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Environmental Impact Assessment Review 27 (2007) 755–769
Environmental Impact Assessment Review
www.elsevier.com/locate/eiar

Impact significance determination—Back to basics

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Received 27 December 2006; received in revised form 18 February 2007; accepted 20 February 2007
Available online 3 April 2007

Abstract

Impact significance determination is widely recognized as a vital and critical EIA activity. But impact significance related concepts are poorly understood. And the quality of approaches for impact significance determination in EIA practice remains highly variable. This article seeks to help establish a sound and practical conceptual foundation for formulating and evaluating impact significance determination approaches.

It addresses the nature (what is impact significance?), the core characteristics (what are the major properties of significance determination?), the rationale (why are impact significance determinations necessary?), the procedural and substantive objectives (what do impact significance determinations seek to achieve?), and the process for making impact significance judgments (how is impact significance determination conducted?). By identifying fundamental attributes and key distinctions associated with impact significance determinations, a basis is provided for designing and evaluating impact significance determination procedures at both the regulatory and applied levels.

Keywords: Impact significance determination; Core characteristics; Key distinctions

1. Introduction

Impact significance determination is widely recognized as a vital and critical EIA activity. Although generally acknowledged as pivotal to EIA practice, impact significance determination remains one of the most complex and least understood of EIA activities (Wood and Becker, 2004). The treatment of impact significance determination is highly variable at both the regulatory and applied levels. At the regulatory level some jurisdictions (e.g., Australia, California) include very detailed requirements concerning which impacts are significant, and how impact significance thresholds and criteria are to be established and applied. Other

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0195-9255/$ - see front matter © 2007 Elsevier Inc. All rights reserved.
doi:10.1016/j.eiar.2007.02.011

jurisdictions (e.g., Canada) require that impact significance interpretations be addressed, provide a general sense of which impact types tend to be more important, and then offer general guidance (e.g., sample criteria and stages). Significance determination at the regulatory level can be defined narrowly (e.g., adverse effects only, only indirect social and economic impacts) or broadly (e.g., social and economic effects included, positive and negative, direct, indirect and cumulative effects).

EIA practice at the applied level, regarding impact significance determination, also is highly variable. Many significance determination procedures and criteria are available from EIA literature and are evident, to varying degrees, in EIA documents. Some variability can be attributed to contextual and value differences (Canter and Canty, 1993). The state-of-practice, based on practitioner surveys, suggests that there is considerable room for improvement (Sadler, 1996). EIA quality and effectiveness analyses, EIA literature, EIA case studies, and sponsored applied research have begun to gradually and tentatively (appreciating the importance of contextual adjustments) establish a body of "good practices." But many deficiencies and dilemmas remain.

Examples of common criticisms of prevailing impact significance determination requirements and practices include:

- Confusion around the concept of significance (e.g., equating magnitude and significance) (Hildén, 1997);
- Insufficient consideration of the significance of social and economic effects, and a failure to appreciate the implications for significance determination of the differences between socio-economic and bio-physical impacts (Lawrence, 2004);
- Insufficient consideration of the significance of positive, indirect, socio-economic, interdisciplinary, cumulative and sustainability effects (Sippe, 1999; Solomon et al., 1997);
- Tendency to be driven by non-Aboriginal society global and national values in contrast to local and regional Aboriginal values (Larcombe and Winds and Voices Environmental Services Inc., 2000);
- The general failure to identify significance thresholds or standards which, if not adequately mitigated, would lead to proposal rejection (Kjellerup, 1999);
- A tendency by assessors to rely on their own judgments regarding impact significance rather than integrating the values of people (Morgan, 1998);
- An implicit and sometimes explicit bias toward the technical, the quantitative, and the positivistic at the expense of qualitative reasoning, contextual analysis, and public knowledge and perspectives (Burdge, 2002; Vanclay, 1999);
- A failure to recognize the political dimension of significance determination (Boothroyd, 1998);
- A failure to acknowledge or to systematically address the uncertainties associated with significance determinations (Marusich, 2001; Wood and Becker, 2004);
- A tendency to defer significance judgments to decision-makers. Such decisions can, in turn, be made in an arbitrary and implicit manner, uninformed by either technical analyses or by stakeholder perspectives and positions (Sadler, 1996);
- Insufficient systematic attention to insights from practice (e.g., which significance determination procedures and methods work well and which do not under various conditions) (Barrow, 2000; Canter, 1996);
- Technical and political resistance to significance determination procedures where the public assumes more than an advisory or review role in deciding what is important and why (e.g., various forms of shared or delegated decision-making) (Boothroyd, 1998); and

- A gulf between the available methods and procedures and the current state of much of EIA practice in significance determination (Sadler, 1996).

