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Effectiveness of EIA

The interminable issue of effectiveness: substantive purposes, outcomes and research challenges in the advancement of environmental impact assessment theory

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An analysis of studies of the outcomes of environmental impact assessment (EIA) indicates that its role in consent and design decisions is limited, due primarily to passive integration with the decision processes it is intended to inform. How much EIA helps sustainable development is largely unknown, but it is hypothesised that it is more than is typically assumed, through a plethora of causes, including emancipation of stakeholders and incremental change in the bureaucracy, companies and scientific institutions. To enhance the effectiveness of EIA, research should focus more on theory about the nature and operation of diverse causal processes, even though the concepts, methods and analytical challenges would be substantial.

Keywords: environmental impact assessment; effectiveness; theory; decision-making; sustainable development

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ENVIRONMENTAL IMPACT assessment (EIA) is a decision tool employed to identify and evaluate the probable environmental[1] consequences of certain proposed development actions in order to facilitate informed decision-making and sound environmental management (Glasson *et al*, 1999; Morgan, 1998; Sadler, 1996). Following its inception in the US National Environmental Policy Act (NEPA) of 1969, EIA spread globally with remarkable rapidity and is currently practised in more than 100 countries and by numerous bilateral and multilateral aid and funding agencies (Petts, 1999a).

The expeditious institutionalisation of EIA on an international scale made NEPA one of the most influential policy innovations of the 20th century (Bartlett, 1988; Caldwell, 1998). It would appear, however, that EIA offers more in theory than it has so far delivered in practice (McDonald and Brown, 1995; Sadler, 1996; Lawrence, 1997). Consequently, the ability of EIA to contribute to environmental governance in an era dominated by the management maxim of sustainable development has recently been questioned (Benson, 2003).

Concern about EIA practices has resulted in the progressive development of a substantial body of research on the issue of effectiveness. It is widely acknowledged that EIA legislation and practices rarely conform to idealised (and largely positivist and rationalist) models of the process (Bond and Wathern, 1999; Glasson *et al*, 1997; Barker and Wood, 1999; Rosenberg *et al*, 1981). However, this does not

necessarily mean EIA is *de facto* ineffective. The concept of effectiveness includes both substantive (that is, whether it achieves its purposes) and procedural (that is, whether it is undertaken according to established expectations) criteria (Sadler, 1996). Research effort has focused overwhelmingly on the procedural criterion (Ensminger and McLean, 1993; Frost, 1997; Petts, 1999a; Bond *et al*, 2004), even though the substantive criterion is the ultimate test of effectiveness (Doyle and Sadler, 1996). It can be argued, therefore, that one of the central paradoxes of EIA is that the issue of effectiveness has been, at best, only partially addressed by the research community.

The predilection for process- and procedure-oriented research is attributable in part to the origins and early evolution of this decision tool. EIA emerged from the vague aspirations for proactive and interdisciplinary environmental management contained in NEPA (see, for instance, Wathern, 1988). This legislation was primarily a political response to an upsurge in popular concern about the consequences of modern development trends and the patent failure of existing decision tools to address these concerns adequately (O'Riordan and Sewell, 1981; Petts, 1999a).

EIA thus originated from a political imperative, not from scientific theory (Lee *et al*, 1995), and practice predated the development of a detailed conceptual foundation. The focus on procedure also resulted from judicial interpretations of NEPA as essentially procedural legislation; that is, NEPA requires federal agencies to follow a set course of action rather than mandating a specific level of environmental protection (Lemons, 1995). More generally, procedural forms of EIA dominate global practices because of difficulties (legal, technical and consensual) in defining and implementing its substantive goals.

The limitations of a process- and procedure-led research agenda are increasingly recognised. The theory of EIA[2] is inadequately developed and detailed (Lawrence, 1994; 1997); restricted consideration has been given to the implications of decision theory (Nitz and Brown, 2001); and the substantive outcomes of EIA are largely uncertain (Caldwell, 1991). Furthermore, in the case of certain jurisdictions with comparatively advanced EIA systems (for instance, The Netherlands), some authors suggest that the principal constraints on effectiveness relate to issues of purpose rather than inadequate legislative provisions or poor practices (Deelstra *et al*, 2003).

Technical issues, whilst significant, may amount to less of a barrier to effective EIA than issues pertaining to its role and form in relation to societal debates that fundamentally concern values and priorities (Caldwell, 1991; Deelstra *et al*, 2003; Beattie, 1995). Implicit in this statement is an assertion that a comprehensive understanding of the purposes of EIA, and the causal processes that can be utilised to achieve these purposes, are prerequisites to effective practice (Doyle and Sadler, 1996; Cashmore, 2004). It is also important to recognise the inherent limitations of 'state-of-the-art' EIA: it is unrealistic to expect EIA to act as a tool for sustainable development unless its role within this concept has been comprehensively considered and incorporated into its theoretical foundations.

This article aims to contribute to enhancing the effectiveness of EIA by examining what is currently known about the substantive outcomes of EIA and analysing the consequential implications for the research agenda and theory advancement. The EIA literature can be criticised for a lack of scientific rigour in elucidating and analysing the values and judgements that underpin contested issues (Lawrence, 2003), such as evaluations of effectiveness.

This paper, therefore, commences with a comprehensive examination of the plurality of interpretations of the purposes of EIA that underpin (albeit predominantly implicitly) judgements on effectiveness. Research on the substantive outcomes of EIA is then concisely reviewed, and the broad implications for the research agenda and theory advancement are analysed. No attempt is made here to propose pragmatic refinements to EIA procedures or practices because such recommendations should be based on additional theorising and empirical research. This article focuses, instead, on developing recommendations for advancing the research agenda and theory of project-level EIA.

Defining the substantive purposes of EIA

It might be presumed, given that EIA is an established and globally practised decision tool, that a reasonable consensus exists concerning its purposes, and this is certainly the case at a superficial level. It is broadly accepted that the basic intention of EIA is to anticipate the significant environmental impacts of development proposals before a commitment is made to a particular course of action (Morgan, 1998; Wathern, 1988; Wood, 2003). The information generated by this predictive process contributes (albeit in a variety of ways) to the environmental design of development proposals and the formulation of decisions on whether, and potentially on what terms, development consent should be granted.

Since the late 1980s, these goals have increasingly been portrayed as the proximate aims of EIA (Sadler and Jacobs, 1989; Sadler, 1996). In the longer term, anticipatory assessments should collectively contribute to a more sustainable form of development, wherein an equitable balance is achieved between economic, social and environmental imperatives (Glasson *et al*, 1999). These are labelled the substantive purposes of EIA in this article.

