An outline of current thinking on sustainability assessment

A background paper prepared for the Western Australian State Sustainability Strategy

by

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CONTENTS

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SUMMARY

For the purposes of this paper, sustainability assessment is defined as **assessment of proposed initiatives (projects, policies and plans) in terms of sustainability to determine whether or not approval should be given and under what conditions.** The paper provides a background to the Western Australian State Sustainability Strategy and is based on worldwide literature and a series of three workshops involving key impact assessment experts in Perth.

The paper suggests that **sustainability assessments are needed to address the economic, social and environmental interdependencies within policies, plans, legislation and projects, in order to complement and extend other assessment and decision-making processes and enable a more inclusive and informed decision-making.** Sustainability assessment needs to integrate issues and seek to assess the cumulative and synergistic impacts of decisions and management practice, and subsequently facilitate comprehensive decision-making in order to deliver greater certainty, transparency and accountability of Government decision-making. Though the literature discussed in the paper may relate to regional sustainability assessment, the paper does not examine this area.

The government's election commitments state the need for the development of sustainability assessment processes for project developments, policies, plans and legislation. Arguably, a single approach cannot be developed across all matters requiring sustainability assessment. However, a formalised comprehensive framework and set of procedures are required to inform each of these approaches. Both **transitional and long-term arrangements** for various forms of sustainability assessment need to be identified.

The need to develop a mechanism to provide integrated social, economic and environmental information for decision makers has been recognised across government and non-government organisations. **The most critical issue with respect to sustainability assessment is *how* environmental, social and economic information is analysed, integrated and presented to decision-makers.** A robust, adaptive and transparent approach to sustainability assessment, based on sound principles, is required. Although there is much experience around the world with environmental assessment and reporting, there are very few examples of where truly integrative sustainability assessments have been undertaken. Any sustainability assessment framework must therefore be designed to ensure continual evaluation and improvement as the government, industry and community all learn from experience.

The paper provides an **overview of current transitions towards sustainability assessment** that are occurring in the form of theory on institutionalising and conducting sustainability assessment, strategic environmental assessment (SEA), integrated assessment, decision-aiding techniques and emerging models or systems of sustainability-based assessment.

The paper makes the **conclusions** that there are many existing processes, methods and techniques that can be adapted and used for sustainability-based assessment, and that techniques need to be carefully chosen for particular proposed initiatives. There is no single preferred model that has emerged from worldwide studies so Western Australia needs to adapt its unique history and legislative base in impact assessment to incorporate the new approaches. However, it will require practice and continued refining before sustainability-based assessment can be a truly integrative and effective process.

INTRODUCTION

Defining sustainability assessment

Much literature and theory surrounding the idea of sustainability assessment argues that current assessment processes often fail to involve sufficient vision and understanding of the interrelations and interdependencies of social, economic and environmental considerations. A similar sentiment is often heard from industry and many governments are recognising the limitations of traditional assessment processes. Researchers conclude that **sustainability assessments are needed to address the economic, social and environmental interdependencies within policies, plans, legislation and projects, in order to complement and extend other assessment and decision-making processes and enable a more inclusive and informed decision-making.** Sustainability assessment needs to integrate issues and seek to assess the cumulative and synergistic impacts of decisions and management practice, and subsequently facilitate comprehensive decision-making in order to deliver greater certainty, transparency and accountability of Government decision-making. This paper will review these sentiments in the light of the Western Australian Government's State Sustainability Strategy. Though the literature may apply, the paper does not deal with regional sustainability assessment.

"Sustainability assessment," for the purposes of this paper, is defined as **assessment of proposed initiatives (projects, policies and plans) in terms of sustainability to determine the conditions under which approval would be given.** It applies a framework (set of procedures and techniques) for assessing the social, environmental and economic implications of projects, policies and programs (PPP) in an integrated manner in order to allow for net benefits. Robert Gibson, in a study for the Canadian Government called *Specification of Sustainability-Based Environmental Assessment Decision Criteria and Implications for Determining "Significance" in Environmental Assessment,* asserts:

> Sustainability-based environmental assessment is certainly different from the more common narrower exercises that typically consider only some aspects of environment and focus chiefly on negative effects. It is more ambitious, more demanding and much more positive. But it is also in important ways, not a huge step from present practice and present capabilities" (Gibson, 2001, p. 50).