These ascribed limitations, especially given the pivotal role of significance determination in the EIA process, suggest the need for an enhanced level of EIA practice. More specifically they indicate that significance determination approaches need to be clearer, more broadly defined, less biased and distorted, more fully substantiated, more open, inclusive and collaborative, and more effectively linked to decision-making and EIA practice. A necessary first step toward addressing these needs is greater clarity, specifically regarding the basic characteristics of significance determination activities. These characteristics encompass the what (what is impact significance?), the nature (what are the properties of significance determinations?), the why (why make significance determinations?), the ends (what do significance determinations seek to achieve?), and the means (how is impact significance determination conducted?) by which impact significance determinations are made. With greater clarity concerning the fundamental attributes of significance determination, significance determinations approaches can be designed, applied and evaluated to more effectively address the other commonly cited deficiencies associated with prevailing practice.

This article explores the fundamental attributes of impact significance determination, first by drawing key distinctions, and second by considering implications for EIA practice and for future efforts to enhance EIA practice. It 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 analysis is a limited form of EIA theory building (Lawrence, 1997a). It includes a series of conceptual distinctions, principles, frameworks and schemas (pre-theory) derived from an overview of relevant EIA literature and practice — an inductive approach. It facilitates understanding (explanatory pre-theory) and enhanced practice (prescriptive pre-theory). Consistent with EIA theory in general and significance determination in particular, the analysis is subjective (value-full), tentative (preliminary), integrative (boundary-spanning), uncertain (imprecise), evolving (not static), practical (directed toward substantive ends) and contingent (varies with context) (Lawrence, 1997a,b, 2003). The distinctions drawn in the analysis will, it is hoped, be further tested and refined in practice at both the regulatory and applied levels (a deductive approach). They could, when supplemented by further related analyses, contribute to more systematic and explicit significance determination approaches. They also could assist in establishing criteria for evaluating proposed and applied impact significance determination approaches and methods.

2. What is impact significance?

Significance determination in EIA practice makes judgments about what is important, desirable or acceptable (Sippe, 1999; Stamps, 1997). It also interprets degrees of importance. Such judgments, as illustrated in Fig. 1, and as described below:

- Focus on relevance to EIA decision-making (e.g., which projects to consider? what is an acceptable impact? which impacts require mitigation?) (Barrow, 2000);
- Consider the interplay between impact characteristics (e.g., magnitude, duration, frequency, spatial distribution, reversibility, positive or negative, likelihood, direct/indirect or cumulative)

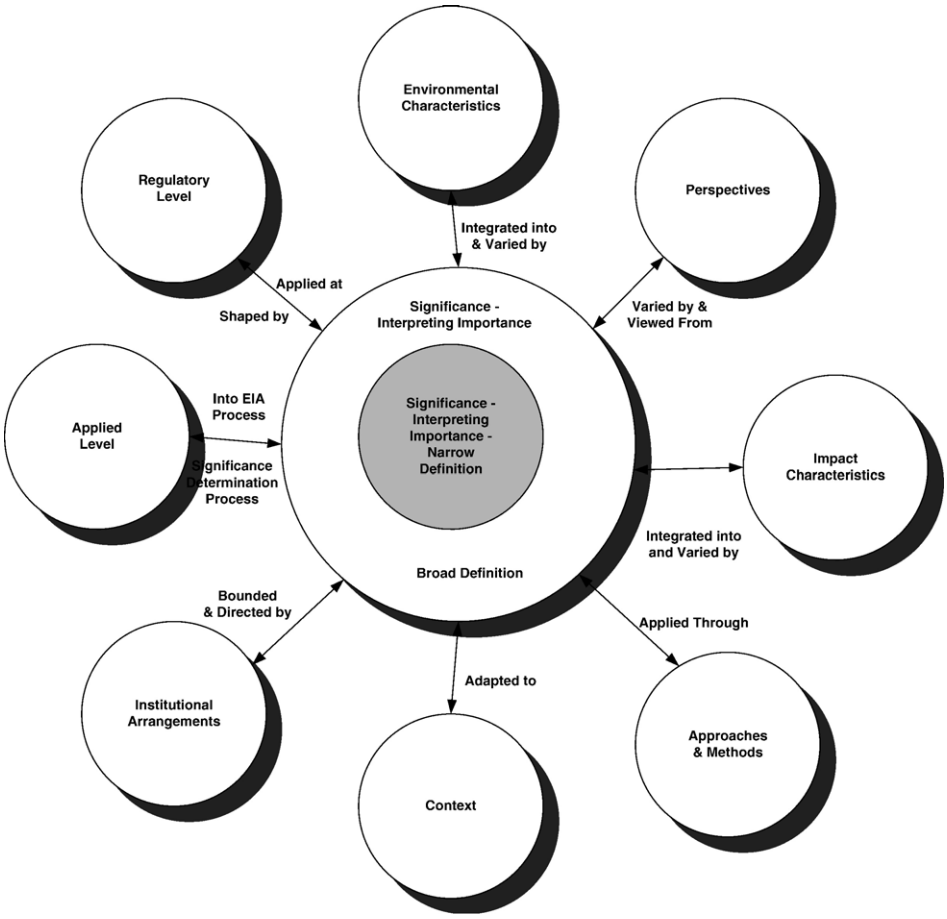

Fig. 1. Defining impact significance.