The substantive purposes of EIA are not considered explicitly in greater detail in most of the literature. However, they have been addressed indirectly as components of debates on procedural,

The intention of the analysis is to promote broader recognition of the multifarious interpretations of EIA's substantive purposes, and the consequential implications for evaluating effectiveness, theory advancement, and the research agenda

methodological and quality issues. It is when more detailed consideration is given to the precise meaning of these superficial statements of purpose that the consensus starts to disintegrate.

The following discussion reviews and summarises the main principles of interpretations concerning the purposes of EIA evident in the literature. The discussion is normative: no attempt is made to identify an 'optimal' conception because there can be no correct choice among what are essentially competing philosophical constructs. Rather, the intention of the analysis is to promote broader recognition of the multifarious interpretations of EIA's substantive purposes that underpin the literature, and the consequential implications for evaluating effectiveness, theory advancement, and, hence, the research agenda.

In reality, all interpretations are likely to incorporate numerous dimensions, but the discussion broadly focuses on three key defining characteristics: whether EIA and decision-making are rational or political exercises (the 'rationality dimension'); whether the purpose of EIA is to inform or influence decisions (the 'decision dimension'); and, the relationship between EIA and sustainable development (the 'sustainability dimension').

The discussion of interpretations is based on the published literature and so does not reflect the perceptions of all EIA stakeholders. It is important to recognise that stakeholders who do not contribute to this literature will view the purposes and operation of EIA in different ways, reflecting, in part, their position and role within the institutional system; their position within society; and, their previous experiences (Morgan, 1998) (see Table 1 for examples). This analysis, therefore, focuses specifically on one defined, but diverse, stakeholder group — influential commentators (be they academics or practitioners), the cohort that principally contributes to, and arguably largely defines, the research agenda.

Multidimensionality of purposes

EIA is often characterised as a tool for mitigating the adverse consequences of development actions by ensuring environmental factors are considered during the project design cycle (for instance, Wathern, 1988; Brown and Hill, 1995). This may be equated, from a minimalist perspective, to the identification of relevant 'end-of-pipe' mitigation measures or, more holistically, to avoiding and minimising impacts by considering environmental engineering principles throughout the design cycle (for instance, McDonald and Brown, 1995). The purposes of EIA are also interpreted by some authors to include provision for comprehensive environmental management during the full lifecycle of a development action (Nitz and Holland, 2000).

Most frequently, however, EIA is envisaged as a tool to facilitate informed decision-making (for instance, Weston, 2000; Department of the Environment, Transport and the Regions, 1999), principally in relation to the consent (project authorisation) decision but also for development design. No assumption is necessarily made that the resultant decisions will be more environmentally sensitive or socially just than would otherwise have been the

Table 1. Potential interpretations of EIA by stakeholders who do not contribute to the primary literature

Stakeholder	Potential interpretation of EIA	Feasible determinants of effectiveness
Local resident	A public relations tool used by developers and politicians to justify decisions	Substantive changes in the design Abandonment of project
Non-governmental organisations	A tool to improve stakeholder involvement in decision-making and make decision-makers more accountable	Level and amount of public involvement Changes to the *status quo*
Developer	An unnecessary, additional bureaucratic hurdle undertaken, at the developer's expense, for reasons of political expediency	Cost Time taken Gaining of planning consent
Politician	A process that demonstrates to the electorate that environmental concerns are important to, and being addressed by, the Government	Poll ratings for environmental issues Maintenance of the *status quo*
Environmental economists	A theoretically deficient response to public and political resistance to place economic values on issues affecting human welfare	Quantification of impacts Rationality of process and decisions

Source: Adapted from Morgan (1998), Glasson et al (1999) and Bateman (1999)

case. Rather, the goal of informing decision-making is often perceived as axiomatic to the facilitation of rational decisions (for instance, Glasson *et al*, 1999). This reflects the dominance of rationalist decision theory during the formative years of EIA practice (Nitz and Brown, 2001) and the broad appeal of the concept of rationality within most scientific paradigms (Gamble, 1981).

A rational decision is defined as one in which the option that most satisfactorily achieves the stated objective(s) is selected, based on a complete understanding of the consequences of all relevant alternatives and consensus about the goals that govern the decision (Simon, 1957; Nilsson and Dalkmann, 2001). Thus, much writing on EIA is based (albeit usually implicitly) on an assumption that passive provision of accurate predictions on the environmental consequences of a wide range of alternatives, on its own, will lead to better (that is, more rational) decisions (Krønøv and Thissen, 2000).

According to this view, the purpose of EIA is to provide focused scientific analyses on environmental and social consequences (Rosenberg *et al*, 1981; Mostert, 1996; Munn, 1979); the way in which the information is interpreted and used by decision-makers, and other stakeholders, is outside the remit of scientific enquiry (Royal Commission on Environmental Pollution, 1998), and hence is not the concern of EIA practitioners (Beanlands and Duinker, 1983). The effectiveness of EIA is determined, therefore, by factors such as: rigorous undertaking of the key stages in the EIA process; an emphasis on quantification of data, and in particular impact predictions; and, presentation of the EIA findings in a logical, coherent and comprehensible manner (Lee *et al*, 1999).

Rationalist theory is normative — it describes how decision-making *should* take place, not necessarily how it *does* take place (Weston, 2000; Krønøv and Thissen, 2000) — and there is considerable empirical evidence that decision-making in the real world does not conform to the exacting ideals of rationalism (Nilsson and Dalkmann, 2001; Phillips, 2002). This does not necessarily mean that rationalist theory is invalid or of no practical use (just because the goal has not been achieved does not mean it should not be pursued (Caldwell, 1991)) but rational decision theory has been dismissed by some theorists as unrealistic, given real world constraints (for instance, Simon, 1957; Lindblom, 1959).

Alternative conjectures on how decisions are made in practice, and their attendant implications for EIA theory, have only recently begun to receive detailed consideration, primarily as a consequence of the increasing contribution to the literature made by social scientists. Instead, rejection of the rationalist theory (implicitly or explicitly) typically has been based on observations of the political character of decision processes and the inevitability of value-judgements in science (for instance, Caldwell, 1991; Beattie, 1995; O'Riordan, 2001).

The outcomes of political decisions often are difficult to predict because they are reached through a process that involves trade-offs, compromise and stakeholder interactions, and may reflect power relationships and vested interests. A strict separation of fact and values may also be considered an impossibility because science is said to be governed by paradigmatic rules concerning what constitutes knowledge and legitimate methods of deriving knowledge (Kuhn, 1970; O'Riordan, 2001).

