



Impact significance determination—Designing an approach

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Abstract

The question of how best to go about determining the significance of impacts has, to date, only been addressed in a partial and preliminary way. The assumption tends to be made that it is either only necessary to provide explicit, justified reasons for a judgment about significance and/or to explicitly apply a prescribed procedure—a procedure usually involving the staged application of thresholds and/or criteria. The detailed attributes, strengths and limitations of such approaches and possible alternative approaches have yet to be explored systematically.

This article addresses these deficiencies by analyzing the characteristics, specific methods and positive and negative tendencies of three general impact significance determination approaches—the technical approach, the collaborative approach and the reasoned argumentation approach. A range of potential composite approaches are also described. With an enhanced understanding of these approaches, together with potential combinations, EIA practitioners and other EIA participants can be in a better position to select an approach appropriate to their needs, to reinforce the positive tendencies and offset the negative tendencies of the selected approach and to combine the best qualities of more than one approach.

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Keywords: Impact significance determination; Technical approach; Collaborative approach; Reasoned argumentation approach; Composite approaches

1. Introduction

The question of how best to go about determining the significance of impacts has, to date, only been addressed in a partial and preliminary way. The proposed or applied procedure for reaching significance judgments is usually described in a very cursory manner. Usually the approach is

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limited to ad hoc and inconsistent judgments with reasons and/or to the staged application of thresholds and/or criteria. In both cases the descriptions of the adopted approach tend to be very general and the roles of participants are not well defined. Little or no effort tends to be made to describe the detailed attributes of the approach or to recognize and respond to the strengths and limitations of the proposed approach. Possible alternative approaches are almost never systematically explored.

This article seeks to provide a more systematic and comprehensive treatment of the various ways in which impact significance judgments can be made. It describes the characteristics, specific methods and positive and negative tendencies of three general impact significance determination approaches—the technical approach, the collaborative approach and the reasoned argumentation approach. Good impact significance determination practices, associated with each approach, are identified. A range of composite approaches also are described. Overall conclusions also are presented.

The overall intent is to contribute to significance determination procedures that are less biased and distorted, more fully substantiated, more open, inclusive and collaborative and more effectively linked to decision making and EIA practice. The analysis integrates distinctions, frameworks and insights derived from a series of applied research studies and presentations undertaken on behalf of the Joint Review Panel for the Mackenzie Gas Project, the Mackenzie Valley Environmental Impact Review Board, the Yukon Environmental and Socio-economic Assessment Board and the Canadian Environmental Assessment Agency (Lawrence, 2002, 2004, 2005). The conceptual distinctions, frameworks and schemas presented are a limited form of EIA theory building (Lawrence, 1997). It is hoped that the analysis will be further tested and refined in practice at both the regulatory and applied levels.

2. The technical approach

The technical approach to determining impact significance starts from the premise that ascertaining what is more or less important is best undertaken by breaking the question into its constituent parts, and then by applying a technical procedure to progressively aggregate relevant impact significance determination considerations. Such procedures are viewed as providing a scientific and technically sound decision-making basis. The value of consistency, transparency and ability to replicate is stressed (Marusich, 2001).

Heavy reliance is placed on expert and technical data, analyses and knowledge (Cloquell-Ballester et al., 2007; Kirk, 2001). EIA specialists, working closely with other members of the EIA team, assume the lead role. Provision is often made for external (e.g., political representatives, government agencies, members of the public) input and review. Both impacts and the environment are viewed as capable of subdivision. Aggregation is by means of qualitative and/or quantitative procedures. It tends to be assumed that preferences can be ordered in the abstract and remain reasonably constant. Quantitative aggregation procedures are often favored because they are considered more consistent and objective.

The technical approach, at the regulatory level, can take the form of political representatives, government staff and the public jointly defining matters of national, provincial or territorial significance. These priorities are incorporated into EIA legislation. Staff then, with consultant advice and public input, define, in greater detail, significance thresholds for matters of area-wide significance. These requirements are incorporated into EIA regulations. Alternatively, EIA requirements can focus on the roles of significance determinations in EIA decision making (e.g., which requirements to apply, when mitigation is warranted, when more detailed assessment is

required). Generic guidelines are prepared for applying the thresholds and/or criteria. These guidelines describe procedures for collecting, analyzing and interpreting data, for assessing if thresholds are likely to be exceeded, for selecting and applying various classes of criteria, before and after mitigation, for managing uncertainties and for involving the public and politicians. Often generic significance determination guidelines are further refined and adapted by government officials and built directly into project-specific requirements and guidelines. Sometimes these requirements and guidelines will identify those potentially significant impacts and/or valued socio-economic and bio-physical components that should receive particular attention.

Technical impact significance determination at the applied level operates within the context of regulatory significance determination requirements. The point of departure tends to be criteria. The most basic procedures simply list criteria, sometimes in the form of questions or checklists. Progressively greater levels of precision can involve significance thresholds for individual criteria, scaling levels (e.g., major, moderate, minor, no significance), clearly defined boundaries for scaling levels, quantitative boundaries for scaling levels, qualitative decision rules for combining scaled criteria, quantitative decision rules for combining scaled criteria, statistical significance tests and the use of procedures for addressing uncertainties (e.g., sensitivity tests, fuzzy set analysis) (Cloquell-Ballester et al., 2007; Gartner Lee Limited (GLL), 2001; Marusich, 2001).

The basic building blocks of technical impact significance determination procedures are thresholds (a clearly defined performance level that explicitly establishes significance) and criteria (which explicitly and consistently differentiate the factors contributing to significance determination judgments) (Gartner Lee Limited (GLL), 2001; Sippe, 1999). There are numerous threshold types. Examples include:

- Legal thresholds (e.g., regulatory standards will be contravened, likely to conflict with public policies, plans, guidelines, criteria or objectives) (Australian Government, 2006);
- Project characteristics thresholds (e.g., high level of resource or energy consumption or waste generation, activity inherently causes significant effects);
- Environmental characteristics thresholds (e.g., receptors are highly sensitive or significant, resources or features are very scarce or unique) (Erickson, 1994);
- System function thresholds (e.g., likely to disrupt the functioning of ecological, resource, social or economic systems, carrying capacity jeopardized, establishes a precedent for future actions with significant effects) (Canter and Canty, 1993);
- Impact intensity thresholds (e.g., magnitude, duration or frequency of effect is great relative to ambient conditions) (Gartner Lee Limited (GLL), 2001);
- Impact characteristics thresholds (e.g., permanent or irreversible effects, trans-boundary effects likely, potential human health risks, major inequities in the distribution of effects are likely, high degree of uncertainty regarding impact magnitude and distribution, high cumulative effects potential) (Sadler, 1996);
- Preference thresholds—contrary to community norms or regional norms, likely a high level of public controversy, reflects preferences of individuals, groups or organizations) (Vanclay, 1999); and
- Sustainability threshold—if and extent to which proposed action advances or inhibits sustainability (Sadler, 1996).

A criterion is a comparative mechanism that facilitates assessment and judgment. There are both generic (e.g., positive/negative, degree of intensity, spatial extent, frequency, duration,

reversibility, likelihood, direct/indirect, cumulative effects potential) and feature-specific (e.g., linked to specific setting types, locations, limits and impacts) criteria (Vanclay, 1999). Criteria can be subdivided by discipline. In some cases distinctions are drawn among impact magnitude, receptor significance and impact importance criteria.

Threshold and criteria application can occur before and after considering mitigation potential. Often a further iteration addresses cumulative effects. Sometimes the sequence progresses from the less to the more complex, from prescribed to discretionary, from quantitative to qualitative and from individual to cumulative (e.g., (1) public policy—legislative, regulatory, standards, guidelines, (2) individual quantitative, (3) individual qualitative, (4) cumulative quantitative, (5) cumulative qualitative). Some procedures only proceed through the initial steps (e.g., only legal, individual and quantitative). Technical impact significance determination proponents generally favor thresholds and criteria where there is a minimum of ambiguity (e.g., quantified boundaries), and where thresholds can be clearly defined and consistently applied (i.e., which require a minimum of interpretation) (Canter and Canty, 1993; Gartner Lee Limited (GLL), 2001). This reduces the potential for bias and speculation in decision making. Procedures for integrating contextual factors and stakeholder perspectives are less well developed.