and the characteristics of the receiving environment (e.g., environmental significance, sensitivity, resilience, scarcity, stability, capacity) (Beanlands and Duinker, 1983);

- Vary by context (e.g., spatial — global, national, regional and local, temporal — short term, long term and other past, current and future actions, physical, ecological, social, cultural, economic and political conditions, relative to background conditions). Linking significance interpretations to context makes it easier to address such matters as scarcity, scale, reversibility, thresholds, sensitivity and cumulative effects (Kjellerup, 1999; Lockie, 2001).
- Are structured and partially determined by institutional arrangements. What represents a significant impact is bounded and influenced by EIA legislation, regulations, guidelines and legal precedents, and by government policies, plans, standards and objectives regarding, for example, the environment, land use, resources and sustainability (Rickson et al., 1990a,b; UNEP, 2002).
- Vary depending on perspective (e.g., legal or institutional recognition, political or public recognition, professionally judged to be important) (Canter, 1996; FEARO, 1985). Significance perspectives also can vary among individuals, groups, communities and sectors of societies.
- Take place at both the regulatory level (e.g., varying requirements for different proposals and for various environmental and effect types, impact significance objectives, principles,

thresholds, criteria and procedures in legislation, regulations and guidelines, project acceptance or rejection, judicial review and interpretation), and at the applied level (e.g., key issues during scoping, the ranking of criteria for evaluating alternatives, what represents valued ecological and socio-economic components, significant impacts, when mitigation is warranted, when a project is unacceptable, when monitoring is warranted) (Canter, 1996; Kjellerup, 1999);

- Apply procedures (e.g., staged evaluation procedures, community involvement and shared decision-making procedures) and/or methods (e.g., threshold application, the scaling of criteria, quantitative aggregation) to determine impact significance (GLL, 2001; Sadler, 1996);
- Can be defined narrowly (e.g., only adverse impacts, only indirect social and economic effects, statistical significance only, only as defined in EIA legislation and regulations, only when contravenes government policies or standards, only as determined by the EIA team) (Larcombe and Winds and Voices Environmental Services Inc., 2000); and
- Can be defined broadly (e.g., positive and negative impacts, direct and indirect social and economic effects, all forms of significance, interpretations from multiple perspectives including what people consider important).

These characteristics have many implications for EIA practice. The links between significance determination and decision-making should be clearly identified and substantiated, especially regarding how significance determinations shape and direct the EIA process. The significance determination approach should match the impact and environmental characteristics, as well as other aspects of context. How institutional arrangements shape and direct significance determinations should be identified and explained. The perspectives represented by the significance determinations should be clearly evident and justified. Preferably the significance determination approach should explore and integrate multiple perspectives.

Links between the treatment of significance determination at the regulatory and applied links should be explicit. Gaps and inconsistencies between the two levels could necessitate regulatory or guideline reform and/or further efforts at the applied level to extend from and comply with significance determination requirements and guidance. The procedures used to determine significance should be appropriate to the context, consistent with good practice standards, and inclusive of a range of significance determination perspectives. Approaches that define significance narrowly can be problematic, particularly when arbitrary limits are imposed on which types of impacts can be considered significant and/or on which parties can participate in significance determinations. Because of the close links between significance determinations and decision-making, a narrowly defined significance determination approach can unduly constrain the entire EIA process. Future consideration should be given to which approaches and methods tend to be most effective for which types of contextual characteristics, the appropriate level of detail for regulatory requirements and guidelines that foster good practice without unduly constraining innovation and contextual adjustments, and the decision-making and methodological implications of broad or narrow impact significance definitions.

3. What are the major properties of significance determination?

There are several inherent properties associated with impact significance judgments in EIA practice. Each property has implications for how significance determination procedures can and should be conducted. Significance determinations, for example:

- Are subjective, normative and value-dependent. This suggests that significance determinations must be substantiated (McBride et al., 1993). It demonstrates that significance determinations

should not be the exclusive prerogative of technical "experts" or "specialists" (Hague, 1996; Ross, 1990). Care should be taken to avoid implicit or explicit biases, and to make explicit the value basis of interpretations and assumptions (Beckwith, 2000; CEARC, 1985; Westman, 1985). Members of the public are experts on their own needs and values, and on whether the decisions and actions intended to benefit them are appropriate (Wolf, 2002).