Consequently, it is highly improbable that decisions made in political arenas and informed by science will be truly rational. Thus, Bartlett (1986, page 107) interprets EIA as an attempt to "influence government activities by changing — subtly and yet profoundly — the decision structures and evaluative standards" of decision processes. In this interpretation, EIA is less about information provision. It is a tool for influencing outcomes: by altering the norms and values that govern decision-making; by facilitating purposeful deliberation on environmental policy issues; and, by making decisions transparent and decision-makers accountable (O'Riordan and Sewell, 1981). The effectiveness of EIA, therefore, is assessed by criteria such as: the substantive influence on the actions and attitudes of stakeholders; the inclusiveness of decision processes; and legitimisation of social, cultural and ecological values (O'Riordan, 2001; Bartlett and Kurian, 1999; Vanclay, 2003).

Bartlett (1986) argues that the ultimate purpose of EIA remains unavoidably based on a concept of rational decision-making, but not the simplistic conception of public administration theory. Rather, EIA is intended to achieve 'ecological rationality' — preservation of the ecological foundations of human society.

Many other authors interpret the main aim of EIA more broadly, viewing it as an important element of sustainable development strategies (Sadler, 1996; Glasson *et al*, 1999; Petts, 1999b). Yet despite the fact that sustainable development appears widely accepted as a, if not the, principal purpose of EIA, the implications of this concept, with few exceptions, have received minimal consideration in the literature. It could be argued that the maxim of sustainable development has been adopted more as a catch phrase than a purposeful goal.

One likely reason why the role of EIA in promoting sustainability principles has received limited consideration is that the concept of sustainable development is extremely difficult, if not inherently impossible, to define (O'Riordan, 1993). There is broad consensus that the generic aims of sustainable development are inter- and intragenerational equity (for instance, World Commission on Environment and Development, 1987; Pearce *et al*, 1989). However, depending on an individual's ideology, these goals can be equated to (Turner, 1993):

- conservation of the aggregate capital stock (natural, human and physical) based on an assumption

of perfect substitutability among all forms of capital (so-called very weak sustainability);
- conservation of the aggregate capital stock and some proportion of essential ecological life support services and functions (so-called critical natural capital) (weak sustainability);
- strict conservation of critical natural capital and conservation of the aggregate stock of all other natural capital (strong sustainability); or,
- strict conservation of all natural capital, with only the net annual increment of renewable resources available for exploitation (very strong sustainability).

Furthermore, the principles of sustainable development are frequently interpreted as more relevant to strategic tiers of decision-making than development planning at the project level (for instance, Feldmann *et al*, 2001; Benson, 2003; Emmelin, 1998). The fundamental issue, therefore, is not whether EIA should contribute to sustainable development, but the interpretation of sustainable development that underpins EIA and the inherent limitations of a project-based assessment tool.

Sadler (1996; 1999), in one of the few detailed considerations of the implications of sustainable development for EIA theory and practice, presents a model of EIA based on, what he terms, a strong sustainability perspective. EIA is viewed as a "front line" instrument for sustainability (Sadler, 1999, page 12) because of its potential to help operationalise the principle of intergenerational equity (Sadler and Jacobs, 1989). EIA should be employed to ensure critical natural capital is only destroyed in cases of overriding social need and that aggregate stocks of natural capital are maintained or increased. To facilitate development whilst conserving 'non-critical' natural capital, the specification of 'in-kind' compensation, to make good capital losses with broadly equivalent replacements, is a central element of the EIA process (Sadler, 1996).

George (1999), in contrast, emphasises the importance of EIA in promoting principles of environmental governance through its role in widening access to decision processes. The effectiveness of EIA thus might be assessed according to such criteria as: the maintenance of the absolute stock of critical natural capital and the aggregate stock of all other natural capital; the internalisation of externalities; protection or enhancement of source and sink capacity; and the inclusiveness of decisions (Sadler, 1999; George, 1999).

Substantive outcomes of EIA

The principal findings of empirical research concerning the substantive outcomes of EIA identified through a review of the literature are summarised in Table 2. The data focus on the contribution of EIA (variously defined) to consent and design decisions (the 'decision dimension') because there is superficial consensus on these purposes and a paucity of research on the substantive contribution of EIA to sustainable development goals (the 'sustainability dimension').

It is difficult to formulate generalisations based on these results because of, amongst other things, differences in research methodologies, varying interpretations of the way in which EIA should contribute, and the limited quantity and restricted geographical spread (that is, predominantly 'Eurocentric') of the research. Nevertheless, the data clearly indicate that the majority of stakeholders surveyed believe EIA does influence consent and design decisions, but to varying degrees.

In relation to the influence of EIA on consent decisions it would appear that, while EIA does affect these decisions, the contribution typically made is moderate (that is, categories such as 'some', 'important' or 'medium') rather than substantial. A general trend of moderate influence is also evident in research concerning the effect of EIA on project design, although the results are more ambiguous. A number of studies have found that modifications are made to project design, either before or after submission of the EIA report, in approximately one half to two-thirds of cases in the UK (Kobus and Lee, 1993; Lee *et al*, 1994; Frost, 1997; Wood and Jones, 1997).

It appears that this might be broadly representative of practices in a number of jurisdictions. For example, stakeholders surveyed in the International Study of the Effectiveness of Environmental Assessment indicated that EIA was felt to be 'very' or 'moderately' influential in affecting project design in 56% of cases and was found to have caused design changes in 52% of plans and projects sampled in a study of practices in The Netherlands (Sadler, 1996; ten Heuvelhof and Nauta, 1997).

Evaluations of the effectiveness of EIA, however, appear considerably more favourable when based on broad definitions of substantive outcomes (for instance, contributing to consent and design decisions) than when assessed against more specific, result-oriented criteria (Emmelin, 1998). For example, Wood and Jones (1997) report that more than one-third of planning officers stated that environmental

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Table 2. Contribution of EIA to decision-making