Examples of specific technical significance determination methods include:

- Impact thresholds and criteria defined at the regulatory level (i.e., significant if anticipated impact levels not in compliance with government laws, policies, plans, standards and objectives) (US Army Corps of Engineers, 1983);
- Environmental or resource sensitivity, quality or significance thresholds or criteria (e.g., significant if likely to adversely affect a pre-defined valued ecosystem component, as identified by public institutions, interest groups or technical specialists) (Gartner Lee Limited (GLL), 2001);
- Sustainability thresholds and criteria (e.g., application of sustainability principles, criteria and indicators to determine significance) (Sadler, 1996);
- Statistical significance testing—testing of the impact ratio with confidence intervals (applied when major changes in the environment can be predicted; isolates human-induced changes from natural variation; a common approach in monitoring to assess the significance of differences over time and place) (Beanlands and Duinker, 1983; McBride et al., 1993);
- Generic impact magnitude, environmental or importance thresholds or criteria (Erickson, 1994; Sippe, 1999);
- Location or project-specific thresholds or criteria (Canter, 1996; Kirk, 2001);
- Simple rating systems (e.g., low, moderate, high), with or without generic definitions for each level (Finsterbusch and Freudenburg, 2002; Gartner Lee Limited (GLL), 2001);
- Qualitative aggregation procedures (e.g., decision rules for combining impact/environment/importance ratings) (Finsterbusch and Freudenburg, 2002; Joyce and MacFarlane, 2001)
- Quantitative aggregation procedures (e.g., multi-criteria analysis methods for combining criteria scores with or without criteria weightings, concordance analysis, goals achievement analysis, hierarchical decision analysis, paired comparison analysis) (Hildén, 1997; Marusich, 2001);
- Tiered or staged evaluation procedures (e.g., decision trees, checklists, questionnaires, matrices) (Gartner Lee Limited (GLL), 2001; Westman, 1985);
- Uncertainty management procedures (e.g., fuzzy set theory, testing with alternative assumptions and scenarios) (Cloquell-Ballester et al., 2007; Wood and Becker, 2004); and
- Combinations of methods to address variations in measurement levels, disciplinary differences and level of uncertainty differences.

Fig. 1 presents an example of a technical approach to significance determination. The scope of the analysis is defined based on public and agency issues and knowledge and through the establishment of study areas and time horizons. The analysis is adjusted to suit the context and to match the nature of predicted impacts. Both significance thresholds (clear distinction between significant and insignificant impacts) and criteria (for addressing degrees of significance) are defined and substantiated. Decision rules are defined for applying the criteria. Thresholds and criteria are refined. Criteria are scaled. Impact magnitude ratings, for addressing variations in the intensity and in the spatial and temporal distribution of impacts, are defined and then applied. Impact magnitude ratings are adjusted based on such considerations as uncertainty, reversibility, cumulative effects potential, regulatory compliance, policy consistency, environmental sensitivity and environmental equity. Where clear significance thresholds can be defined they are applied. Both the significance ratings and the threshold application outcomes are reconsidered in light of mitigation potential, in terms of the significance of cumulative effects, and with respect to if and the extent to which sustainability is reinforced or undermined. The analysis is documented in a form suitable for decision making and then integrated into impact management (e.g., significance triggers as part of monitoring requirements).

Table 1 provides examples of good practices associated with the technical approach to significance determination. Table 2 summarizes examples of positive and negative tendencies associated with the technical approach. The technical approach can, if effective and appropriate to context, systematically, explicitly and consistently integrate technical, scientific and community analysis and knowledge into individual and cumulative impact significance determinations. It can focus on key decision-making factors, effectively integrate regulatory standards and policies and make helpful distinctions regarding such matters as impact magnitude, receptor sensitivity, the distribution of effects over time and space and the degree and nature of uncertainties. A technical significance determination approach should distinguish between thresholds and degrees of significance, ensure that thresholds, criteria and methods are fully defined, substantiated and appropriate to the situation, effectively integrate public and agency concerns and preferences, fully consider the implications of uncertainties and of impact management potential and concentrate on major proposal-related issues and impacts and valued socio-economic and ecological components and interactions.

Care should be taken not to exclude or marginalize the public, ignore or undervalue community knowledge and interests, apply methods inappropriate to the situation, inhibit dialogue and negotiation among interested and affected parties or constrain innovation and adaptation. Professional judgments and technical methods (e.g., matrices, quantitative aggregation procedures) are decision aids not decisions. Clear and substantiated reasons for significance judgments still need to be provided—reasons that draw upon both technical and non-technical procedures and view significance from multiple perspectives.

Technical methods and scientific knowledge about impact magnitude characteristics, although usually necessary, do not provide a sufficient basis for impact significance determinations. Adjustments to impact magnitude ratings based on such considerations as uncertainty, public controversy and environmental sensitivity should be explicit and consistent. It is especially important that decision rules are fully substantiated rather than being treated as matters of professional judgment best left to experts, and not needing a coherent, reasoned rationale. Active involvement by interested and affected parties remains essential. This is especially the case when interpreting potential social and economic impacts.

The range of technical methods available means that positive and negative tendencies are present to varying degrees with different methods. The more quantitative and technically complex

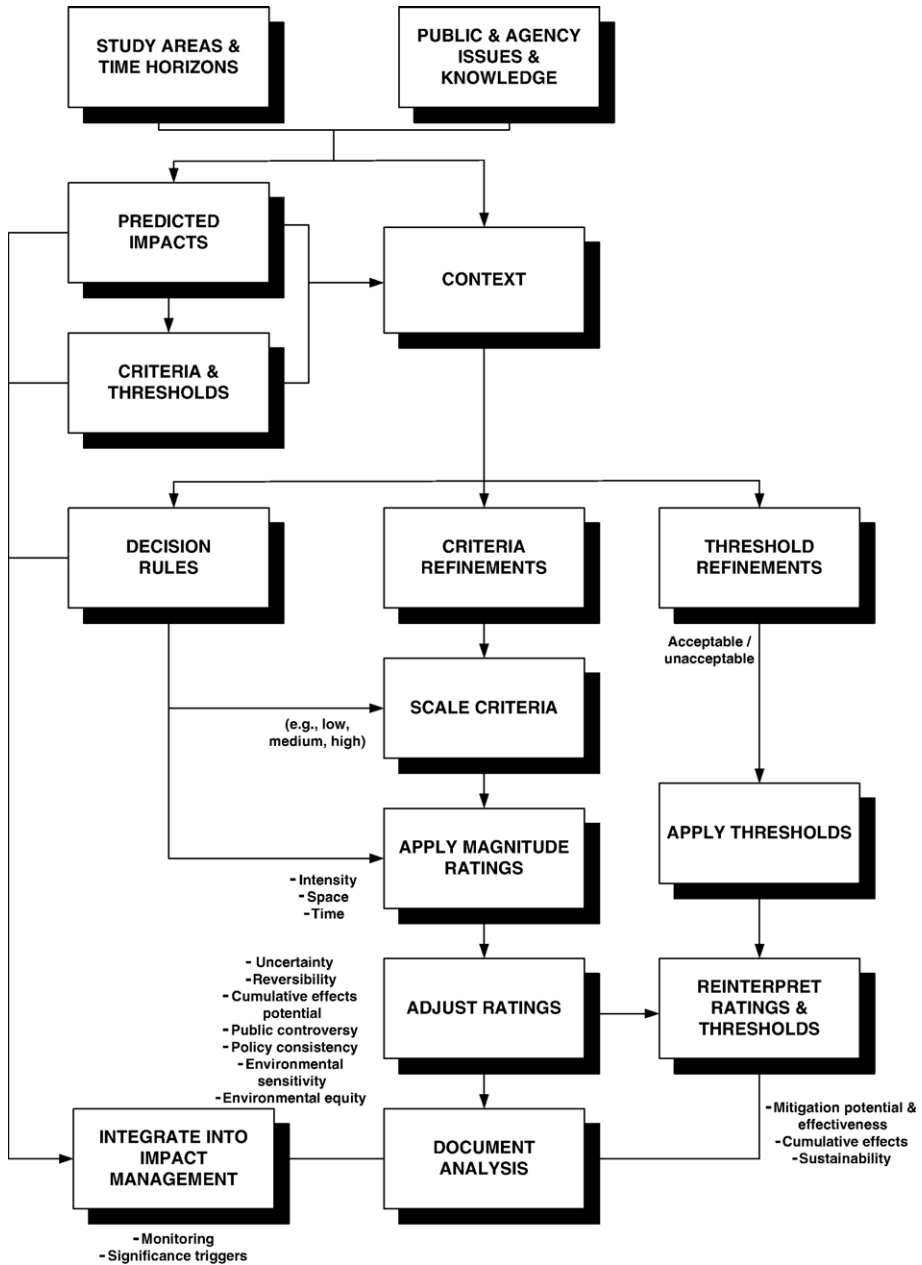


Fig. 1. An example of technical approach.