- Are imprecise. People rarely order their values with precision in the abstract. Values, perceptions, attitudes, positions and worldviews are difficult to measure with precision, often vary greatly from group to group, and can change dramatically over time, in an unpredictable manner (Barrow, 1997; Burdge and Vanclay, 1995; Vanclay, 1999). Aggregating values across impacts and disciplines can be especially problematic (Lawrence, 1993; UNEP, 2002). Ample allowance should be made for uncertainties, and for the role of intangibles.
- Vary among EIA activities. The meaning of significance and the appropriate choice of significance determination procedures can vary when applied, for example, during scoping, option screening and comparison, environmental characteristic interpretation, impact interpretation, cumulative effects assessment, and impact monitoring (Kjellerup, 1999; Stamps, 1997). The procedures employed should reflect the unique characteristics of each activity.
- Vary for different types of effects and environments. This illustrates the need, for example, to appreciate the differences between socio-economic and bio-physical environments and effects, and their associated implications for significance determination (Lawrence, 2004).
- Are context-dependent. A thorough understanding of contextual factors (e.g., local ecological, social and cultural conditions, judgments in related decision-making areas) likely to influence significance judgments is essential (Gilpin, 1995; Sadler, 1996; Sippe, 1999).
- Are political and often controversial. They are closely connected to decision-making and, therefore, allocate power (Beanlands and Duinker, 1983; Pritchard, 1993). The role of significance determinations in, for example, fostering or inhibiting the participation of various parties in exercising influence and power in decision-making should be considered (Rickson et al., 1990b). It also is desirable to understand, explore and, where practical, resolve controversies associated with conflicting perspectives about what is important (Gilpin, 1995).
- Are not the same as magnitude of change. Magnitude of change is a factor in determining impact importance (Westman, 1985). Magnitude of change is more amenable, especially for physical and biological concerns, to objective, quantitative procedures. Once magnitude of change is combined with other more value-based and subjective considerations (e.g., context, level of public concern), significance determinations become more subjective (Sadler, 1996). Significance determination procedures should not be limited to impact magnitude considerations. It should not be assumed that they exhibit the same characteristics as impact prediction methods.
- Involve a process. Impact significance determination procedures rarely simply label an impact as significant or insignificant, with or without a reason. Usually a series of steps or stages are involved (e.g., re-interpreting significance after considering mitigation potential and likelihood). Such processes systematically integrate all relevant knowledge and perspectives (Canter and Canty, 1993; Erickson, 1994).
- Are collective. Significant determinations are subjective and value-full. Impact significance interpretations also vary among individuals, groups, communities, and sectors of society (Hildén, 1997; Taylor et al., 1998). Deciding what is important is necessarily a joint, preferably collaborative, endeavour where all EIA team members participate, as do interested and affected parties (Burdge and Vanclay, 1995; Hildén, 1997).
- Are complex and difficult. Significance determination procedures integrate facts, knowledge, values and perspectives (UNEP, 2002). They are multi-dimensional. They encompass both the

objective and the subjective (i.e., a science and an art) (Morgan, 1998; Wood and Becker, 2004). The meaning of significance evolves and changes as knowledge progresses and as attitudes alter (Barrow, 1997). Context assumes a pivotal role. The act of deciding what is important tends to be controversial. It is prone to bias (e.g., technical perspective, driven by non-Aboriginal society values) (Larcombe and Winds and Voices Environmental Services Inc., 2000). It often is closely associated with social and political conflicts, some of which may be based on deeply held values that reflect cultural, historical and social norms (Hildén, 1997). Opinions vary greatly regarding the appropriate approach or mix of approaches and methods for determining significance. The importance of impacts can change dramatically during implementation because of prediction and management uncertainties (Cloquell-Ballester et al., 2007; Sippe, 1999). Accordingly, significance determination approaches should be carefully constructed and substantiated, open, adaptable and inclusive. Lessons and insights from similar projects and environments can be especially helpful.

Collectively these properties demonstrate that approaches that treat the interpretation of impact significance as a task best addressed by value-free, technical, precise, simple, standardized procedures, and best undertaken by impact analysis "experts" are inherently at odds with the nature of impact significance judgments. They further illustrate that significance determination procedures tend to be more effective when they are "value-full," non-technical (except in a support sense), adaptive, and when they involve an open, collective, iterative process that focuses on issues, is closely tied to decision-making and is sensitive to context. These properties should be clearly evident in the procedural and substantive objectives established for significance determination approaches. They also can serve as criteria and performance standards for evaluating the effectiveness of significance determination requirements, guidelines, processes and documents. Further analysis could be conducted of how significance determination properties are expressed and addressed in EIA practice at the regulatory and applied levels in various contexts. This would, in turn, make it easier for practitioners to avoid recurrent pitfalls and to improve the overall level of impact significance determination practice.