Study	Jurisdiction	Basis of analysis	Contribution to the consent decision	Contribution to project design
Kobus and Lee, 1993	UK	22 EISs reviewed; 19 questionnaire responses; and an unspecified number of telephone interviews	0% 'very important'; 55% 'important'; no further data	47% 'minor changes'; 11% 'major changes'; no further data
Lee *et al*, 1994	UK	Utilised results of the above study in combination with previously unpublished work giving a total sample of 47 projects	44% 'important'; no further data	51% of projects modified; no further data
Nelson, 1994	UK	30 consent decisions studied by questionnaire survey	23% 'much assistance'; 60% 'some assistance'; 14% 'little assistance'; 3% 'no assistance'[a]	Not assessed
Ministry of Housing, Spatial Planning and the Environment and Ministry of Agriculture, Nature Management and Fisheries, 1994	The Netherlands	Review of 10 EIAs and interviews with competent authority and development initiator	Visible effectiveness: 20% directly or indirectly effective; 50% ineffective; 30% uncertain Apparent effectiveness: 40% directly or indirectly effective; 50% ineffective; 10% uncertain Perceived effectiveness: 60% directly or indirectly effective; 20% ineffective; 10% uncertain; 10% no authorisation decision[b]	50% influence on project development; 40% no influence on project development; 10% not known
Jones and Wood, 1995	UK	10 public inquiry decisions studied by questionnaire survey of planning inspectors and interviews with various stakeholders[c]	20% 'major weight'; 40% 'some' or 'moderate weight'; 30% 'considerable weight'; 10% 'substantial weight'[d]	Planning inspectors: 0% of projects modified prior to, or during, the inquiry on the basis of EIA findings Developers: 10% of projects modified prior to, or during, the inquiry on the basis of EIA findings
Netherlands Commission for EIA, 1996 (cited in Glasson, 1999)	International survey	Questionnaire responses received from 14 jurisdictions	Not assessed	Approved with no/minor modification: 0% of projects in 1 case; 1–20% in 4 cases; 41–60% in 1 case; 61–80% in 2 cases; 81–100% in 6 cases Approved with moderate/major modification: 0% of projects in 3 cases; 1–20% in 5 cases; 41–60% in 1 case; 61–80% in 2 cases Rejected: 0% of projects in 6 cases; 1-20% in 8 cases
Sadler, 1996	International survey	324 completed questionnaires received from EIA stakeholders: 170 responses from members of the International Association of Impact Assessment, with the remainder coming from EU EIA networks, UK local authorities and consultants, and New Zealand and Australian practitioners	23% 'very influential'; 46% 'moderately influential'; 25% 'marginally influential'; 2% 'no influence'	Redesign of proposals: 14% 'very influential'; 42% 'moderately influential'; 32% 'marginally influential'; 8% 'no influence' Siting of proposals: 12% 'very influential'; 36% 'moderately influential'; 33% 'marginally influential'; 15% 'no influence'

(*continued*)

Table 2 (*continued*)

Study	Jurisdiction	Basis of analysis	Contribution to the consent decision	Contribution to project design
Wood *et al*, 1996	Europe	Analysis of 18 EISs undertaken in the UK (6), Germany (6) and Spain (6)	Not assessed	Modifications made in 95% of cases 75% of UK modifications of 'major significance'; 'most' German modifications of 'moderate significance'; 'most' Spanish modifications of 'minor significance'[e]
Department of the Environment 1996	UK	Interviewed 15 planning officers and 22 consultees	Planning officers: 20% 'much influence'; 60% 'some influence'; 20% 'little' or 'no influence'; 0% 'don't know' Consultees: 5% 'much influence'; 32% 'some influence'; 27% 'little' or 'no influence'; 36% 'don't know'	Not assessed
ten Heuvelhof and Nauta, 1997	The Netherlands	More than 600 telephone 'questionnaire' responses from EIA stakeholders for 100 projects	Direct impact: 79% 'clear impact' (52% impact on development design and 68% impact on opinions); 21% no impact Indirect impact: 65% indirect impact; 35% no indirect impact[f] Net beneficial impact: 14% 'large impact' 26% 'reasonable impact'; 30% 'small impact'; 30% 'no impact'[g+]	
Wood and Jones, 1997	UK	40 consent decisions studied by reviewing relevant documentation and interviewing planners, developers and consultants	35% 'substantial' or 'considerable influence'; 26% 'some' or 'moderate influence'; 29% 'marginal influence'; 5% 'no influence'; 5% 'no comment'[h]	21% of projects modified before or after EIS published; 31% modified solely prior to EIS publication; 16% modified solely after EIS submission; 32% not modified
Gwilliam, 2002	England and Wales	58 questionnaire responses from planning officers in England and Wales. Follow-up telephone interviews with 10 planning officers	28% (67%) 'large influence'; 46% (29%) 'medium influence'; 24% (2%) 'small influence'; 2% (2%) 'no influence'[i]	Not assessed

Notes:
[a] Level of assistance provided by the EIA findings in reaching the consent decision
[b] Key: Visible effectiveness — impact reflected in project documentation and related sources; Apparent effectiveness — impact evident in documentation and from reconstructing the case; Perceived effectiveness — interpretation(s) of effectiveness made by stakeholder(s)
[c] Subset of the sample discussed in Wood and Jones (1997)
[d] Weight given to EIA findings in recommendations made by planning inspectors
[e] Different researchers examined practices in each of the three countries considered. Although a standardised review method was used, there is potential for inconsistency in the interpretations of the nature and extent of modifications. The results from a number of other Member States detailed in the annexes to this report are not considered here because of concerns about the methodology used and the accuracy of results
[f] An indirect impact was defined as one where EIA had an impact on processes other than those that it was undertaken for (for instance, capacity development or changing value systems)
[g] Net beneficial impact of EIA taking into consideration whether added value of EIA for decision-making processes adequately compensated for the costs and time involved. Sample of 98 EIAs because two development initiators were unable to answer the question
[h] Results relate to planning officers' perceptions of the weight given to EIA findings in drawing up their recommendations
[i] Those figures not in brackets relate to the influence EIA has in practice compared with (those figures in brackets) perceptions of the influence EIA should have

issues were the overriding consideration in decision-making and EIA had a 'substantial' or 'considerable' influence on their recommendations (37% and 35%, respectively).

Yet in only one case (3%) did a planning officer believe the consent decision would have been reversed if an EIA had not been undertaken. A substantial number (47%) of planning officers felt that EIA made no difference at all to the consent decision, whilst the remainder (50%) suggested that, although the decision would not have changed, EIA produced other benefits. These benefits pertained to the provision of additional information for consideration in decision-making and the provision of information that could be used to establish consent conditions.

These findings are broadly reflected in the results of the International Study of the Effectiveness of Environmental Assessment (Sadler, 1996). Overall, 69% of respondents thought EIA had a 'very' or 'moderately' influential effect on decisions. The data in Table 3, however, illustrate that EIA was considered relatively inefficient at ensuring: impacts were minimised; irreversible impacts were avoided; and sustainable development was facilitated. Furthermore, only in a relatively small proportion of cases was EIA considered 'always' successful at informing decisions (28%) and preventing damage that would otherwise have occurred (16%). This study also highlighted the important role of EIA in establishing conditions governing the construction and operation of developments: EIA was thought to be 'very' or 'moderately' influential in establishing consent conditions by almost three-quarters of respondents (72%).