procedures, for example, tend to be more consistent, traceable and explicit but weaker in facilitating community involvement and avoiding technical biases. More qualitative procedures are more adaptable and are more amenable to community involvement and the integration of community knowledge. But they are often more inconsistent and less explicit. Composite

Table 1

Technical approach—examples of good practices

-
- Ensure that the analysis addresses both significance thresholds and degrees of significance.
 - Ensure that thresholds and criteria are clearly defined, unambiguous, readily applicable and fully substantiated.
 - Ensure that thresholds and criteria are relevant to and linked to the local and regional context.
 - Be sensitive to potential impact discontinuities (e.g., exceeds ecological or community service carrying capacities).
 - Ensure that the procedures for applying thresholds and criteria are explicit, logical, clearly explained, easily applied, fully substantiated and appropriate for the available data and values.
 - Ensure that the degree of precision is consistent with the reliability and level of measurement of the relevant data.
 - Explicitly integrate public and agency concerns and preferences.
 - Treat thresholds as a point of departure for agency and community discussion rather than as absolute standards to be applied regardless of public and agency comments.
 - Ensure that the significance determination criteria and procedures are directly relevant to and explicitly linked to decisions in the EIA process.
 - Allow for the possibility that different impact types may require different significance determination approaches and methods.
 - Identify and take into account the characteristics, strengths and limitations of specific methods.
 - Explicitly take into account uncertainties and associated implications. Seek to minimize the consequences of being wrong.
 - Address the significance of positive and negative, direct and indirect, individual and cumulative and bio-physical and socio-economic effects.
 - Provide regulatory requirements and guidelines for applying technical significance determination procedures that take into account the positive and negative tendencies of such methods.
 - Take into account the implications of impact management measures, bearing in mind potential differences in the effectiveness of such measures.
 - Ensure that the choice and application of thresholds, criteria and methods are conducive to determining if and the extent to which environmental and sustainability objectives are being advanced.
 - Ensure that the significance determination thresholds, criteria and methods are conducive to interpreting the significance of major proposal-related issues, identified valued socio-economic and ecological components and the major anticipated impacts.
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technical procedures mix qualitative and quantitative criteria and methods to match the procedures and criteria to various classes of environmental and impact characteristics. Methods and refinements also can offset and minimize negative tendencies and reinforce positive tendencies.

3. The collaborative approach

The collaborative impact significance approach starts from the premise that subjective, value-based judgments about what is important should result from interactions among interested and affected parties. EIA specialists make no generic pre-judgments (e.g., thresholds and/or criteria) prior to public involvement. Instead the public (or more properly a heterogeneous collection of publics, each with separate agendas, concerns and perspectives) fully participate in either deriving the thresholds and criteria, and/or in directly interpreting the significance of issues of concern and potential impacts. Context is fully integrated into significance determinations.

The collaborative significance determination approach presupposes an interactive, collective, continuous involvement decision-making model (Taylor et al., 1998). The parties jointly determine what is acceptable and unacceptable, important and unimportant and how much importance to attach to any given concern or potential impact (i.e., degrees of significance) (Vaughan and Seifert, 1992). Ideally the parties reach a consensus on significance determinations. Substantiation is provided by recording the joint reasoning of the parties as they make impact

significance judgments. Technical analysis can assist the process. But technical involvement is at the discretion of the parties to the process. The process can be aided by third parties (e.g., conciliators, facilitators, mediators).

The approach presumes that preferences regarding importance are fluid, value-full and context-dependent. Joint interactive decisions regarding what is important are not constrained by artificial categories of environmental components and impacts. Instead a holistic view tends to be adopted of the environment and of patterns of direct and indirect impacts. The approach assumes that it is neither possible nor appropriate to order value preferences with precision in the abstract. Significance determination is open, transparent, inclusive and participative (Couch, 2000). The process encompasses all interested and affected parties. It is highly dependent on effective interactive public participation methods (Holden, 1999).

Significance determination is approached from multiple perspectives. The integration of a diversity of perspectives and values is essential, especially those of potentially affected individuals, groups and communities (Baines et al., 2003; Rickson et al., 1990). Collaborative significance determination approaches seek to balance interests and perspectives. They often use measures to ensure that all parties can fully participate (Beckwith, 2000). Compatibility with local visions and objectives is often stressed (Bronfman, 1991). The process is characterized by effective two-way communications, mutual learning and negotiations (Hildén, 1997). It should be conducive to identifying and accommodating conflicts and to enhancing the level of control that local people have in deciding what is important (Buchan, 2003; Lockie, 2001). Both significant public issues and impacts are evaluated. Collaborative significance determination is characterized by bottom-up (individuals/groups/communities to governments and proponent) and inside-out (community to external parties) decision making (Dale and Lane, 1994; International Association for Impact Assessment (IAIA), 2003).

The collaborative approach at the regulatory level focuses on facilitating and encouraging the direct and ongoing involvement of interested and affected parties in impact significance determination. Pre-judgments regarding potentially significant impacts are tightly circumscribed (e.g., instances where widely accepted and supported public standards and policies are likely to be contravened). Government agencies are sensitive to regional and local conditions and issues when applying policies and standards. Considerable discretion is left at the project/local level for decisions regarding which impacts and uncertainties merit more or less attention. A key government role is facilitating the involvement of the most directly affected and most vulnerable groups and individuals (e.g., through participant funding). Regulatory and project-specific requirements emphasize the need for proponents to demonstrate and document how they involved interested and affected parties in significance determinations. Public issues, concerns and preferences should be documented, together with where and how they are addressed in the EIA. If they are not addressed reasons should be provided. EIA guidelines encourage two-way interaction and more frequent and continuous forms of public involvement in significance-related decision making.

The collaborative approach at the applied level generally involves an inner circle of stakeholder representatives who participate in intensive and ongoing involvement forums and an outer circle of interests and constituents who participate by means of a host of consultation methods. The role of the public in these interactive forums can be advisory, full partner (i.e., shared decision making) or decision-maker (i.e., delegated decision making). This open and iterative process parallels and is closely connected to the EIA process. The procedure identifies, analyzes, interprets and manages issues and tradeoffs. Any impact or issue, identified by an affected party as important, is considered worthy of assessment. Significance, from each

Table 2
Positive and negative tendencies of significance determination approaches

Criteria	Technical approach	Collaborative approach	Reasoned argumentation approach
Focused/Efficient	+ Can focus on key decision-making factors - Can average out critical concerns	+ Focuses on key value-based choices and tradeoffs - Can be protracted procedure when multiple parties and limited potential for consensus	+ Tends to be issue oriented - A lengthy written exploration of relevant significance determination matters could be inefficient
Consistent/unbiased	+ Treats comparable situations in a comparable manner) - Prone to subtle or implicit biases (e.g., most easily measured over most important, technical over community knowledge, facts over values, certain over uncertain)	+ Reduces the potential for technical or quantitative bias - Often treats parallel situations in different ways - Prone to domination by a few vociferous and aggressive individuals - Prone to influence of fear mongering and scare tactics	+ Generally sensitive to bias; tests assumptions and assertions + Structure can enhance consistency - Simply using reasons and advantages and disadvantages leaves open the possibility that comparable situations will not be treated consistently - Prone to advocacy (i.e., case making rather choices from multiple perspectives) and bias (e.g., selective use of data and analysis, implicit values) - Tends not to make much use of decision aids, such as matrices, that can enhance consistency + Expressed in a form readily understandable by all parties + Makes explicit the underlying logic behind significance determinations - Unclear when incomplete
Clear/explicit/ understandable	+ Substantiates interpretations and conclusions + Explicit value judgments + Many worthwhile distinctions (e.g., impact magnitude, receptor sensitivity, project phases, study area variations) - Complex technical procedures can inhibit public understanding	+ Facilitates public understanding - Can gloss over complex but important technical and scientific matters	+ Expressed in a form readily understandable by all parties + Makes explicit the underlying logic behind significance determinations - Unclear when incomplete - A lengthy written exposition concerning significance could be difficult to follow - Tends not to use tables and matrices that can abbreviate analysis and facilitate understanding + Can encompass both individual and cumulative impacts
Comprehensive/ systematic/traceable	+ Stimulates consideration of alternative actions	+ Ensures full treatment of concerns and preferences of all participants	