4. Why are impact significance determinations necessary?

EIA practice can never be fully comprehensive. It is always possible to address more potential impacts, interactions and alternatives over a wider area, for a longer time period, and to a greater level of detail. With no "stopping rule" value-laden judgments must be made and substantiated regarding what should and should not be examined, and to what level of detail (Beckwith, 2000). Also, systematic, explicit, open and thoughtfully supported significance judgments help to ensure that:

- The value basis for decisions is explicit;
- Resources are allocated efficiently and effectively;
- The many uncertainties associated with value judgments and the prediction of future conditions are effectively managed;
- Comparable situations are treated in a comparable manner;
- A sound technical/scientific basis for decision-making is provided;
- Community knowledge, concerns, attitudes, values, perceptions and preferences are effectively integrated into decision-making; and
- Proposed actions and EIA processes and outcomes are consistent with and supportive of government policies, plans, standards, objectives and priorities.

In addition, surveys of EIA effectiveness point to marginal to poor performance levels in determining significance in technical guidelines, in impact evaluation, and in specifying the significance of residual impacts (Sadler, 1996). Thus significance determination is not only necessary in EIA practice but there is considerable room for improvement in how impact significance determination is conducted.

Impact significance determination procedures recognize that (1) not all potential impacts can be considered, (2) not all impacts should be considered to the same level of detail, and (3) impacts vary in their decision-making importance. Value-based (i.e., subjective) judgments must, therefore, be made to bound and direct the EIA process (Harrop and Nixon, 1999; Joyce and MacFarlane, 2001). By acknowledging that impact significance determinations are both necessary and appropriate, it is incumbent upon EIA practitioners to ensure that such judgments are explicit, are supported by analysis, are effectively placed in a regulatory context, demonstrate the role of all interested and affected parties, involve the wise use of available resources and methods, and clearly address the implications of uncertainties. Further consideration could be given to why the effectiveness performance levels for significance determination activities tend to be so low, which significance determination approaches tend to be more or less effective under which conditions, and how best to elevate the level of significance determination practice at both the regulatory and applied levels.

5. What do impact significance determinations seek to achieve?

Significance determination in EIA practice, if properly undertaken, should identify and seek to achieve both procedural (how significance determinations are made) and substantive (outcomes from significance determinations) objectives. Examples of procedural objectives for significance determinations include:

- Focused and efficient. Significance determination procedures should concentrate efforts and resources on matters critical and relevant to decision-making, consistent with regulatory requirements and public and agency concerns (Barrow, 1997, 2000).
- Explicit and clear. The value basis for judgments, the roles of all parties in the process, and the basis for the assumptions and procedures employed should be readily understandable (Lee and Colley, 1991).
- Logical and substantiated. All parties should be able to follow how the reasoning process supports the significance judgments. The judgments and the data, analyses, perspectives and knowledge that inform the judgments should be directly linked (Schibuola and Byer, 1991).
- Systematic and traceable. A coherent and orderly procedure should integrate impact characteristics, environmental characteristics, contextual factors, institutional requirements and objectives, and the perspectives and concerns of interested and affected parties. Other parties should be able to independently reconstruct how judgments were derived from inputs (Schibuola and Byer, 1991; Lynch-Stewart and Associates, 2000).
- Appropriate. The judgments should reflect an appreciation of and sensitivity to the context (e.g., local and regional setting) (Sadler, 1996).
- Consistent. Comparable situations should be treated in a comparable manner (Canter and Canty, 1993; Kirk, 2001).
- Open and inclusive. The significance judgment procedure should be conducive to understanding and participation by all interested and affected parties (Harrop and Nixon, 1999).
- Collective and collaborative. Interested and affected parties should jointly determine what is and is not important and why (Beckwith, 2000).

- Effective. Outcomes from the significance determination procedure should help realize public policy substantive and procedural objectives and priorities (Sadler, 1996).
- Adaptable. The significance determination approach should be able to readily adapt to uncertainties and changing circumstances (Cloquell-Ballester et.al., 2007).