Similarly, EIA may result in the modification of many projects, but there is evidence that the modifications are relatively minor in many instances. Environmental analyses appear to result predominantly in 'fine tuning' of designs and proposals for impact mitigation, rather than fundamentally affecting such issues as location (see, for instance, Kobus and Lee, 1993; Sadler, 1996). Furthermore, research has shown that design changes are made after the publication of the EIA report in a significant number (50%) of cases (Frost, 1997). These design changes might render obsolete mitigation proposals made as a result of the EIA process.

Nevertheless, the actual influence of EIA on project design might be more substantial than is implied by these data, as there is evidence that the presence of an effective EIA system acts as a deterrent against proposals for intrinsically environmentally unsound developments (Netherlands Commission for EIA, 1996; Glasson, 1999). It is thus somewhat paradoxical that, whilst this would indicate EIA is having a significant preventative effect, such an influence would be extremely difficult to quantify accurately.

It is important to emphasise that the accuracy of data concerning the influence of EIA on decisions is uncertain, given that there can be no objective quantification of influence[3]. Furthermore, there is evidence that EIA stakeholders may overstate the influence of EIA when asked questions concerning its broad outcomes. For example, Wood and Jones (1997) observed that, where EIA was stated to have more than a marginal influence on a decision, this was not reflected in decision-makers' summary reports on development proposals. Moreover, despite environmental factors being deemed the single most important factor in the consent decision, the eventual impact of EIA on consent decisions, as discussed previously, appears limited (Wood and Jones, 1997).

Decision-based EIA and EIA-based decisions

The literature indicates that the influence of EIA on consent and design decisions in the UK has been "gradual rather than revolutionary" (Wood and Jones, 1997, page 1254), and there is evidence (mostly anecdotal rather than empirical) that this conclusion is probably representative of the influence of EIA in a number of other jurisdictions (Sadler, 1996; Lee, 1995; Wood, 2003). It appears that, rather than altering the substantive outcomes of authorisation decisions or avoiding irreversible perturbations, EIA exerts a subtler influence by affecting stakeholders' perceptions through the provision of information. It is also used, and perhaps with

Table 3. Contribution of EIA to environmental management

	Always (%)	Often (%)	Sometimes (%)	Seldom (%)	Never (%)
Contributes to more informed decision-making	28	42	27	3	0
Prevents environmental damage/ social losses beyond what would be achieved without assessment	16	38	38	6	1
Minimises impacts of development 'to as low as reasonably practical'	5	28	44	19	2
Avoids irreversible changes	3	15	50	25	4
Ensures development is placed on a sustainable basis	4	15	39	31	9

Source: Sadler (1996)

increasing regularity, to establish the parameters within which a development can operate (Wood and Jones, 1997).

Comparable findings are evident in research on the influence of EIA on project design: rather than promoting genuine consideration of a wide range of fundamental alternatives, EIA, at least in some jurisdictions, results in comparatively modest 'fine tuning' of developments[4]. Thus, it often appears to operate more as a tool for negotiation than a preventative mechanism, in that it assists decision-makers superficially to reduce the negative consequences of development and maximise the benefits (Abaza, 2000).

This analysis supports assertions made by Bartlett and Kurian (1999) and McDonald and Brown (1995) that EIA functions predominantly as a passive tool for information provision and, as such, is relatively inefficient and ineffective at proactively and substantially influencing environmental decision-making. Yet there is limited evidence that decision-makers believe EIA should have a significantly greater influence than it does at present (Gwilliam, 2002).

These findings do not necessarily mean that an information provision model of EIA based on rational decision theory is *de facto* ineffective. Conversely, neither does the existing research necessarily support the oft-cited conclusion that EIA is having a largely positive influence, but its effectiveness could be improved through such factors as enhanced resource allocation, process strengthening and commitment to methodological innovation (for instance, Sadler, 1996; Doyle and Sadler, 1996; Wood *et al*, 2000; Barker and Wood, 1999). As Emmelin (1998, page 139) provocatively suggests "[w]hat else would one expect an emerging profession to state?".

Improving centrality of EIA to decision processes

Rather, it is hypothesised that the primary barriers to enhancing the contribution made by EIA to project design and consent decisions are its passive integration with decision processes (in particular, the emphasis placed on the production of a stand-alone EIA report in most jurisdictions) and the parochialism of EIA research. The importance of improving the centrality of EIA to decision processes has been recognised for some time (for instance, Wood, 2003), but too often this has been viewed as a problem to be addressed through increased political support (Wood, 2003), reform of planning practices (McDonald and Brown, 1995) or stronger EIA legislation (Leu *et al*, 1996).

Whilst these are valid assertions, there is also a need to consider how EIA itself can evolve to interact and interface more effectively with decision processes. Greater research attention must be given to such factors as: the nature and form of decision processes; the needs and requirements of decision-makers, in terms of input timings and types; and, the broader institutional, political and socio-cultural context in which decision-making occurs. The development of decision-oriented theory, it is suggested, is an essential, but rarely considered, prerequisite to effective practices.

The limited amount of research attention given to the interactions and interfaces between EIA and decision processes is clearly evident in the literature. Although the rationalist underpinnings of EIA have always been acknowledged, albeit generally in a low key manner, it is only relatively recently that the strengths, limitations and implications of competing decision theories have been purposefully contemplated (for instance, Weston, 2000; Nilsson and Dalkmann, 2001; Krønøv and Thissen, 2000; Bond, 2003).

It is self-evident that the development of decision-oriented environmental assessment practices assumes greater significance at strategic tiers of decision-making (particularly at the policy level), but the principle is equally applicable to environmental decision-making for individual projects. This should not be interpreted as an argument against rationalist theory. As a minimum, however, proponents of rationalist theory must develop a more comprehensive appreciation of real-world decision processes if only, perhaps, to improve their rationality (Emmelin, 1998).

EIA procedures thus have been based overwhelmingly on a largely uncritical and implicit application of one particular decision theory. Similarly, the scientific model underpinning EIA has evolved as a consequence of the dominance of certain philosophies of science amongst individuals who contribute to the literature (Cashmore, 2004). The needs of decision-makers have received minimal attention in the development of process, procedures and methods, and the resultant theory of EIA is unlikely to be particularly efficient or effective at contributing to decision processes.