	<ul style="list-style-type: none"> + Clearly defined thresholds, criteria and decision rules - Tends to be weak on system-level characteristics and indirect and cumulative effects 	<ul style="list-style-type: none"> - Can oversimplify complex issues - Group decisions clear but reasoning process that provided the basis for decisions not always as clear 	<ul style="list-style-type: none"> + Conducive to systematically exploring issues - Prone to information loss; when reducing to fundamentals key pieces of data or analysis may not be applied or applied effectively - Tendency not to systematically apply significance thresholds and criteria + Well suited to substantiating interpretations, conclusions and recommendations + Recognizes that ultimately will be necessary to provide reasoned substantiation for significance judgments - Stress on qualitative reasoning can mean that insufficient use made of quantitative analysis to support interpretations
Logical/substantiated/ reasoned	<ul style="list-style-type: none"> + Replicable + Logical and supported steps and interpretations - Produces outputs (e.g., scores) rather than reasoning process 	<ul style="list-style-type: none"> + Joint reasoning process; all interpretations substantiated - Can make some decisions and interpretations based on incomplete or incorrect information 	<ul style="list-style-type: none"> + Well suited to integrating community and traditional knowledge + Blends technical and non-technical - May not fully and systematically integrate all relevant knowledge + Usually considers implications of major uncertainties
Integrates knowledge	<ul style="list-style-type: none"> + Systematically integrates technical and scientific knowledge - Often poor at integrating community knowledge 	<ul style="list-style-type: none"> + Conducive to the integration of community and technical knowledge - Can give inadequate consideration to available technical and scientific data and knowledge 	<ul style="list-style-type: none"> - May not be suitable for systematically exploring the implications of uncertainties for significance determinations + Conducive to external and internal scrutiny
Manages uncertainties	<ul style="list-style-type: none"> + Can explicitly address nature and implications of uncertainties (e.g., alternative assumptions, data limitations) - Tends to overestimate certainty 	<ul style="list-style-type: none"> + Addresses uncertainties identified by each party - Uncertainties do not tend to be addressed systematically or quantitatively 	<ul style="list-style-type: none"> + Consistent with the format of government guidelines and review comments; can be directly linked to public policies + Can be readily understood in quasi-legal and legal forums - Selective and inconsistent use of support data and analysis can inhibit decision making
Effective decision- making support	<ul style="list-style-type: none"> + Generates debates regarding what is important + Amenable to integration of public standards and policies - Can marginalize politicians 	<ul style="list-style-type: none"> + All parties directly involved in decision making - Can produce results that do not stand up well to intense scrutiny, especially in judicial and quasi-judicial forums 	

(continued on next page)

Table 2 (continued)

Criteria	Technical approach	Collaborative approach	Reasoned argumentation approach
Open/inclusive/ involves public	+Can explicitly incorporate public concerns and preferences -Can marginalize public; highly quantitative can be especially intimidating	+Facilitates public involvement; ensures the direct and ongoing involvement of all interested and affected parties -Unorganized population segments and broader perspectives not always well represented	+Highly accessible +Can address choices and impacts from multiple perspectives +Well suited to integrating public concerns and preferences -A reasoned argument prepared by one or more individuals may not adequately address all public perspectives +Often provides a forum conducive to mutual learning and collaboration -Unclear how will reconcile conflicting perspectives and arguments -Tends not to derive the full benefits (e.g., mutual learning, synergy) of dialogue and negotiation
Collective/collaborative/ facilitates learning/ facilitates conflict resolution	+Can be applied as support to collaborative forums -Can create or exacerbate conflict when thresholds, criteria or procedures perceived to be arbitrary or biased -Does not provide forums conducive to mutual learning	+Conducive to mutual learning +Facilitates dialogue between decision-makers and interested and affected parties +Maintains effective communications between individuals/groups directly involved in process and broader constituencies -Technical perspectives may not be well represented +Builds public credibility, trust and support	+Consistent with how judgments are made in democratic decision making +Politicians and public likely to be comfortable with this approach -If significance determinations made by independent third party can inhibit local and regional decision making and empowerment
Democratic/ empowering/ facilitates public support	+Makes decision-making role of participants explicit -Subtly reinforces existing power relationships -Tends to place public at periphery of significance determination judgments	+Fosters local and regional empowerment and democratic decision making +Minimizes potential for top-down and outside-in values and perspectives dominating significance determinations -Danger of gulf between participants and broader constituencies	+Consistent with the format that all parties use to make their points +Not wedded to pre-defined environmental and impact categories +Consistent with the subjective, critical and discursive nature of significance determinations
Appropriate to context/ real/genuine	+Can be adapted to local conditions -Sometimes “force-fits” thresholds, criteria and aggregation procedures -Can artificially disaggregate and re-aggregate environment	+Minimizes artificial boundaries and distinctions +Procedures and judgments appropriate to context +Consistent with the subjective, qualitative and uncertain nature of significance determination	+Consistent with the format that all parties use to make their points +Not wedded to pre-defined environmental and impact categories +Consistent with the subjective, critical and discursive nature of significance determinations

	-Tries to turn an essentially subjective task (significance determination) into an “objective” procedure	-Individuals involved in forums not always representative of broader constituents	-Matching to context dependent on sensitivity of those preparing the significance determinations to contextual variations
Appropriate participant roles	+Explicit participant roles -Artificially extends role of technical expert from data analysis expert to expert in value interpretation	-Tends to attach limited value to non-local and regional concerns and priorities +Reflects local and regional community perspectives, goals and aspirations -Places heavy burden on individuals participating in interactive forums; prone to high turnover	+Role of technical confined to decision support +Multiple perspectives considered and integrated in establishing significance determinations
Adaptive/innovative	+Adaptable to variations in measurement levels +Can be modified to consider evolving values -Inhibits innovation and adaptation when very detailed and structured procedures	+Conducive to synergistic and creative interpretations and problem solving +Readily adaptable to changing attitudes, values and perspectives -May not be open to technical and scientific innovations	-Potential for inconsistencies in whether and extent to which participants’ roles are appropriate +Fully adaptable to contextual variations +Can draw upon decision aids to support judgments +Adaptable to oral and written arguments and presentations -Extent to which adaptive and innovative varies depending on those individuals preparing significance determinations
Value-full/ethical/favors most vulnerable	+Makes value basis for decisions explicit -Often less effective in involving most vulnerable and least organized segments of society	+Emphasizes value-based tradeoffs and differences +Ensures that procedural and substantive equity concerns are fully addressed +Facilitates the involvement of the most vulnerable and most affected individuals, groups and communities -Has difficulty coping with major value and worldview conflicts	+Tends to focus on major value choices and tradeoffs +Generally considers issues from multiple perspectives, with particular attention to most vulnerable -Propensity to be inconsistent can mean that variations in how well values and ethical concerns are addressed
Substantive/facilitates environmental enhancements/sustainable	+A tool that can make explicit environmental contribution -Sometimes critical environmental issues and net environmental benefits or losses masked by technical procedures	+Tends to focus on nature and extent of substantive environmental improvements -Tends to make decisions based on consensus when difficult but controversial significance determinations are more environmentally sound	+Generally reflects systems perspective, with an emphasis on net environmental gain and sometimes sustainability -Approach can be narrower if focus limited to “sound” reasons for significance judgments

stakeholder's perspective, is assessed. Systematic and explicit procedures identify, track and respond to public comments and suggestions. Social/psychological issues are considered real and important rather than misconceptions to be ignored or countered. Steps are taken to offset procedural and substantive inequities and to ensure that a single point of view or special interest does not dominate the process. Care is taken not to create unrealistic expectations about what a proponent can deliver. Much effort is exerted to building trust and to maintaining credibility. Creating and maintaining effective links with the broader public is critical.