No significance determination approach or method can fully achieve the preceding objectives. Which objectives receive the most and least attention is itself a significance judgment. Procedural objectives can provide an initial checklist of characteristics that should be readily evident in a significance determination approach and/or be included in significance determination guidelines. With explicit procedural objectives EIA practitioners and other parties are better able to contribute to and assess the effectiveness of proposed or applied significance determination approaches. Procedural objectives also can help in evaluating and comparing the specific strengths and limitations of significance determination requirements and guidelines in various jurisdictions, and in reviewing individual EIA processes and documents. Further consideration should be given to if, to what extent and why EIA processes are or are not successful in achieving procedural significance determination objectives.

Examples of substantive significance determination objectives include:

- Regulatory compliance and policy consistency;
- The avoidance and reduction of potentially significant negative impacts, to extent practical;
- The avoidance and reduction of all negative impacts, to extent practical;
- The reduction of all adverse impacts considered potentially significant, as defined by significance thresholds, to acceptable levels;
- Net positive impacts (benefits outweigh negative impacts);
- The public interest (public a net beneficiary);
- The greatest good for the greatest number (utilitarianism);
- The greatest good for the least advantaged (distributional equity);
- Local and regional benefits exceed adverse local and regional impacts, risks and costs (local and regional communities and environment net beneficiaries);
- Issue resolution or management (major points of contention resolved or ameliorated to acceptable levels);
- Consensus among major parties (major parties or stakeholders can reach an accommodation on major points of disagreement);
- Net benefits to the environment;
- Sustainability (contributes to rather than inhibits sustainability); and
- Combinations of the above.

EIA documents are not always clear or consistent regarding which substantive objectives are being applied when determining impact significance. Such inconsistencies or lack of clarity can inhibit communications among parties, reduce understanding of documents, undermine the credibility of parties, and lower the potential for resolving conflicts and/or building consensus. The consistent and clear application of substantive objectives for significance determination can be problematic if there are fundamental differences among parties regarding which substantive objective or objectives should determine when an impact is or is not significant. Decisions regarding which substantive objectives are to guide significance determinations, therefore, should be made early in the EIA process (e.g., during scoping). Such decisions also should be explicit, substantiated and collaborative.

Although necessary it is not sufficient simply to make the substantive objectives of the significance determination approach explicit, together with a rationale. In practice, substantive objectives for significance determination can be narrowly and artificially circumscribed (e.g., only regulatory compliance and only potentially significant negative effects) notwithstanding EIA requirements and/or an EIA process that ostensibly has much broader substantive objectives (e.g., sustainability, local benefits, net environmental benefits). At a minimum the significance determination process should be as broadly defined as the EIA requirements and the EIA process. Sometimes the significance determination approach, if characterized by broad substantive objectives, can facilitate the broadening of an EIA process and, over time, EIA guidelines and requirements. Further analysis should consider which implicit and explicit substantive objectives tend to drive significance determination procedures and requirements, whether and why the significance determination substantive objectives tend to be broader or more narrowly defined than those of overall EIA requirements or EIA processes, whether and which substantive significance determination objectives are or are not achieved under varying circumstances and why, and the relative effectiveness of various approaches for incorporating broadly defined substantive objectives into EIA requirements, processes and documents.

6. How is impact significance determination conducted?

Significance determinations vary among EIA process activities (Lawrence, 2002). Some key importance judgments associated with various EIA activities are summarized in Fig. 2. Each of the preceding interpretations involves value-based, subjective judgments. Each requires substantiation. The choice of appropriate procedures and methods for each judgment will vary depending on the characteristics of the activity (Ross and Thompson, 2002).

The characteristics of impact significance determination processes vary considerably, depending on the approach and methods selected. However, four general characteristics commonly exhibited in many significance determination procedures include:

- Staged — impact significance determination procedures tend to proceed from clear thresholds to comparative criteria, from the legal to the non-legal, from the quantitative to the qualitative, from the absolute to the relative, from pre-defined external standards to context-specific judgments, from individual to cumulative to sustainability impacts, and from professional judgments to public concerns (Canter, 1996; GLL, 2001). Significance-related considerations that can be most readily applied tend to be applied first. Sequence of application is not a reflection of importance. Also, the process should not stop (e.g., only important if tied to public policy and if can be quantified) when the issues associated with making significance determinations become more subjective and complex.
- Iterative — impact significance determination procedures tend to be iterative and discursive (Holden, 1999). This characteristic reflects the need to progressively explore and integrate significance determination criteria and considerations, to introduce and apply the perspectives and knowledge of multiple stakeholders, to address the implications of mitigation and enhancement measures, to identify and manage uncertainties, and to adapt to changing circumstances (UNEP, 2002).
- Internal and external involvement — impact significance determination procedures generally provide for involvement and review by relevant experts (both within and external to the EIA team), by public and private organizations, and by interested and affected individuals, groups, communities and sectors of society (Sadler, 1996). The nature and extent of involvement vary among approaches (Kirk, 2001; Lynch-Stewart and Associates, 2000).