There is, for instance, a limited amount of evidence that EIA does not necessarily satisfy all the information requirements of consent decision-makers and that this problem is not entirely a consequence of poor quality work, but arises as a result of diverging expectations about the information required. Kobus and Lee (1993) found that, although planning

The needs of decision-makers have received minimal attention in the development of process, procedures and methods, and the resultant theory of EIA is unlikely to be particularly efficient or effective at contributing to decision processes

officers concluded that 70% of EIA reports were of satisfactory quality, less than a quarter (23%) of these documents were deemed satisfactory when assessed against the criteria of the Lee and Colley Environmental Statement Review Package (Lee and Colley, 1992).

The occurrence of consultation with the planning officer on the scope of the analysis appears to have significantly affected their perception of quality, whereas such differences were not recorded in results obtained using the Lee and Colley Review Package. Nevertheless, planning officers still requested additional information in approximately 70% of cases, seemingly regardless of their perceptions concerning the adequacy of the documentation.

A similar quantitative trend of requests for additional information is evident in the research undertaken by Wood and Jones (1997). Despite nearly three-quarters of planning officers indicating that the EIA report was adequate for decision-making purposes, further information was requested in 68% of cases. A correlation was found to exist in this study between perceived quality and requests for additional information: a developer was more likely to be asked for further information if the planning officer judged their EIA report unsatisfactory.

If it is accepted that EIA is a process for influencing design decisions (implying that some degree of integration is required between EIA and design processes) then EIA research can also be criticised for focusing excessively on the consent decision and neglecting the requirements of developers and their design teams. It is recognised that administrative procedures in many jurisdictions limit EIA to the role of an audit tool based implicitly on a false assumption that the design process will remain in stasis while the EIA report is being prepared (McDonald and Brown, 1995; Brown and Hill, 1995). The resultant scientific 'snapshot', no matter how comprehensive or detailed, can rapidly become redundant because of the iterative nature of project planning (Frost, 1997). It is also highly unlikely that this model of EIA makes a particularly efficient or effective contribution to sustainable environmental design and engineering practices (Abaza, 2000).

It is not suggested that EIA theorists have been entirely unaware of, or unresponsive to, the needs of decision-makers. There has been some speculation in the literature about how EIA can better address the requirements of decision-makers (and particularly those responsible for consent decisions); a major international conference (IAIA'02) was convened around this issue in 2002. Suggestions for improvements cover procedural (for instance, the importance of scoping), technical (for instance, the development of improved modelling techniques) and communication issues (for instance, the importance of concise reports and writing as a narrative) (Sadler, 1996; Duinker, 1985; Bendix, 1984; Miller, 1984; Gwilliam, 2002; Crawley, 2003).

Yet the suggestions appear to be based primarily on the perceptions of the EIA community, with little empirical investigation having been undertaken of how they are received by decision-makers themselves. The EIA research literature, it can be argued, has also failed to make adequate use of research conducted in related disciplines, but has instead been dominated by environmental assessment practitioners "communicating amongst themselves" (Nitz and Brown, 2001, page 329).

There has been, for example, a long running debate in the literature concerning whether quantitative or qualitative impact predictions most efficiently and effectively serve decision-makers' needs (Duinker, 1985; Bailey and Hobbs, 1990; Walters, 1993; Miller, 1993). The dominant view is that impact predictions should be quantified wherever possible, and the vague and imprecise predictions contained in many EIA reports consequently have been interpreted as an important failing of EIA practice (for instance, Rosenberg *et al*, 1981; Beanlands and Duinker, 1983).

Paradoxically, however, there has been no detailed research on precisely how the nature of impact predictions affects the attitudes and actions of decision-makers. It is conceivable, for example, that the most significant contribution to environmental design will result from the provision of pragmatic and timely comparative evaluations of design options rather than rigorous, quantitative evaluations focused on the preferred alternative.

Importance of stakeholder involvement

The importance of stakeholder involvement to decision-makers in the UK is an issue that clearly emerges from certain studies. Research has shown that consultation (to use the researchers' phraseology) on an EIA report and a planning application are generally perceived as slightly more influential than the information contained in the EIA report (see Figure 1) (Kobus and Lee, 1993; Wood and Jones, 1997). There is a limited amount of evidence that the influence of consultation declined over time (Lee *et al*, 1994; Wood and Jones, 1997), which might suggest that reliance on consultation reflected early recalcitrance to EIA in the UK, but further research would be required to establish whether this trend continued after the initial years of EIA implementation.

The emphasis placed on stakeholder involvement might reflect decision-makers' desire to ensure that democracy is 'seen to be done'. It might also reflect the issue of trust to a certain degree. Decision-makers possibly place greater trust in the opinions of consultees, who might be viewed as 'independent' and 'expert' in certain cases, than information contained in a report sponsored by the developer. Gwilliam's (2002) research provides support for this hypothesis in that it indicates that many decision-makers treat the results of EIA circumspectly because of concerns about bias.

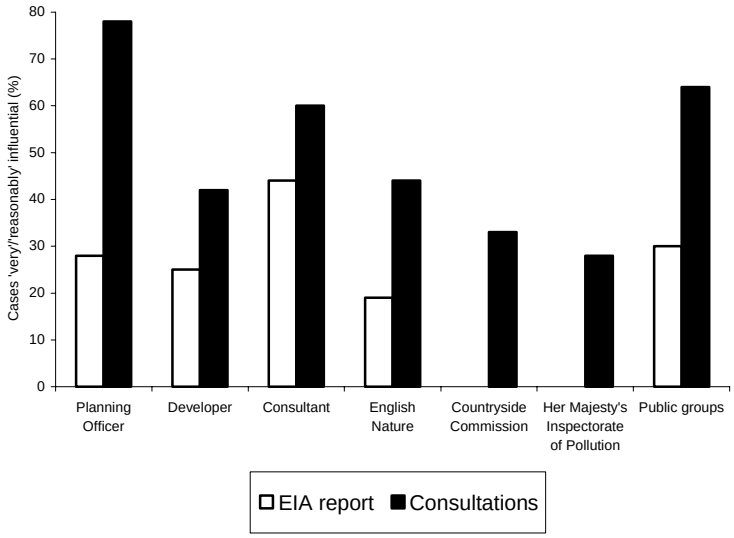

Figure 1. Influence of EIA reports and consultation on consent decisions
Note: Consultees include equivalents in Scotland and Wales in each case
Source: Wood and Jones (1997**)**

However, decision-makers have been found to place greatest emphasis on the results of consultation with major interest groups and local action groups, rather than (technical) government agencies (Wood and Jones, 1997). The dichotomy between expert and lay input into the EIA and consent decision processes might not be as significant as has sometimes been supposed (Liebow, 1993). This would seem to support the general trend toward flexible and participatory EIA systems (EIA as a civic science), where subjective opinions and values are given much greater priority in environmental governance (Weinberg, 1972; O'Riordan, 2001; Shepherd and Bowler, 1997; Deelstra *et al*, 2003; Wilkins, 2003).