Ideally, sustainability assessment would integrate social, environmental and economic considerations at **every stage in decision-making**. It should be noted that this pure form of sustainability assessment is **a challenge to develop** and evidence of achieving this in practice is yet to be seen. In the absence of examples where these concerns have actually managed to be integrated from the start, sustainability assessment will involve the integration of social, economic and environmental assessments into a single sustainability-based assessment report. However, if the three areas are not integrated from the start then this report would in actual fact be a **"Triple Bottom Line"** assessment report and not a sustainability assessment, because it would simply present a **list** of social, environmental and economic concerns to be analysed in decision-making, rather than integrating and analysing these concerns throughout the assessment process. This concept of an interim/transitional form of sustainability assessment (similar to TBL) as well as the preferred integrated form of sustainability assessment, are referred to as "sustainability-based assessment" in this paper.[1]

[1] Sustainability auditing and Triple Bottom Line (TBL) reporting are different to sustainability assessment. Sustainability auditing and TBL are used to assess a company or organisation's performance in terms of sustainability; sustainability assessment differs because it aims to *integrate* social, economic and environmental factors at appraisal, decision-making and management levels, rather than simply listing social,

Dalal-Clayton asserts that a sustainability assessment framework should apply across the range of project to policy levels (Dalal-Clayton, 1992). In *How Green is the City?* Devuyst suggests that sustainability-based assessment framework needs to be sufficiently flexible to accommodate the many different applications but must operate within the limits of the environment's carrying capacity in which the activity takes place (Devuyst, 2001, p. 176). He cites Rees who provides **four initial steps** to adapting EIA for sustainability:

- Extend the scope of activities subject to EIA to cover the full range of ecologically and socially relevant public and private sector proposals and actions
- Create a variety of institutional frameworks for environmental assessment adapted to the increased diversity of initiatives and activities to be assessed
- Develop methods for environmental assessment that reflect the discontinuous temporal and spatial dynamics, and the resilience properties of ecosystems
- Implement the preceding as part of a broader planning and decision-making framework that effectively recognizes ecological functions as limiting factors (Rees, 1988).[2]

Devuyst also cites Lawrence (1997) who provides a succinct definition of sustainability assessment: applying the broad principles of sustainability "to the assessment of whether, and to what extent, various actions might advance the cause of sustainability."

Context

In the 2001 state election the current government developed an Environment Policy and committed to establishing a Sustainability Policy Unit which would fulfil the **election commitments**:

- "to ensure that ESD principles and practices are incorporated into all aspects of government decision-making (not just the environmental agencies); and
- "to coordinate and monitor the economic, environmental and social impact assessments undertaken by relevant agencies."
- "undertake an ESD assessment of Cabinet submissions, proposed legislation and agreements entered into by Government"
- "in order to fully implement ESD, it is necessary to ensure that its principles are included in policy formulation and policy-making processes, legislation, corporate plans and reporting requirements"
- "work with agencies and departments to prepare a code of conduct for policy making and management practices" (ALP (WA) Environment Policy, p. 5).

This covers a wide range of matters, from project developments, to policies and plans. Arguably, a single approach cannot be developed across all matters requiring sustainability assessment. However, a formalised comprehensive framework and set of procedures are required to inform each of these approaches. The need for a sustainability assessment framework is being addressed in the State Sustainability Strategy, identifying and recommending **transitional and long-term arrangements** for various forms of sustainability assessment.

The need to develop a mechanism to provide integrated social, economic and environmental information for decision makers has been recognised across government and non-government organisations. **The most critical issue with respect to**

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economic and environmental impacts and considering then separately. Furthermore, sustainability-based indicators projects, such as the Sustainability Indicators Project in Texas, have sought to increase regional awareness and commitment to sustainable community development, but such projects tend to focus on social factors and regional planning and often fail to *integrate* social, economic and environmental elements within indicators. Indicators have been used as a *reporting* mechanism and differ from sustainability assessment, which provides appraisal of initiatives *before* approval as well as *during* the life of the initiative.

[2] Note that there is no mention of the economic here.

sustainability assessment is *how* environmental, social and economic information is analysed, integrated and presented to decision-makers. A robust, adaptive and transparent approach to sustainability assessment, based on sound principles, is required. Although there is much experience around the world with environmental assessment and reporting, there are very few examples of where truly integrative sustainability assessments have been undertaken. Any sustainability assessment framework must therefore be designed to ensure continual evaluation and improvement as the government, industry and community all learn from experience.

Most models proposed by researchers of sustainability assessment are **flexible enough to apply to various areas** of Government decision-making. In its overview of sustainability assessment systems, this paper looks at the original intended uses for the models and how the models can be adapted for different Government decision-making needs.

It is important to clarify here that the term "Sustainability Assessment" has been used in literature and practice in two very different contexts. The first context involves checking if a community or organisation is progressing towards sustainability. It is an auditing or performance testing system. The second context attempts to assess the sustainability of proposed projects, plans, policies or legislation before they are implemented and is similar to impact assessment processes. Essentially, the second type of instrument asks: **"Is this initiative in keeping with sustainability?"** (Devuyst, 2000, p. 72). There are many examples of the first type of instrument in practice but fewer of the second. This paper discusses the relevance of the second type of instrument to assessment of projects, policies and programs (PPP). It provides an overview of the current status of sustainability assessment and focuses on frameworks rather than methodologies or techniques. There is a proliferation of well-established assessment and decision-aiding techniques that could be drawn on for sustainability assessment. However, this paper will simply identify these techniques whilst documenting sustainability assessment thinking and models.