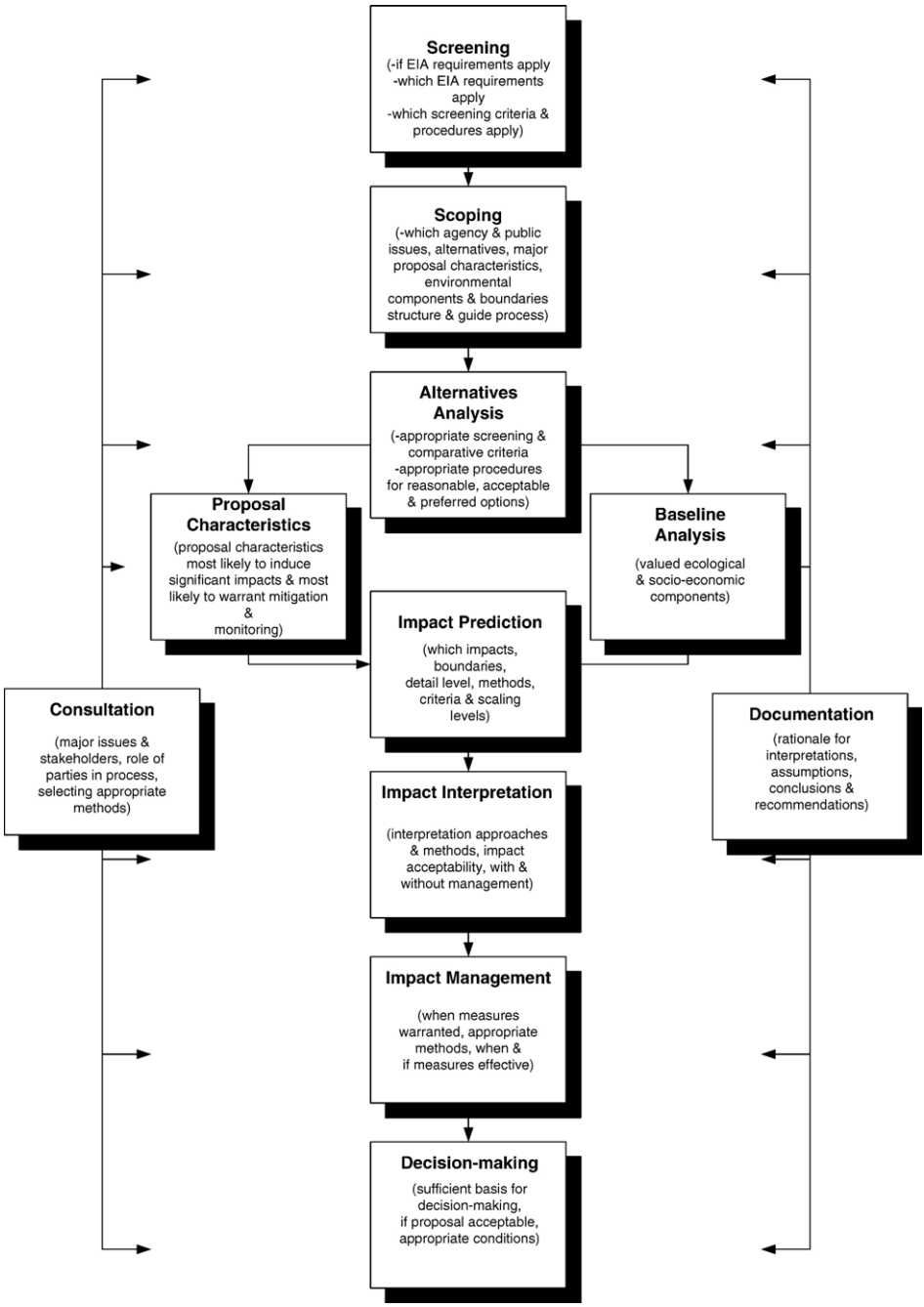

Fig. 2. Impact significance interpretations in the EIA process.

- Internal and external support — a variety of methods and procedures are commonly applied to support the significance determination process with technical and community data, knowledge, experience, concerns and preferences.

These significance determination process characteristics point to the need to adapt methods and procedures to suit individual EIA process activity characteristics. They also demonstrate that impact significance determination approaches that ascribe significance ratings in a single step, with limited to no provision for refinement, feedback, the input of interested and affected parties, or technical support are likely to be problematic. Further consideration should be given to the various ways in which staged, iterative, open and well-supported significance determination procedures can be designed and applied, and to which process characteristics tend to be more and less effective under which circumstances.