EIA-oriented decisions

In addition to the requirement to develop decision-oriented EIA theory, there is a concurrent need for purposeful consideration of capacity development in decision-making institutions; that is, the development of EIA-oriented decisions. Legislative provisions for EIA often have been introduced without due consideration of their institutional requirements in terms of organisational structure, staffing and capacity development (Morgan, 1995; Dixon *et al*, 1997; Duthie, 2001). This undoubtedly limits the influence of EIA on decision-making, but frequently institutional requirements have been viewed as an issue to be addressed by politicians and bureaucrats (Wood, 2003), not EIA theorists.

Yet it is conceivable that there are instances in which developing institutional capacity might represent a more appropriate strategy for enhancing effectiveness than reform of EIA practices. For example, a frequently cited recommendation for good practice is to ensure EIA reports are written concisely and in a style that can be understood by the plethora of stakeholders affected by economic development (for instance, Department of the Environment, 1995; Weiss, 1989). This is partly a response to the encyclopaedic EIA reports produced in the USA to mitigate against litigation (Wathern, 1988) and the complex technical phraseology that frequently is employed in these documents (Gallagher and Patrick-Riley, 1989; Sullivan *et al*, 1996).

Research shows that decision-makers rarely read the entire EIA report and that length and language are issues (Glasson *et al*, 1999; Crawley, 2003). Gwilliam (2002), for instance, found that decision-makers felt EIA reports were too long in 44% of cases and the principal constraints that prevented them reading more were time (41%) and technical expertise (46%). Focused documentation is extremely important, but it might be that improved resource allocation (in terms of the availability and expertise of personnel) is a more meaningful way of enhancing the substantive contribution of EIA to decision-making than concentrating solely on reducing complexity or length.

At a more fundamental level, however, the restricted contribution of EIA to decision processes, in part, might result from decision-makers' limited understanding of its purposes and potential. The 'moderate' contribution of EIA to decisions (see the previous section) could reflect an interpretation of EIA as a tool to provide additional environmental information. Improving effectiveness, therefore, might involve replacing the image of EIA as a tool for passive provision of additional information with that of a positive, dynamic and creative tool for environmental management (Abaza, 2000; Brown and Hill, 1995; Clark, 1999).

Beyond decision-oriented EIA: sustainability

It is not contended, as Deelstra *et al* (2003) suggest, that research should focus solely on the development

of decision-oriented EIA theory. A detailed and rich understanding of decision processes is a critical prerequisite to more effective practices, but there are many other ways in which EIA can contribute to sustainable development goals.

Culhane *et al* (1987) describe two causal processes, other than the passive provision of scientific analyses, that socially or institutionally amplify the effects of EIA: (1) the internal reform model, wherein capacity development in environmental expertise affects the politics and dynamics of government agencies; and, (2) the external reform model, where increased transparency and accountability to 'external' stakeholders force, or reinforce, change in government agencies. These causal processes are elaborated on by Bartlett and Kurian (1999) to include such factors as the symbolic impact of EIA (in what they term the symbolic politics model), the corporate impact of EIA (the political economy model), and the impact of EIA on value systems in government agencies (the institutional model).

Although Culhane *et al* (1987) and Bartlett and Kurian (1999) propose a series of distinct models, these models are by no means mutually exclusive. The most substantial influence of EIA, in terms of its contribution to sustainable development, is likely to result from deliberate targeting of all the causal processes identified in the various models (Cashmore, 2004). Indeed, it has been suggested that at present the indirect influence of EIA on environmental management (by stimulating changes in institutional environmental capacity, politics, values and accountability) is more significant than its direct influence on decision processes (Culhane, 1974; Bartlett, 1986; Caldwell, 1991; 1993).

Table 4 provides a broad indication of the measurable scale of institutional change in the UK attributable to EIA legislation. Thus, McDonald and Brown (1995, page 486) conclude that, even if EIA was ineffective in contributing to decision processes, which they contend it is not, "its continued existence is more than justified in the immediate future through the educative and stimulative role".

Yet EIA can, and arguably does, affect the actions and activities of society in a range of additional (and largely intangible) ways. Foremost amongst these is its role in promoting stakeholder empowerment, through enhanced stakeholder involvement (in terms of amount and type) in environmental decision-making. The process of empowerment potentially may have far-reaching and self-reinforcing consequences.

Its role in increasing transparency and accountability is well recognised (O'Riordan and Sewell, 1981), but there are additional consequences. For example, through visioning (that is, allowing society to envisage the type of future it wants, free of all impediments (Meadows *et al*, 1992)) EIA might also contribute to changes in society's expectations of democracy and development. Nonetheless, the degree to which this is considered a positive contribution to sustainable development will depend on an individual's ideology.

Table 4. Discernible institutional consequences of EIA in the UK

Institution/sector	Discernable changes
Environment Agency	Approximately 150 planning liaison staff working on EIAs external to the Agency
	Approximately 25 staff working on EIAs conducted by the Agency
Local planning authorities	472 authorities, each needing to deal with EIA and having staff to do so
Environmental consultancies	280 consultancies with specific expertise in EIA in the UK
Planning consultants	431 organisations out of 450 on the RTPI (Royal Town Planning Institute) database claiming expertise in environmental assessment
Education	63 separate courses
	10 schemes taught at 9 different institutions have EIA as focus and teach upwards of 200 students per year in the UK
	Remaining programmes have some component of EIA (possibly optional) and teach upwards of 500 students per year at another 29 institutions

Source: Adapted from Bond (2003)

The contribution of EIA to the development of philosophies of science and scientific method has also probably been inadequately recognised. The text of NEPA unquestionably was visionary, promoting interdisciplinary environment science and principles of environmental management articulated almost two decades later in definitions of sustainable development (Sadler, 1996). In addition, greater awareness of the realities of environmental management (for instance, resource constraints, uncertainty and the need for stakeholder involvement) within the scientific community may have contributed to the development of civic science. In this scientific paradigm, science is viewed as a process involving a combination of fact and values, analysis and judgement, explanation and participation, and data and ethics (O'Riordan, 2001).