Collaborative significance determination procedures assume multiple forms (e.g., panels, committees, task forces, inquiries). Numerous methods can facilitate the functioning of the interactive core of the collaborative significance determination approach (e.g., alternative dispute resolution, participant funding, technical assistance, applied research, creative problem-solving methods). Many consultation methods are available for forging effective links with the broader public(s) (e.g., open houses, public meetings, surveys, referenda, community profiling, key informant interviews, Web sites, hot lines). These methods help ensure that community perspectives and knowledge concerning potentially significant impacts are fully integrated into the process. They also can provide a "sounding board" for interpretations and judgments reached through the more interactive forms of participation.

Fig. 2 is an example of a collaborative approach to impact significance determination. The group or groups begin by identifying significant issues, perspectives and aspirations. This provides the foundation for a preliminary list of potentially significant impacts. The preliminary list is refined through discussion and then reinterpreted based on technical and procedural support and advice. The significance of both individual and cumulative impacts is determined. Significance from a sustainability perspective also is addressed. The outcomes from the process are documented, fully substantiated and presented in a form suitable for decision making and impact management. The collaborative significance determination approach is structured around a series of interactive forums. Ample use is made of technical and procedural support and advice. Care is taken to ensure systematic and frequent links to broader publics and public agencies.

Table 3 provides examples of good practices associated with the collaborative approach to significance determination. Table 2 summarizes examples of positive and negative tendencies associated with the collaborative approach. The collaborative approach interprets significance openly and inclusively. It can facilitate public understanding and involvement, integrate community and traditional knowledge, build community credibility, trust and support, contribute to dialogue, mutual learning and creative problem solving and foster local and regional empowerment and democratic decision making. The public and elected representatives and local and community perspectives and aspirations are central to rather than at the periphery of impact significance determinations. The collaborative approach focuses on value-based tradeoffs, effectively integrates equity-related concerns and reflects the subjective, qualitative and uncertain nature of significance determination.

Multiple methods are available for structuring a collaborative procedure, facilitating and supporting the process and establishing and maintaining links to the broader public. Collaborative significance determination approaches, when effectively designed and managed, are adapted to the needs and characteristics of each public, fully integrate community, traditional and technical knowledge, actively correct and resolve misinformation and misunderstandings, balance interests and perspectives, offset procedural inequities, focus on local and regional issues, tradeoffs and aspirations from multiple perspectives and fully document the rationale for all joint interpretations and conclusions.

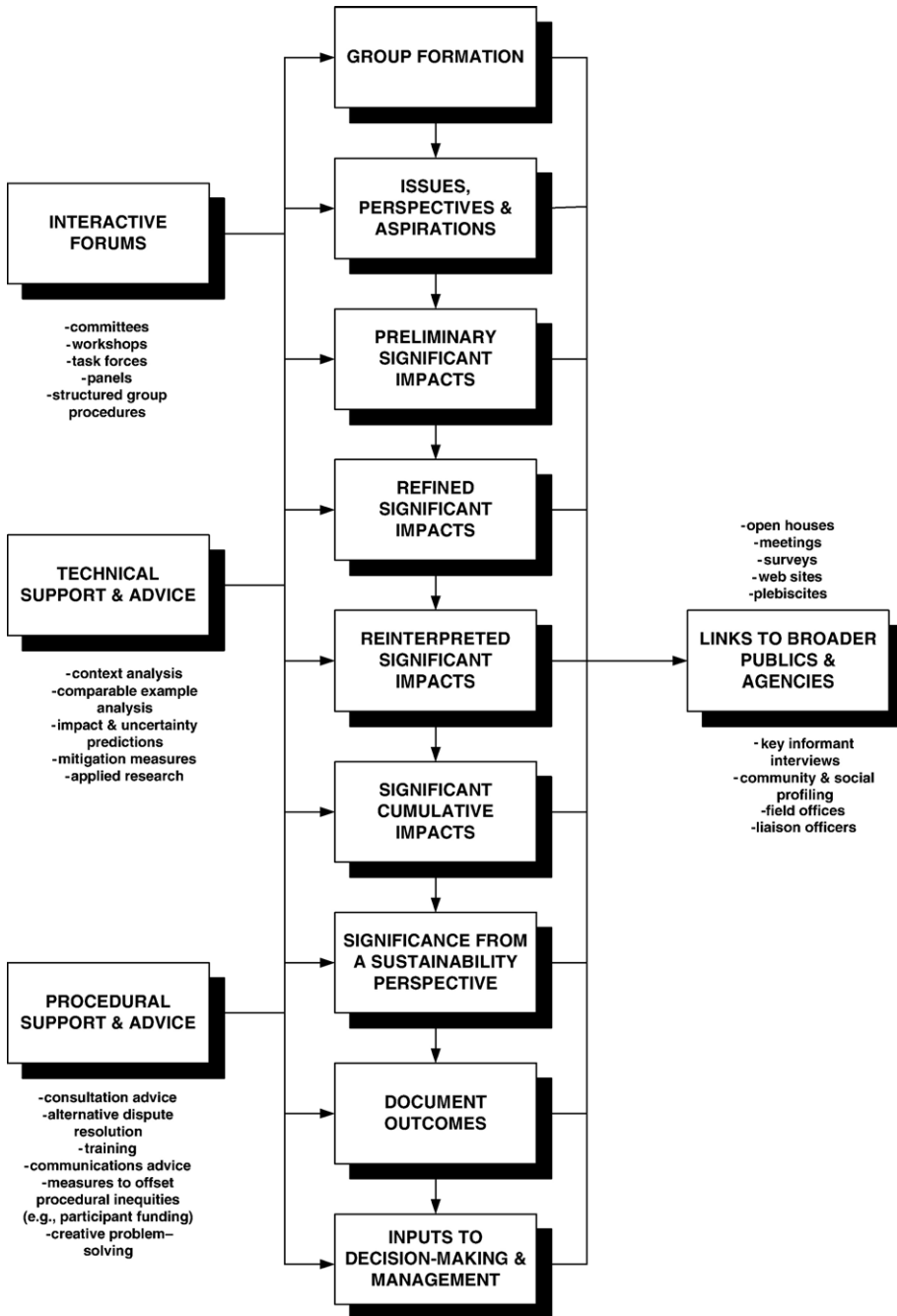


Fig. 2. An example of collaborative approach.

Complex issues are sometimes oversimplified with the collaborative significance determination approach. The demands on those participating in ongoing interactive forums can be very onerous, which can, in turn, result in high turnover and a lack of continuity. The reasons for interpretations can

Table 3

Collaborative approach—examples of good practice

-
- Make a concerted effort to involve, prior to each judgment and decision, the most directly affected and vulnerable individuals, groups and communities.
 - Ensure early, effective and frequent links back to the broader public.
 - Adapt consultation methods to the characteristics and needs of each public.
 - View from multiple perspectives, consistent with the range of values and interests held by interested and affected parties.
 - Use multiple forms of participation, tailored to the needs and characteristics of the interested and affected parties.
 - Ensure that the process is open, transparent and inclusive.
 - Fully consider and integrate technical, community and traditional knowledge.
 - Ensure that the membership in interactive forums (small and large groups) reflect the full range of interests and values associated with the proposed action.
 - Ensure complete documentation of the rationale for all interpretations and conclusions, with direct ties to decision making.
 - Immediately seek to correct and resolve misinformation and misunderstanding.
 - Focus on major local and regional issues and tradeoffs from multiple perspectives.
 - Ensure that the support materials and advice are unbiased and are conducive to understanding and application by participants.
 - Provide measures to offset procedural inequities (e.g., participant funding) where needed to ensure the full participation of interested and affected parties.
 - Ensure that the substantive implications of the compromises needed to achieve consensus are considered before significance determinations are made.
 - Consider lessons and insights from comparable situations.
 - Be aware of and seek to facilitate the achievement of community goals, visions and aspirations.
 - Ensure, where pertinent, the full consideration of Aboriginal societal values, interests, perspectives, rights, priorities, worldviews, concerns and knowledge in significance determinations.
 - Minimize discrepancies between the values represented by the significance determinations and the values of local and regional communities.
 - Draw upon, as needed, alternative dispute resolution (e.g., facilitators, conciliators, mediators).
 - Make effective use of full qualified consultation specialists, with ample local and regional experience.
 - Provide, where needed and requested, procedural and substantive training for forum participants and for community members to conduct their own significance-related research and interviews.
 - Actively seek to facilitate community empowerment and local democratic decision making, without ignoring or undervaluing broader values and perspectives.
 - Take into account the concerns, policies and priorities of relevant government agencies and those of the proponent.
 - Seek to balance interests and perspectives, while devoting particular attention to the most vulnerable and most affected environmental components and segments of society.
-

be difficult to trace and occasionally reflect incomplete or incorrect information. Committee members are not always representative of broader constituencies. Occasionally, a few aggressive individuals dominate proceedings. Major public issues are not always the same as major, potential impacts. Sometimes, in the face of controversy and major value conflicts, consensus is not always the most environmentally sound outcome. In some cases insufficient consideration is given to available technical and scientific analysis and knowledge or to national or international needs and perspectives. It is possible to guard against and offset these negative tendencies by using and adapting good practices, by avoiding poor practices and by selectively drawing upon other approaches.