Workshops

The Department of Premier and Cabinet Policy Office hosted a series of **workshops on sustainability assessment** with key assessment workers and researchers in Perth,[3] which indicated more than anything what an overwhelming and long-term process the development of a truly integrative sustainability assessment framework/mechanism would be. The three workshops focussed on sustainability assessment of legislation and projects but also considered assessment of policies, plans and programs. The workshops involved the knowledge of environmental and social impact assessment experts, among sustainability experts and others, and generated much useful discussion about the difficulties and dangers, as well as the strengths, of an integrative sustainability assessment framework.

Strengths identified through the workshops included the wide availability of significant techniques and expertise extending from planning, strategic environmental assessment and social and environmental impact assessment, and the benefit of approaching sustainability assessment as an iterative process that could be constantly refined. **Dangers and difficulties** included identifying how and when integration of environmental, social and economic factors would occur, defining environmental and social bottom lines/thresholds, identifying the roles and responsibilities of proponents, community and

[3] See list of attendees in acknowledgements.

government, whether different frameworks would be needed for projects, policies, plans and programs, how tradeoffs would occur, whether sustainability assessment would build on existing assessment arrangements or start with a clean slate and how to ensure those undertaking a sustainability assessment would have the necessary skills and resources to do so. The difficult issue of trade-offs was canvassed in the workshops and Professor Bryan Jenkins, a workshop participant, has since pointed out the need for **reconciliation of social, economic and environmental factors rather than trade-offs. The workshops generally indicated the need for clarification and agreement on the sustainability principles to be used, and the importance of developing robust guidelines and criteria from them.**

When thinking about sustainability assessment it is easy to get caught up deliberating over the best possible principles as a foundation for assessment. One loses sight of the bigger picture when focussing on whether to draw on principles adopted by the UN, principles developed in the UK, Canada and other countries, whether to start with fresh principles specific to Western Australia, and whether the principles could be made more comprehensive, clear and tight-knit to allow for ease, sufficiency and consistency in the sustainability assessment process. Attention should be given to the bigger problem: how to truly integrate social, environmental and economic factors as early as possible in the assessment process. The workshops **concluded that the development of a sustainability assessment framework would be a long-term process and that short-term measures (such as greater use and extension of triple bottom line assessment and reporting) would open the way for the long-term goal of a formalised and truly integrative sustainability assessment framework.**

Structure of the paper

The following parts of the paper cover:

- the movement towards sustainability-based assessment,
- strategic environmental assessment and sustainability assessment,
- integrated assessment and sustainability assessment,
- techniques for sustainability assessment including multi-criteria analysis (MCA) and other decision-aiding techniques, and
- emerging models for sustainability assessment.

Conclusions are made and an appendix is provided including an overview of techniques relevant to sustainability assessment of projects, plans and programs.

THE MOVEMENT TOWARDS SUSTAINABILITY-BASED ASSESSMENT

Since at least as much thinking as action has occurred surrounding sustainability-based assessment, it is important to consider some of the conflicting views on it.

Literature background

There is a worldwide movement to develop a sustainability assessment system. Many researchers and commentators recognise the **absence of a truly integrative sustainability-based assessment and the limitations of current environmental, and other, assessment processes.**

The bulk of research on sustainability assessment has originated in Canada, Europe and the UK as will become clear in this paper. The ideal form of sustainability-based assessment is still being sought after in research circles. Eggenberger and do Rosário Partiário (2000) in their article "Integration", propose new research to search for sustainability-based assessment experience and develop a sustainability assessment framework that is true to the principles of sustainability.

Similarly, Smith and Sheate (2001), in "Sustainability Appraisal," suggest what a true sustainability assessment process would involve and document what changes would be needed to build existing sustainability appraisal practice up to European Union SEA Directive standards.[4] **Researchers in the UK are currently trying to develop a sustainability appraisal process that incorporates the requirements of EU SEA directive, because existing assessment practices do not have the capacity to fulfil the requirements.** A number of options for a sustainability-based assessment process have been identified: "carry out SEA rather than sustainability appraisal; undertake SEA and separate economic and social appraisals; or establish a sustainability appraisal process that incorporates the specific requirements of the SEA Directive." It is interesting to see that an "interview survey of 25 experts and practitioners revealed clear support for the latter [sic] option" (Smith and Sheate, 2001, p. 263).