The contention that EIA makes an extremely limited contribution to sustainable development goals, therefore, is misguided, although it is extremely difficult to prove this empirically and conclusively. Certainly EIA has inherent limitations, but it has the potential to promote sustainable development in multifarious ways, many of which have been largely ignored within the literature. Thus, the contribution of EIA to consent and design decisions can be viewed resolutely as one component of incremental changes in institutions, organisations, philosophy, science and culture. This broader conception of EIA, and its relationship to sustainable development goals and society, is outlined schematically in Figure 2.

Furthermore, it is important to remember that EIA does not operate in a policy vacuum, as some of the

Certainly EIA has inherent limitations, but it has the potential to promote sustainable development in multifarious ways, many of which have been largely ignored within the literature

literature would appear implicitly to presume (for instance, Benson, 2003). It is supported by a wide range of other policy initiatives, and the incremental effects of EIA are likely to undergo amplification (social, cultural and institutional) within this broader environmental management context.

Conclusions

The issue of effectiveness has been an overarching theme of EIA research ever since this decision tool was first enacted (Sadler, 1996). Nonetheless, research has focused overwhelmingly on procedural definitions of effectiveness, and remarkably little is known about the degree to which EIA is achieving its substantive purposes. It is, furthermore, evident that the precise purposes of this decision tool have been interpreted in different ways, in part due to the diversity of scientific disciplines EIA encompasses and the changing nature of the human–environment relationship.

Such plurality is problematic when considering theory advancement and evaluative research: firstly, a decision must be made concerning the philosophical construct on which to base EIA theory; and, secondly, the term effectiveness cannot be reduced to simplistic statements of purposes and outcomes because its definition varies among individuals. Evaluations of effectiveness must therefore be based on unambiguous statements of the research teams' interpretation of the purposes of EIA and the meaning of effectiveness, a practice which has not been undertaken in the majority of research studies.

In this article, those research studies that have focused on the substantive outcomes of EIA have been analysed in an attempt to identify opportunities to advance theory, practice and (ultimately) effectiveness, without making a judgement on the precise purposes of this decision tool. It appears that, when questioned about the broad outcomes of EIA, many stakeholders state that it typically exerts a moderate influence on both consent and design decisions (for instance, Wood and Jones, 1997; ten Heuvelhof and Nauta, 1997). When compared with more result-oriented evaluation criteria, however, the outcomes of EIA appear considerably more limited (for instance, Sadler, 1996; Wood and Jones, 1997).

This does not mean that EIA is *de facto* ineffective, but it is suggested that passive integration with decision processes, in part a result of the preoccupation with the EIA report, has significantly reduced its substantive outcomes. The parochial nature of much of the EIA literature has further compounded this problem. Greater consideration must now be given to the development of a decision-oriented theory if EIA is to fulfil its theoretical potential for contributing to the 'decision dimension'.

It has also been suggested that the research

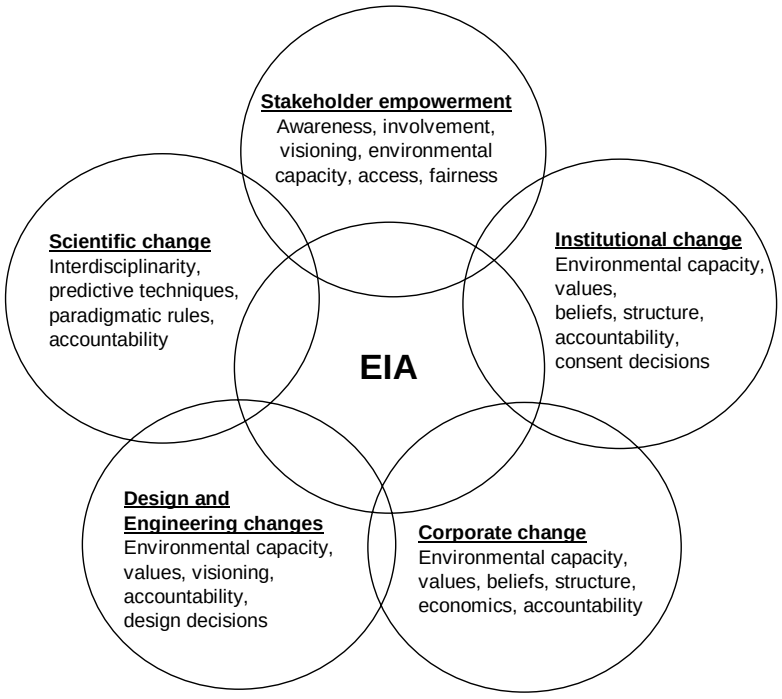

Figure 2. EIA as an agent of incremental change
Source: Based on Cashmore (2004)

agenda must extend beyond decision-oriented theory development to encapsulate more fully the role of EIA in promoting sustainable development goals. The potential for EIA to contribute to sustainable development, it is suggested, has been widely underestimated. This is partly because:

- relatively little consideration has been given to the relationship between EIA and sustainable development;
- simplifying assumptions employed to reduce the concept of sustainable development to operational principles (for instance, environmental economics accounting rules) often neglect many of its subtle nuances, for example: justice, fairness, respect and sincerity (O'Riordan, 2001); and
- reductionist analyses have neglected the broader institutional framework within which EIA operates.

Nevertheless, some researchers (for instance, McDonald and Brown, 1995; Bartlett, 1986) contend that the greatest contemporary impact of EIA results from its influence on causal pathways other than consent and design decisions. This may well be true, but it is clearly a coincidental, rather than deliberate, result of EIA practice.

It is, therefore, reasonable to contend that the contribution could be enhanced if greater attention were given to deliberate and purposeful targeting of the broader range of causal pathways. This will necessitate reform of the research agenda to encompass outcome-oriented research studies that are bedevilled with conceptual, methodological and analytical challenges for the research community (Bond, 2003; Cashmore, 2004). The importance of redefining EIA as a purposeful tool for sustainable development, it is suggested, necessitates that such challenges are more adequately confronted.

Notes

1. A broad definition of the term environment, covering biophysical, socio-economic, socio-cultural and health impacts, is employed in this article.
2. The term theory is used in a variety of ways within the literature; indeed, Singleton and Straits (1999) suggest that it is one of the most misunderstood scientific terms. In the context of this article, EIA theory is a multilayered concept that describes our understanding of the causal mechanisms, and their contingent and necessary conditions, by which its purposes (however defined) are achieved. To put this more simply, theory can be described as "one's understanding of how something works" (Shoemaker *et al*, 2004, page 6).
3. The reliance on subjective proxies, and associated methodological and analytical complexities, might partially explain the paucity of research on the outcomes of EIA.
4. It could be argued, however, that this is an intrinsic limitation of EIA that cannot be overcome at the project level.

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