4. The reasoned argumentation approach

Reasoned argumentation is evident in some aspects of EIA and in many fields related to EIA. The systematic testing and refuting of alternative hypotheses is central to natural and social science theory building. There are numerous ongoing debates regarding the appropriate applied

roles of the natural sciences and a variety of conflicting and overlapping social science models, theories and frameworks. The social sciences are characterized by discursive and critical argumentation. Consequently, reasoned critical debate and discourse are very evident in SIA literature and practice (Burdge and Vanclay, 1996). Varying perspectives also surround alternative EIA processes (Lawrence, 2003). Debate, in the form of the systematic and rational exploration of choices, was for many years the core approach in planning and administration. Numerous other approaches and models have emerged over the past three decades. These are usually presented as alternatives to or variations of the rational model. There also is a long tradition of reasoned argumentation in judicial and panel decisions.

As is evident from the above, reasoned argumentation is a major element of the conceptual foundation of EIA. What has received less attention is how this tradition is and should be expressed in judgments regarding impact significance. The reasoned argument approach to significance determination is usually expressed qualitatively, although it can incorporate quantitative data and analyses. It views significance determination as making reasoned judgments, supported by evidence. It is evident in all EIA documents, despite a propensity to cloak subjective reasoning in “objective” scientific and technical language. The reasoned arguments concerning significance tend to be more explicit in summary documents intended for public review and comment.

The reasoned argumentation approach starts from the premise that both technical and collaborative approaches are too narrow to provide an adequate foundation for value-based significance judgments about what is and is not important. The technical approach is viewed as pre-occupied with technical analysis and quantification, at the expense of community perspectives and knowledge. The collaborative approach is viewed as too quickly equating public concerns and issues with impact significance, at the expense of other sources of insight and knowledge. Arguably, the reasoned argumentation approach has the potential to integrate technical and community knowledge, facts and values, multiple perspectives and both the qualitative and the quantitative information into a form (a reasoned, comprehensive and fully substantiated written and/or oral argument) that all parties can understand and jointly construct.

At the regulatory level, reasoned argumentation is evident in how governments identify substantive and procedural priorities in the preambles, objectives and sometimes body of EIA legislation and regulations (e.g., human health effects, sustainability). EIA guidelines sometimes expand on the rationale for these “matters of significance”. Often such concerns are singled out as part of the screening process, as triggers for EIA legislation or in differentiating among EIA requirements. They also are expressed by government agencies during scoping, in project-specific requirements and in recommendations for approval, approval with conditions or rejection. Often monitoring conditions also reflect government interpretations of what is more and less important. In each case governments generally make a qualitative written argument in favor of what they consider important.

The reasoned argumentation approach to significance determination is expressed at the applied level in the staged procedures that use relevant data, knowledge, analyses, perspectives and preferences to focus (on what is important), to interpret (whether and to what degree important) and to reach conclusions for each decision in the process. It is present in EIA documents in the document structure, in the values applied to evaluate choices and impacts, and in how relevant inputs are linked, synthesized and summarized in support of interpretations and conclusions. Summary EIA documents and sections generally focus on matters considered especially significant. Panel or court decisions tend to follow a structured reasoning process. Such decisions sift through a vast amount of potentially relevant information, perspectives and values, focus on

matters critical to decision making and progressively build reasoned arguments in support of each judgment, consistent with regulatory requirements.

Multiple methods structure and apply reasoned argumentation to support significance determinations. A reasoned argument, in support of significance determinations can, for example, be structured by:

- Decision-making choices (e.g., reasonable alternatives, preferred alternatives, mitigation measures);
- Impact type or discipline (e.g., displacement, proximity disruption, community, social, ecological);
- Project characteristics (e.g., construction, operations, closure, access corridor);
- Issues (as raised by interested and affected individuals, groups, communities and agencies);
- Perspectives (stakeholder values and interest-based);
- Study areas (e.g., local, regional, territorial, national, international);
- Time horizons (e.g., short term, long term, future generations);
- System types (e.g., ecological, social, political, economic); and
- Combinations of the above.

How an argument is structured may influence its outcome in terms of what is considered significant and why. It may, therefore, be prudent to incorporate several of the above distinctions when structuring significance determinations. Sensitivity analyses to test the decision-making implications of alternative structuring approaches can be useful. The explicit or implicit substantive objectives that guide the reasoned argumentation process for significance determination also can lead to varying conclusions regarding what is important and why. This underscores the need for early and preferably collaborative (jointly with interested and affected parties) judgments regarding objectives for impact significance determinations.

Reasoned arguments regarding impact significance can be written (e.g., EIA documents, briefs and submissions, panel or court decisions) or oral (e.g., testimony, presentations, hearings, stories, dialogue, bargaining). They can be limited to text. They can use decision aids (e.g., figures, tables, matrices, network diagrams, qualitative and quantitative methods, consultation procedures). Such decision aids are not a substitute for reasoned argumentation. It is still necessary to distil from these materials the reasons that support significance judgments. Moreover, because significance judgments are, or should generally be, collective the reasoned argumentation process should either directly involve all interested and affected parties and/or should systematically draw upon the concerns, knowledge, values and preferences of interested and affected parties. This means a broadly based and very effective public and agency involvement process. It also suggests that impact significance determination is not a technical task undertaken exclusively by “experts.”

Fig. 3 is an example of a reasoned argumentation approach to impact significance determination. There is an initial determination of the form that the significance determinations will take (e.g., in a summary report, a hearing panel report, a task force report). An overview of relevant issues, perspectives, contexts and aspirations sets the stage for the analysis. Consideration is given to how the analysis will be structured (e.g., by available choices, by various bio-physical and socio-economic disciplines, by study areas and/or time horizons, by categories of impacts).

The relevant evidence is reviewed to identify potentially significant issues, parties, environmental components, impacts and uncertainties. The characteristics of each potentially significant impact and uncertainty are analyzed. A concerted effort is made to draw together the various types of evidence relevant to impact significance determinations (e.g., oral–written,