7. Conclusions

Impact significance determination is widely recognized as a vital and critical EIA activity. Yet it remains one of the most complex and least understood of EIA activities. There is considerable variability in how impact significance is treated at the regulatory and applied levels. A great many significance determination procedures, criteria and methods are available from EIA literature and elsewhere. No consensus has emerged regarding the most appropriate and effective methods or combinations of methods. There is considerable room for improvement in impact significance determination practice. Impact significance determination has been criticized as being ill or too narrowly defined, as biased in favour and against particular values and practices, and as devoting too little attention to some types of impacts, to uncertainties, to theory, and to lessons from practice. These ascribed limitations can be ameliorated with better practice. Some divisions in perspective and intractable problems will remain. Also, given the centrality of values, subjectivity, complexity, conflict and uncertainty, absolute (regardless of context) good practice impact significance determination standards are unlikely to emerge.

In view of the many limitations, uncertainties, and variations in the quality of practice associated with impact significance determination, despite its widely acknowledged importance in EIA practice, it is necessary to revisit the core characteristics and major distinctions involved in making judgments about the significance of impacts. Greater clarity regarding such attributes can contribute to EIA theory building (especially if refined and tested in practice), and can facilitate the design, application and evaluation of impact significance determination approaches.

Impact significance, as a concept, is quite simple (i.e., importance-related judgments). These judgments focus on decision-making interpretations, address the interplay of impacts and the receiving environment, vary by context and perspective, operate at the regulatory and applied levels, involve the application of procedures and methods, and can be defined broadly or narrowly. These characteristics point to the need to identify, substantiate and assess the effectiveness of links between significance determination and decision-making, contextual adaptations, the role of varying perspectives, the scope of significance determination procedures, and the selection of methods.

Impact significance determinations are subjective, normative and value-dependent. They are imprecise, vary among EIA activities and environments, and are context-dependent. They are political, are often controversial, are not the same as magnitude of change, involve a process, are collective, and are complex and difficult. These properties suggest that significance determination tends to be more effective if value-full, non-technical but technically supported, adaptive, focused on issues and decision-making, and open. Significance determination properties can help guide practice, especially if their roles in practice are systematically assessed.

Systematic, explicit, open and thoughtfully supported significance judgments are central and critical to effective EIA practice at the regulatory and applied levels. EIA significance determination

practice has advanced to the point that it is possible to identify procedural significance determination objectives (e.g., focused, explicit, logical, substantiated, systematic, traceable, appropriate, consistent, inclusive, collaborative, effective, adaptable). No significance determination or method can fully achieve these objectives. Procedural objectives can help select, adapt and combine significance determination methods. They also can aid in evaluating the treatment of impact significance in EIA requirements, guidelines, processes and documents. Further attention should be devoted to the use and effectiveness of procedural and substantive objectives in EIA practice. Substantive impact significance determination objectives should be explicit and consistently applied. They should be established early in the EIA process (e.g., scoping). Interested and affected parties should help establish and substantiate procedural and substantive significance determination objectives. Broadly defined procedural and substantive objectives are generally more consistent with significance determination properties. Arguably, the burden of proof should be on those seeking to apply very limited procedural and substantive objectives for impact significance determinations.

Impact significance determinations vary among EIA process activities, and depending on the approach and methods selected. But they generally are staged, iterative, and usually provide for internal and external involvement and support. These process characteristics should be considered when formulating, adapting and applying significance determination procedures and methods. Further analysis of the relative effectiveness of alternative significance determination processes and methods could contribute to enhanced practice.

It is hoped that the conceptual distinctions presented in this article will help EIA practitioners and others involved in the EIA process begin the process of designing an impact significance determination approach appropriate to their needs and circumstances, and in their efforts to evaluate and improve the approaches to impact significance contained in EIA requirements and documents. The definition of impact significance and the major properties can, for example, be used in explanations of the significance concept for inclusion in EIA requirements, guidelines and documents. The reasons for why significance determinations are necessary, the procedural and substantive objectives, and the description of the impact significance determination process can help structure and bound impact significance requirements and approaches. The major properties and the procedural and substantive objectives also can serve as criteria for evaluating the strengths and limitations of proposed impact significance approaches.

Acknowledgements

The research undertaken for this article was sponsored by the Joint Review Panel for the Mackenzie Gas Project (Joint Review Panel), the Mackenzie Valley Environmental Impact Review Board (MVEIRB), and the Yukon Environmental and Socio-economic Assessment Board (YESAB). Financial support was provided by the Canadian Environmental Assessment Agency. Helpful questions, comments and suggestions, provided by other presenters, MVEIRB board members and Joint Review staff, peer reviewers, and hearing and workshop attendees, are gratefully acknowledged.

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