EMP implementation costs
		Capacity to monitor impacts

Source: Author's own work

EMP, environmental management plan; EIA, environmental impact assessment; EMS, environmental management systems.

The third step was to analyse the data to produce statistical information. For example, the % of negative impacts realised can be analysed to show trends, to test hypotheses that impact mitigation is not improving, or to show the average status of a project or administrative area with respect to effectiveness of mitigation measures. At a higher level, the authorities can realise an overall picture of how much worse anticipated negative impacts are becoming, hence the substantive effectiveness on mitigation measures.

Strengths

This section will briefly discuss the advantages of the MRR model over the other EIA system evaluation tools or models. Firstly, the MRR model is a simple model. It is easy to conceptualise because it is based on basic parameters of implementing any intervention strategy, that is, compliance with set process, participation of stakeholders and capacity to implement the intervention. For this reason, the MRR model clearly employs the evaluation theory which is a widely accepted and understood model.

Secondly, the MRR model is holistic, that is, it attempts to encompass all issues that can arise or are involved in the implementation of an EIA system. It is argued here that any conceivable issues relating to effectiveness, relevance, efficiency and sustainability of the EIA system can be distilled down to one or more of these three categories, that is, compliance, participation and capacity (or method, rights and resources).

Thirdly, the MRR model is specifically intended to reduce subjectivity in terms of what constitutes criteria for evaluating an EIA system. This is done by ensuring that the EIA system is measured not according to abstract ideas of an expert, but according to the fundamental principles on which it was built. The first general principle is that there is need for a specific set of steps which must be followed to ensure that the environment is protected. These steps are based on the consensus of stakeholders based on previous experience and rationale. The second basic principle is that stakeholders have a right to be involved in matters affecting their well-being. The last principle is that adequate resources are necessary to successfully implement an EIA system.

Another objectivity advantage is that the MRR model focuses to a large extent on measuring stakeholder experience as well as direct measurement of outcomes and outputs. This provides a triangulation and hence adds to the robustness of the analysis of effectiveness. Another point is that the MRR model emphasises formulation of specific indicators by which effectiveness can be measured. Another point is that the MRR model is adaptable, able to be customised to a single country situation or generalised across various jurisdictions for comparison purposes.

Another point is that, the focus on data collection using indicators enables the proponents and policy makers to be informed in terms of which impacts to give more attention,

where to cut costs and so forth. More importantly for the proponent, sustained data collection informs the entire risk management regime and provides opportunity to link EIA outcomes with other tools and activities such as environmental management systems (EMS).

Lastly, the conventional methods of data collection and statistical analysis can be easily applied when applying the MRR model. There is potential to use a wide array of statistical tools including testing for various hypotheses and trends analysis.

Limitations

There are also challenges with the MRR model. The main challenge is that although quantitative methods can be used with the MRR model, the model still falls short of directly addressing the inherent challenge of quantifying non-use environmental impacts as well as attribution.

Secondly, applying the model can be very costly depending on other factors. The process of collecting monitoring data based on a list of elaborate indicators is likely to result in additional costs for the proponent and the regulatory authority. However, the MRR model can be narrowed down to suit the situation and information flow is an unavoidable element of any successful intervention.

Because the MRR model focuses on collection of data with respect to implementation of EMPs and IMPs, it follows that the evaluation of effectiveness is dependent on the quality of the EMPs and IMPs, and hence on the robustness of the EIA studies. For example, if the EIA study does not identify all the reasonably anticipated impacts, then the effectiveness of the EIA system will be negatively affected by the missing or undocumented mitigation measures. Sound scientific studies are paramount for the MRR model to be effective.

Conclusion

This article set out to introduce a new model or approach for evaluating the effectiveness of EIA systems. The article shows that there is an alternative model which addresses some of the shortcomings of current models. Although the article does not provide a magic bullet to overcome the inherent challenge of quantifying some environmental impacts and the central problem of attribution, it leads into a new direction in which specific and to some extent universal indicators can be designed to provide a more comprehensive model for measuring the effectiveness of EIA systems.

In a nutshell, the MRR model relies on a framework derived from the founding documents of the EIA system (i.e. compliance, participation and capacity), applies the evaluation theory through use of indicators and baseline benchmarking, proposes compliance as a measure of substantive effectiveness of EIA systems especially in the post-certification phase (which is implementation of mitigation avoidance measures)

and proposes to build evaluation into the EIA system rather than applying evaluation to the EIA system.

The major recommendation of this article is to point towards further application testing of the MRR model, especially with respect to formulating and fine-tuning the indicators.

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Competing interests

The author declares that he has no financial or personal relationship(s) which may have inappropriately influenced him in writing this article.

Authors' contributions

The author conceptualised and adapted the MRR model from his previous research. The underlying theoretical framework, the indicators and the arguments to support the MRR model were drawn from literature review and the author's experiences as a researcher and a practitioner in the environmental management and development sectors.

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