According to Devuyst, there are two possible ways to incorporate sustainability into impact assessment:

- introduction of sustainability principles into existing EIA and Strategic Environmental Assessment (SEA) legislation and guidelines; or
- development of a separate system for sustainability assessment (Devuyst (ed), 2001, p.176).

These researchers, like many others, seem to be concerned with how best to introduce sustainability assessment, that is, how to institutionalise or make arrangements for it.

There are many examples around the world of processes that build on environmental assessment to involve simultaneous consideration of social, economic and environmental factors. There is a spectrum of sustainability-based assessment processes that have occurred at *many* levels in *most* sectors. These examples usually take the form of integrated assessment, strategic environmental assessment, sustainability indicators, and sustainability auditing or triple bottom line reporting. Although these represent well-

[4] The directive requires certain plans and programs to undergo a strategic environmental assessment (Smith and Sheate, 2001, p. 264).

established processes and provide **much groundwork for sustainability-based assessment**, in reality a widely accepted and **truly integrative sustainability-based assessment mechanism/framework is yet to be established** out of these experiences.

There are many **variations** of the forms of sustainability-based assessment existing throughout the world. **Many international organisations** and associations have adopted sustainability and have been developing indicators for sustainability and triple bottom line assessments. Some of these organisations and associations include Organisation for Economic Cooperation and Development (OECD), World Trade Organisation (WTO) (currently developing methodology for Sustainability Impact Assessment (SIA) of proposed WTO Multilateral Trade Negotiations), World Economic Forum's (Pilot Environmental Sustainability Index), the Dow Jones Sustainability Indexes, and the Global Mining Initiative (GMI) Mining Minerals and Sustainable Development (MMSD) assessment process (assessing the state of the mining industry in terms of sustainability).

Furthermore, different levels of government, to varying degrees, are beginning to develop sustainability indicators projects and to use triple bottom line assessments. **Environment Australia** has been developing National Headline Sustainability Indicators as "a way of assessing, over time, whether we are maintaining and enhancing the economic and social services and institutions which Australians, as a community most value while, at the same time, maintaining the ecological systems on which all life depends" (see ABS, 2000). Another Australian example is the City of Melbourne's partnership with the International Council for Local Environmental Initiatives (ICLEI) (the international environmental agency for local governments that aims to build and serve a worldwide movement of local governments to achieve tangible improvements in global environmental and sustainable development conditions through cumulative local actions). Together they have developed the Triple Bottom Line (TBL) Toolkit for integrating TBL into local government through corporate planning and sustainability assessment of proposals considered by council (see ICLEI, 2002). Furthermore, Sydney Water has developed sustainability indicators to report on its consistency with the principles of ESD (Sydney Water, 2002), and in Western Australia the Water Corporation has prepared similar reports.

Although these forms of assessment are performance related (apart from the WTO SIA and the TBL Toolkit) and not typically used for assessment of proposed initiatives, the wide research and thinking they have generated has some bearing on "sustainability-based assessment" (assessment of proposed initiatives in terms of sustainability, to determine whether or not approval should be given).

The nature of current sustainability-based assessment models

Another critical issue for sustainability assessment is **how to integrate qualitative and quantitative information into a single assessment.** Questions remain surrounding this fundamental nature of sustainability assessment. As will be discussed in the section Techniques for Sustainability Assessment, some decision-aiding techniques in use are able to combine qualitative and quantitative data in a manner accurate and effective for decision-making, but others are problematic in their attempt to combine qualitative and quantitative information through standardisation or conversely the use of symbols (in the planning balance sheet approach) that require decision-makers to take their attention away from the integrative task at hand and refer to additional information (McAllister, 1980, p. 155).

Many sustainability assessment systems documented in this paper involve the use of qualitative techniques as a foundation and sometimes employ quantitative techniques. Most research on sustainability assessment has adopted **qualitative** rather than quantitative methodology because of the complexity of analysis required to address the vast array of issues surrounding any given proposal/initiative, and the absence of well-developed quantitative sustainability assessment tools. This is not to say, however, that effective quantitative methods for integrating social, environmental and economic factors in assessment cannot be established in the future. Tools used in social impact assessment and strategic environmental assessment, together with EIA mechanisms, will pave the way to developing accurate quantitative instruments for sustainability assessment. Until such instruments are established through inclusive and objective processes, qualitative methods will continue to be advocated in order to avoid misrepresentation, oversimplification and narrow analysis. These qualitative instruments make non-quantitatively measurable impacts explicit but can nevertheless involve a degree of quantification.