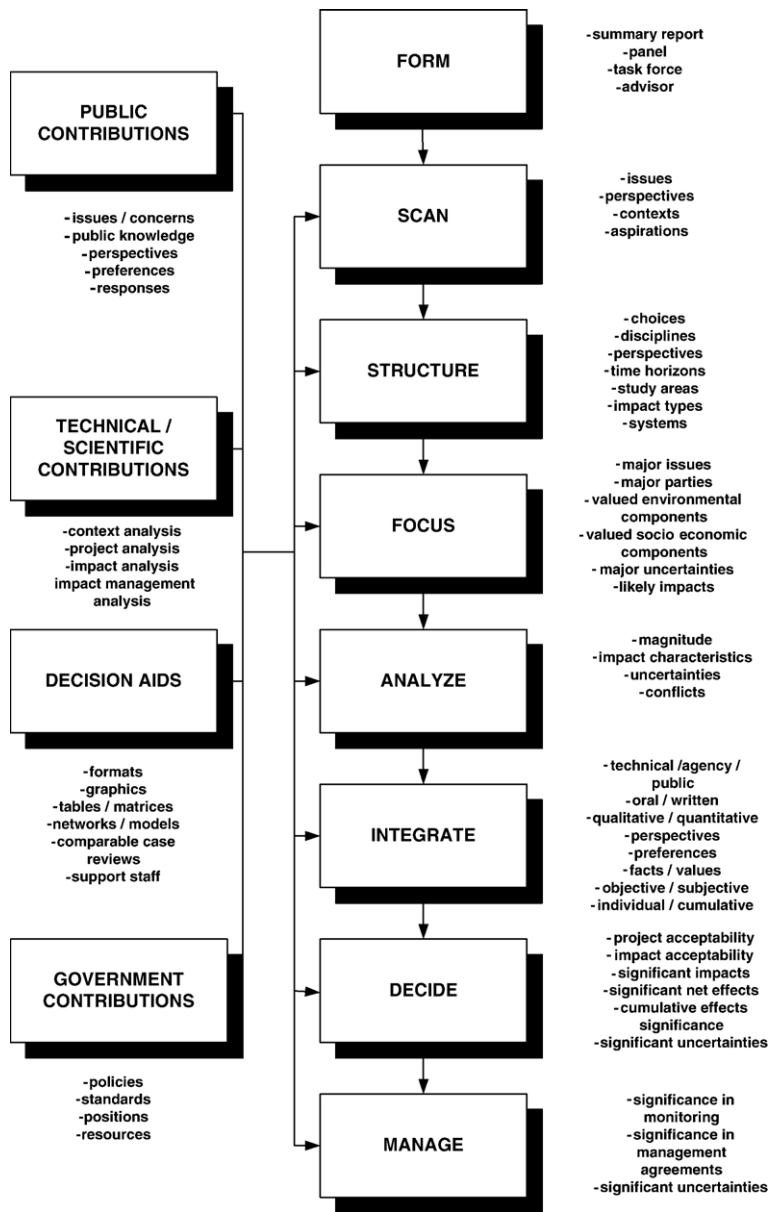


Fig. 3. An example of reasoned argumentation approach.

public–agency–technical, objective–subjective). The integrated evidence provides the basis for conclusions regarding project acceptability, impact acceptability, significant impacts (after considering mitigation potential), the significance of cumulative effects and the significance of uncertainties. Each conclusion is fully and systematically substantiated.

The results of the analysis are integrated into pre- and post-approval decision making regarding the role of significance in monitoring, in management agreements and in efforts to manage uncertainties. The reasoned argumentation approach makes full and effective use of

public, technical/scientific and government contributions. It also uses, as appropriate, decision aids (e.g., tables, figures, staff advice, reviews of comparable cases) to facilitate a consistent, focused and readily understandable analysis.

Table 4 provides examples of good practices associated with the reasoned argumentation approach to significance determination. Table 2 summarizes examples of positive and negative tendencies associated with the reasoned argumentation approach.

The reasoned argumentation approach provides a basis for judgments that all parties (proponents, government, technical specialists, community groups, Aboriginal peoples, affected individuals) are familiar with and can readily understand and contribute to. It can effectively blend the technical and the non-technical, the subjective and the objective and the qualitative and the quantitative. It is conducive to contextual adaptation, to exploring value-based choices from multiple perspectives, to integrating community and technical knowledge, to incorporating oral and written arguments, to drawing upon technical decision aids and to interpreting the importance of both individual and cumulative impacts. It can provide a sound, explicit, focused and traceable foundation for decision making. The output from this approach is the systematic and written substantiation of interpretations of importance—an outcome ultimately required for summary EIA documents and, where applicable, for panel or court decisions.

A succinct and plausible set of reasons for importance judgments does not mean that sufficient consideration has been given to technical, scientific, community and traditional analysis and knowledge, or to multiple and varying perspectives, values, beliefs and interests. The policies and perspectives of government agencies may or may not be adequately considered. Lessons from comparable situations and contextual characteristics may or may not be adequately addressed. The implications of uncertainties can be thoroughly explored or alternatively they can be arbitrarily dismissed or ignored. Sometimes data and arguments are used selectively to support pre-defined positions (i.e., advocacy or bias). It can be difficult to identify inconsistencies in qualitative written, reasoning procedures. These potential drawbacks underscore the importance, when applying the reasoned argumentation approach to significance determination, of integrating elements of both the technical and collaborative approaches.

Table 4
Reasoned argumentation approach—examples of good practice

-
- Identify and explicitly seek to achieve procedural objectives for significance determination.
 - Identify and explicitly substantiate, early in the EIA process, substantive objectives for significance determination.
 - Make systematic use of community and traditional knowledge.
 - Systematically explore the arguments and perspectives of all interested and affected parties.
 - Guard against advocacy and bias.
 - Ensure that judgments are supported by qualitative and quantitative data, clear evidence, logical deduction and reasoned arguments.
 - Ensure that substantiation for significance judgments is traceable and explicit.
 - Ensure that the reasoning process for significance judgments is sensitive to contextual characteristics.
 - Make use of decision aids whenever practical and appropriate.
 - Provide opportunities for collaborative reasoning processes, including the possible use of alternative dispute resolution.
 - Make a concerted effort to treat comparable situations in a comparable manner.
 - Make a concerted effort to draw upon all relevant data, analyses and knowledge.
 - Explicitly consider the implications of information loss as progressively summarize and distil to major relevant reasons.
 - Build in insights from comparable environments and projects.
 - Make a concerted effort to support rather than inhibit local and regional democratic decision making.
 - Explicitly consider the implications of uncertainties in making significance judgments.
 - Incorporate a range of distinctions (e.g., choices, perspectives, study areas) when structuring significance determinations.
-

5. Composite approaches

Three approaches to impact significance determination have been presented. Each exhibits both positive and negative tendencies. Each approach, depending on how it is designed and managed, can provide (or may not provide) a sound basis for impact significance determinations. The acceptability and suitability of the approach employed depends in part on context, and in part on the extent to which good practices are used and poor practices avoided. In general terms, the technical approach tends to be especially effective in integrating technical and scientific analysis and knowledge. The collaborative approach tends to be more effective in integrating community knowledge and perspectives. The reasoned argumentation approach tends to be especially effective in deriving and documenting the rationale for significance judgments in a form that all parties can understand and potentially support.

The positive tendencies of any of the approaches can be reinforced. Negative tendencies, with appropriate adjustments and adaptations, can be largely avoided and minimized. Blended approaches offer the potential to offset the negative tendencies of individual approaches. It is neither necessary nor appropriate to suggest that any of the approaches (or any approach combination) is inherently superior or inferior. It is, however, reasonable to suggest (with appropriate substantiation) that a particular approach or approach combination is more or less suited to a particular context. Also, it is reasonable (again with appropriate substantiation) to indicate that a particular approach or approach combination exhibits good or poor practices in impact significance determination. In the most extreme cases (e.g., significance determinations without substantiation, demonstrable bias, serious factual inaccuracies in the basis for significance determinations, failure to consider major factors that should have a bearing on importance judgments, failure to consider the perspectives of parties with a direct interest in the outcomes from the EIA process, an approach clearly inconsistent with key contextual characteristics and/or with decision-making requirements) severely flawed impact significance determinations could contribute to a decision that EIA documents require major revisions or are unacceptable. Again, such conclusions should be fully substantiated, including links to regulatory requirements.

Blended approaches can offset the negative tendencies of individual approaches. As illustrated in Fig. 4, composite approaches could blend two or all three approaches (Seebohm, 1997). Examples of possible two-way composite approaches include:

- a technical approach;
 - supplemented and informed by frequent or continuous public involvement and collaborative opportunities; and/or
 - that utilizes collaborative technical analysis methods (e.g., Delphi).
- A collaborative approach;
 - Structured by thresholds or criteria or other technical methods;
 - Supported by technical analysis; or
 - With provision for technical membership in collaborative forums; or
 - With periodic technical involvement; or
 - A combination of the above.
- A collaborative approach;
 - Which involves and integrates reasoned arguments by each party; and/or
 - Where parties work together to jointly and collaboratively make and substantiate significance judgments.