S.E.A. AND SUSTAINABILITY ASSESSMENT

Strategic environmental assessment (SEA) is well-established in California and in countries such as Canada, New Zealand and Australia (Annandale and Morrison Saunders, 2002; Thomas, 2001, p. 66), as well as in the EU, particularly for urban planning in the Netherlands (see DHV Environment and Infrastructure & S. Nooteboom, 1999). There are also **many examples** of SEA used for strategic planning and project appraisal in Hong Kong (Devuyst (ed), 2001, p. 140). Sadler has commented that most OECD countries now have formal provisions for SEA. Those that do not (such as Austria, Ireland, Luxembourg and Portugal, and the accession countries of Central and Eastern Europe) are respectively in the process of adopting SEA, or will be required to adopt it as a condition of EU membership (Sadler, 1998, 32). It must be remembered, however, that although "an increasing number of countries and international organisations now undertake some form of strategic environmental assessment (SEA)," general approaches, institutional arrangements, requirements, scope of application and **procedures vary considerably** (Sadler, 1998). It is also important to note that the extent to which SEA benefits are achieved, and **the extent to which it accommodates sustainability, depend on the provisions for inter-sectoral dialogue, skills within public and private organisations, human and financial resources, administration, acceptance by decision-makers, the local history of implementation, and "the degree to which overall strategies of sustainable development are in place"** (Dalal-Clayton & Sadler, 1995, and Sadler and Baxter, 1997, cited in Dalal-Clayton & Sadler, 2002, p. 8).

While SEA is occurring in various Australian states in its various forms and with differing approaches and formal provisions, in **Western Australia** it is restricted to environmental assessment of town planning schemes and only occurs in that environmental considerations are included in planning which involves social and economic concerns (Bennett, 2002). All town planning schemes must be referred to the EPA which decides whether or not assessment is needed. SEA in Western Australia is ad hoc; there are no formal requirements for SEA procedure (Dalal-Clayton & Sadler, 2002, p. 10), although legislation does not prevent SEA from being used. Section 16e of the Environmental Protection Act, amended 1996, states that the functions of the Authority are "to advise the Minister on environmental matters *generally* and on *any matter which he* [sic] *may refer to it for advice*, including the environmental protection aspects of any proposal or scheme, and on the evaluation of information relating thereto" (emphasis added). Therefore, Western Australian examples of SEA in practice do exist, but formal guidance is lacking

and the opportunities to extend this to a more sustainability-based assessment remain open.

By some observers, SEA is considered to be almost **akin to sustainability-based assessment**. Noble, in "The Canadian Experience with SEA and Sustainability," states that "Strategic EA (SEA), the EA of proposed and existing PPP and their alternatives, is gaining widespread recognition as a supporting tool for decision making towards achieving sustainable development" (Noble, 2002, p. 3). **However, Noble concludes that adjustments and additions to SEA in Canada must be made "if SEA is to contribute to the design of more sustainable policies and strategies"** (p. 3): "the effectiveness of SEA in achieving sustainability objectives will only be realised when a structured and systematic methodological assessment framework is adopted" (p. 14). The following section will outline SEA, its limitations and identify some ways in which it differs from sustainability-based assessment.

Generally speaking, SEA incorporates the broader aspects of "environment" and includes issues of character and other aspects not traditionally assessed under EIA (Newman, 2002). However, general impressions of what SEA does, or can do, vary markedly. According to Thérivel and Brown, "(t)he overall effect [of SEA] is one of moving the competent authority's PPP [policy, programme or plan] outcomes towards sustainability" (Petts (ed), 1999, 441). One commentator has described SEA as the full and early incorporation of environmental factors into the planning process (Thomas, 2001, p.64-65). SEA has been developed partly due to the limitations of environmental impact assessment and has been used increasingly in the last 5 years to assess environmental considerations in policies, plans and projects (Annandale and Bailey, 1999, p. 1-10). It is "the environmental analysis and evaluation of initiatives other than projects" (Annandale and Bailey, 1999, p. 1). Because SEA is still developing and is often approached differently and is used for differing applications, it cannot be given a simple definition (Annandale and Bailey, 1999, p. 2). It is seen by some as "merely an extension of project-EIA" that uses similar techniques to assess policies, plans and programs, and by others as "a process for 'trickling down' sustainability ideas, where the focus is on integrating environmental considerations into the making of PPPs, and the methods used are more likely policy analysis techniques than project EIA" (Annandale and Bailey, 1999, p. 2). In the report Strategic Environmental Assessment Existing Methodology (Prepared by DHV Environment and Infrastructure BV under a research contract with Directorate General for Environment, Nuclear safety and Civil Protection (DGXI)) SEA is defined as "taking account of environmental impacts in strategic actions." The report outlines the steps in the SEA process as:

a. Definition of objects (sectoral or regional objectives and constraints, and environmental objectives and environmental issues);
b. Formulation of options for the strategic actions (optimisation for sectoral or regional objectives and optimisation for environmental objectives);
c. Environmental impact analysis;
d. Information analysis (further aggregation, uncertainties and presentation of options and impacts); and
e. Decision (DHV Environment and Infrastructure BV).

It is clear from these steps that **SEA can provide opportunities to incorporate sustainability** into appraisal because in some cases it effectively involves bringing together social, economic and environmental concerns and the formulation of options. Because SEA addresses environmental concerns at a plan level, environmental factors are effectively married with existing social and economic concerns, even though SEA does not formally provide for social, economic and environmental concerns to be assessed

together and in an integrated manner. Furthermore, Arce and Gullón assert that SEA makes a fundamentally important contribution to sustainability because it increases "the possibility of analysing and proposing alternative solutions and incorporating sustainability criteria throughout the planning process, as they carry the principles *sustainability* down from policies to individual projects" (Arce and Gullón, 2000, p. 394-395). In addition, the International study of the Effectiveness of Environmental Assessment identified that good SEA practice involves elaborating on and comparing alternatives, "including no action options to clarify implications and trade-offs" (cited in Thomas, 2001, p. 68). Finally, Sustainability assessment, like SEA, would be different to EIA in that it would take a "proactive approach" rather than a "reactive approach" (Arce and Gullón, 2000): it would be about "promoting the positive" rather than just "managing the negative" (Newman, 2002). **Sustainability assessment would determine conditions of approval that would maximise net benefit and modify the proposed initiative towards sustainability.**

However, the similarity of SEA to sustainability assessment would depend on its ability to actually integrate and negotiate, rather than merely 'bring together', social, economic and environmental concerns, and its provision for fundamental sustainability principles such as integration, the precautionary principle and the principle of transparency and openness (public engagement). Indeed, one commentator has observed that SEA, in Europe and the United States, does lend itself to sustainability but it has limitations.

- SEAs have been typically sectoral (eg for water supply, agriculture, energy), regional (eg metropolitan plans, community plans, redevelopment plans) or indirect (eg science and technology, financial policies, enforcement policies);
- The impacts considered have been traditional (eg air, water, soils), sustainability-related (eg unique natural features, energy, non-renewable resources) or policy-related (eg safety and risk, climatic hazards, social conditions);
- Public involvement is complicated by the breadth of issues considered, arranging meetings of the different groups involved, the appropriate level of the decision-maker and the lack of a specific deadline for a decision (Therivel, 1993).

Other commentators have also found differences between SEA and sustainability-based assessment. To consider these subtle but significant differences, it is necessary here to consider current understanding of what sustainability-based assessment is and its current status. As mentioned earlier, Smith and Sheate, in "Sustainability Appraisal," discuss changes that would be needed to **build existing sustainability appraisal practice up to EU SEA Directive standards**. According to Smith and Sheate, "Sustainability appraisal evolved in response to a perceived need to assess the economic, social and environmental implications of a strategy so that progress could be made on the path towards sustainable development, an ideal in which economic, social and environmental concerns are wholly reconciled" (Smith and Sheate, 2001, p. 264). The UK Government 's (Department for Transport, Local Government and the Regions – DETR) guide for incorporating sustainable development into regional strategies (which includes guidance on sustainability appraisal) has been used for a number of years (Smith and Sheate, 2001, p. 263). As Smith and Sheate comment:

> The appraisal methodology set out in the Guide has gained rapid acceptance and sustainability appraisal itself is increasingly recognised as a means of helping to reconcile economic, social and environmental concerns (p. 264).

However, although this appraisal has been occurring for some time, the extent to which it progresses sustainability is debatable. DETR's definition of sustainability appraisal seems to allow for contributions to sustainability:

> A systematic and iterative process undertaken during the preparation of a plan or strategy, which identifies and reports on the extent to which the implementation of the plan or strategy would achieve the environmental, economic and social objectives by which sustainable development can be defined, in order that the performance of the strategy and policies is improved (DETR, 2000b, p. 4).

UK experience with the guide, however, reveals that the DETR definition of sustainable development "may be considered a relatively weak interpretation since a healthy environment is not emphasised as the bottom line on which economic success and social equity depend" (Smith and Sheate, 2001, p. 275). Smith and Sheate conclude that the DETR guide is lacking in (and if it is to meet SEA Directive standards, needs):

> The designation of consultees; preliminary consultation on the appraisal scope; the provision of baseline information and its use in the appraisal; public consultation; taking the appraisal finding into account; and publishing information on the nature of the changes made in the light of the appraisal. Future guidance should also emphasise the need to report explicitly on the information listed in Annex I to the SEA Directive in order to demonstrate compliance (p. 275-276).