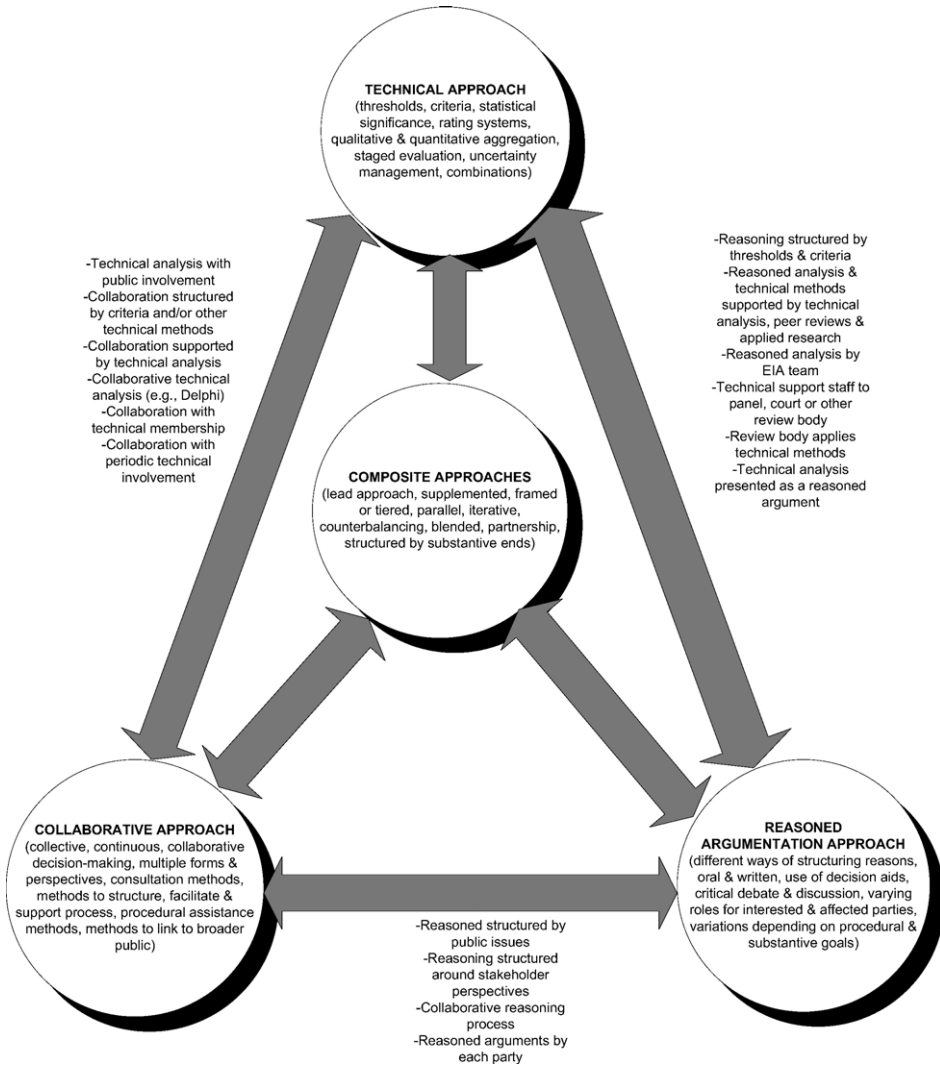


Fig. 4. Composite significance determination approaches.

- A reasoned argumentation approach;
 - Where the reasoning process is structured around public issues; and/or
 - Where the reasoning process is structured around stakeholder perspectives.
- A technical approach;
 - Where technical analysis is presented as a reasoned argument in EIA documents; and/or
 - Where technical analysis is condensed and summarized by technical staff and then converted and refined into reasoned arguments by hearing panels or courts.
- A reasoned argumentation approach;
 - which is;
 - Structured by thresholds and criteria; or
 - Structured by other technical methods; or

- Supported by technical analyses, peer reviews and applied research; or
- Supported by technical staff;
- A combination of the above.

Examples of possible three-way composite approaches to impact significance determination include the following:

- A collaborative approach informed by technical analysis, and involving reasoned oral and written argumentation by the parties;
- A technical approach informed by a collaborative public and agency consultation program, and summarized in reasoned arguments in EIA reports and/or in panel or court decisions;
- A reasoned argumentation approach informed by both technical analysis and collaborative forms of public involvement;
- A fully integrated approach where technical and collaborative approaches;
 - Proceed in parallel with periodic cross checks and synthesis; or
 - Move iteratively between one another; and
 - Where reasoned argumentation integrates the results of each.
- A tiered approach (e.g., technical at the regulatory level, collaborative at the applied level, reasoned argumentation at agency review stage);
- A framed approach:
 - A collaborative approach to establishing priorities and issues and technical methods within that framework; or
 - A technical approach that establishes generic thresholds and criteria (with public involvement) followed by collaborative adaptation and refinement; and
 - Technical specialists and major parties working together to jointly formulate reasoned arguments in favor of significance determinations.
- A partnership approach where politicians, the public, government officials and technical specialists work together on task forces or committees, aided by alternative dispute resolution and informed by public participation forums and technical analyses, to decide what is important and why; and
- A composite approach (as indicated above) but structured by substantive goals (e.g., sustainability) and/or by shared visions (e.g., community/regional plans, policies).

The choice of the most appropriate composite approach to impact significance determination varies with context. Composite approaches offer the potential to:

- Offset the negative tendencies of individual approaches;
- Link and combine technical analysis/knowledge with community knowledge/perspectives;
- Link and integrate the qualitative with the quantitative;
- Combine reason, analysis and values;
- Combine multiple forms of expression (e.g., written, visual aids, oral);
- Generate solutions and insights where the whole is more than the sum of the parts; and
- Bridge the perspectives, interests and values of technical specialists, procedural specialists, government agencies, community groups, Aboriginal peoples, interest groups and other interested and affected parties.

Adopting a composite approach does not mean that this potential will be realized. A tiered approach, where alternative approaches are used at different levels, for example, may inhibit

integration and exacerbate conflicts. A composite approach, where other approaches, constitute little more than minor add-ons is unlikely to offset negative tendencies and can be viewed by other parties as “tokenism”. Composite approaches, if poorly designed and applied, can be more complex and difficult to manage, and can be costly, difficult to understand and more time consuming. Sometimes it is impossible to reconcile or counterbalance fundamentally different value-based perspectives regarding what is important and why. Poorly constructed, different elements of a composite approach can undermine the effectiveness of others (i.e., the whole is less than the sum of the parts). On some occasions, it may be better to take a hard line on what is and is not important for substantive environmental reasons rather than adopt a composite significance determination approach, which leads to unnecessary environmental impacts or compromises in the quest for consensus.

The need for adaptations to context and the variety of composite approaches does not imply that “anything goes” in blending approaches. There are ample opportunities for bad practice. A composite approach, which simply combines poor practices or which treats other approaches as minor add-ons, is not an improvement. A concerted effort should be made to reinforce the positive tendencies, offset the negative tendencies, use good practices (subject to contextual adaptations) and avoid poor practices. The application, adaptation and integration of both individual and composite significance determination approaches would greatly benefit from applied research that assesses the relative effectiveness of alternative approaches and approach combinations in a variety of settings.

6. Conclusions

Three broad approaches to impact significance determination have been described—(1) the technical approach; (2) the collaborative approach; and (3) the reasoned argumentation approach. The technical approach breaks significance questions down into their constituent parts and applies a technical procedure to progressively aggregate the relevant impact significance determination considerations. With the collaborative approach interested and affected parties jointly, in interactive forums closely connected to broader constituencies, determine what is acceptable and unacceptable, important and unimportant and how much importance to attach to each concern and potential impact. The reasoned argumentation approach views significance determination as a process of making reasoned judgments, supported by technical and non-technical evidence.

These three approaches have been formulated and refined to the point that general characteristics (at the regulatory and applied levels), specific methods, positive and negative tendencies and good and poor practices can be identified. Positive tendencies can be reinforced. Negative tendencies can be minimized. Good practices can be refined, adapted to context and applied. Poor practices can be avoided and minimized. No single approach is generally preferable or is always preferable for particular classes of situations. There are sufficient negative tendencies linked to each approach that composite approaches are worth considering. Several two and three-way approach combinations are identified.

Combinations of approaches have the potential to counterbalance many of the negative tendencies of individual approaches. Potentially they can link and combine technical analysis and knowledge, community knowledge and perspectives, the qualitative and the quantitative, reason, analysis and methods and multiple forms of expression. They also can potentially generate synergistic insights and bridge the interests, values and perspectives of multiple interested and affected parties. These potential benefits will not necessarily be realized. Composite approaches also can either perpetuate or aggravate poor practices.

With an enhanced understanding of these approaches, together with potential combinations, EIA practitioners, working in concert with interested and affected parties, can be in a better position to design and apply an impact significance determination approach that addresses the needs and preferences of stakeholders, is consistent with good practice, reinforces the positive tendencies of available approaches, offsets the negative tendencies of available approaches and facilitates the effective match of process and methods to context. Applied research that addresses the relative effectiveness of alternative significance determination approaches and approach combinations in multiple settings could further enhance EIA practice.

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