These suggest process-based deficiencies and support the argument that in a truly integrative sustainability-based assessment, process/procedures are at least as important as the assessment techniques employed and the actual sustainability issues covered.

The trend away from SEA and towards sustainability appraisal (towards considering economic, social *and* environmental issues with equal weight) in the UK is now complicated by the substantial SEA Directive requirements (Smith and Sheate, 2001, p. 263-264). Smith and Sheate cite article 1 of the SEA Directive, which states that its objective is to:

> Provide for a high level of protection to the environment and to contribute to the integration of environmental considerations into the preparation and adoption of plans and programmes *with a view to promoting sustainable development*, by ensuring that . . . an environmental assessment is carried out of *certain plans and programs* that are likely to have significant effects on the environment (Smith and Sheate, 2001, p. 266, emphasis added)

These "certain plans and programs" cover a wide range of areas (see Smith and Sheate p. 266 for list of areas) and would mean considerable extension of existing appraisal processes in the UK. Smith and Sheate make noteworthy distinctions between SEA and existing sustainability appraisal in the UK.

> The sustainability appraisal process set out in the DETR Guide and the requirements of the SEA Directive arguably differ in terms of their overall aims and certainly in terms of their procedural and methodological requirements. With respect to their overall aims, SEA may be considered an advocative approach in that it seeks to raise the profile of environmental considerations in decision-making (from Kørnøv and Thissen, 2000). Sustainability appraisal, in contrast, represents an integrated approach, since it aims to support the decision-making process with respect to all aspects of sustainable development and therefore remains neutral with respect to the interests at stake (Smith and Sheate, 2001, p. 266)

Some supporters of sustainability appraisal see the return to the more environmentally-based assessment of SEA as a step backwards in the progression towards "'integrated' or 'joined-up' decision-making (touted as the only route to sustainable development)" (Smith and Sheate, 2001, p. 266-267). In contrast, SEA supporters may argue that the environmental should be the basis for assessment since economic and social prosperity ultimately depend on it (p. 267). Smith and Sheate suggest that the truth of either side's argument would depend on "whether a 'strong' or 'weak' concept of sustainable development is pursued" (p. 268). I suggest it would also depend on the reality of the two types of assessment in practice and the specifics of local context.

Arguably, sustainability-based assessment is different from other types of assessment (such as SEA) because (a) it is concerned with promoting the positive rather than managing the negative, and (b) it integrates processes rather than just bolting them together. Whereas sustainability-based assessment ideally tries to integrate from the start – starts a fresh with social, environmental and economic concerns (the full range of sustainability issues) and brings them together in one assessment, - SEA involves inserting environmental concerns into already existing processes and expanding these processes, which although cover social and economic concerns, may or may not provide for sustainability and its objective to resolve tensions between issues. This argument may not always hold, and I would suggest, as I did earlier, that process/procedures (and perhaps provision for iteration, inclusion, formulation of alternatives and options, and precaution) are what defines sustainability-based assessment, and not its similarities or differences to existing assessment processes. Although it is useful to study the assessment processes (including examples of the various approaches to SEA) that are paving the way to an integrative sustainability-based assessment, it is important to recognise that an integrative sustainability-based assessment itself will be iterative and may lead to a more refined and comprehensive assessment process in the future. In addition, just as "(d)ifferent types of SEA tools and approaches are needed for different strategic actions," as Thérivel and Brown point out (Petts (ed), 1999, 443), so too will sustainability assessment require flexibility.

The International Association for Impact Assessment's **(IAIA) SEA performance criteria** demonstrates how close SEA can be to a truly integrative sustainability-based assessment process:

> A good-quality Strategic Environmental Assessment (SEA) process informs planners, decision makers and affected public on the sustainability of strategic decisions, facilitates the search for the best alternative and ensures a democratic decision making process. This enhances the credibility of decisions and leads to more cost- and time-effective EA at the project level. For this purpose, a good-quality SEA process:
>
> **Is integrated**
> • Ensures an appropriate environmental assessment of all strategic decisions relevant for the achievement of sustainable development.
> • Addresses the interrelationships of biophysical, social and economic aspects.
> • Is tiered to policies in relevant sectors and (transboundary) regions and, where appropriate, to project EIA and decision making.
>
> **Is sustainability-led**
> • Facilitates identification of development options and alternative proposals that are more sustainable1.
>
> **Is focused**
> • Provides sufficient, reliable and usable information for development planning and decision making.
> • Concentrates on key issues of sustainable development.
> • Is customized to the characteristics of the decision making process.
> • Is cost- and time-effective.
>
> **Is accountable**
> • Is the responsibility of the leading agencies for the strategic decision to be taken.
> • Is carried out with professionalism, rigor, fairness, impartiality and balance.

• Is subject to independent checks and verification
• Documents and justifies how sustainability issues were taken into account in decision making.

Is participative
• Informs and involves interested and affected public and government bodies throughout the decision making process.
• Explicitly addresses their inputs and concerns in documentation and decision making.
• Has clear, easily-understood information requirements and ensures sufficient access to all relevant information.

Is iterative
• Ensures availability of the assessment results early enough to influence the decision making process and inspire future planning.
• Provides sufficient information on the actual impacts of implementing a strategic decision, to judge whether this decision should be amended and to provide a basis for future decisions.

1 i.e., that contributes to the overall sustainable development strategy as laid down in Rio 1992 and defined in the specific policies or values of a country

(*source:* http://www.iaia.org/Publications/sp1.pdf)

The IAIA criteria are intended as a guide to good SEA and clearly demonstrate that SEA in its ideal form shares many principles and objectives with sustainability.

In *Strategic Environmental Assessment: Institutional Arrangements, Practical Experience and Future Directions*, Sadler outlines some areas of concern regarding SEA, including informing and involving the public (Sadler, 1998, p. 35). He suggests that policy level SEA often does not involve enough public input because the general public and local communities tend to be less interested in policy and more interested in projects and plans which directly affect them. Thus, he asserts that it is the significant responsibility of the authority involved "to ensure that the full range of values and interests likely to be affected by the proposal are represented or reflected in a SEA; e.g. by social impact assessment, preference elicitation methods, consensus building approaches" (p. 35). Sadler also discusses the importance of changing the culture of decision-making, suggesting "SEA is as much about raising awareness and building knowledge as it is about instituting structures and procedures" (p. 35).

Such concerns would be shared by sustainability-based assessment and perhaps would be even more integral to successful sustainability-based assessment. Sadler concludes by discussing the future directions for SEA in terms of sustainability: **"The overriding requirement for the future is to link SEA more directly to sustainable development objectives and imperatives"** (p. 37). Other necessary steps are adopting "strong" sustainability (no net loss of natural capital) and application of the precautionary principle. Sadler identifies a way to bring EIA and SEA forward into sustainability-based assessment:

> In the longer term, SEA should be incorporated into integrated appraisal of economic, environmental and social options. An interim step toward full cost analysis (FCA) might involve a combination of four approaches (Goodland and Sadler, 1996):
> i) sound economic analysis of development proposals at the micro level to ensure that environmental costs are internalised;
> ii) environmental accounting at the macro economic level to establish the real of balance sheet of natural capital assets and losses (treating depreciation of resource stocks as environmental depreciation);

> iii) restructuring SEA and EIA as processes *for* ***sustainability assurance rather than impact minimisation*** (e.g. along lines proposed by the International study of EA effectiveness); and
> iv) taking an explicit "effects-based" approach to environmental regulation and management systems. (Sadler, 1998, p. 37, emphasis added).

Finally, but not least, Sadler highlights **the importance of "the construction of scenarios"** as "a potentially important tool for sustainable development planning and policy making" because of the ability of scenario building to formulate alternative options and thus "aid strategic thinking about the likely environmental, social and economic consequences of current and possible future trends and the consequences of making particular policy choices" (p. 37). Scenario building involves developing various scenarios for "the near future (less than five years), the medium term (ten to fifteen years) and the longer term (twenty-five years or more)" (p. 37). According to Sadler, developing scenarios for longer periods proves more difficult because of the range of possible futures, but it is extremely necessary to envisage possible impacts of a business as usual approach in order to consider "the bigger picture issues of sustainable development which are captured by the IPAT relationship (Impact = Population x Affluence x Technology)" (p. 37-38).

In *How green is the City?,* Devuyst similarly provides conclusions about how the **decision-making capacity of SEA can be extended**, and implies that SEA can contribute to a more sustainability-based assessment. He presents **four theses** concerning "developing and integrating SEA methodology into the existing planning and decision-making processes" (Devuyst (ed), 2001, p. 170).

The **first thesis** – "There is a need to see SEA as a learning and communication process" – outlines the learning process and the methodology needed to support communication in an organization. With regard to learning and communication, the SEA process should facilitate the development of preferences, involve political discussion, acknowledge that "dialogue is important but difficult" and accept that knowledge is generated throughout the whole decision-making process.

The **second thesis** – "There is a need for (sustainability) targets" – refers to the current limitations in decision-making where the alternative that is just "good enough" is chosen (instead of choosing a "maximizing" alternative) "by seeing whether the alternative exceeds some criterion or targets."

His **third thesis** – "SEA has to be developed in a way that it produces recognizable and valuable information for the decision-maker" – identifies that decision-makers can only deal with limited information and their interpretation and understanding is almost always based on that of the past; "chosen solutions are therefore not far away from earlier experience."

Finally, in the **fourth thesis** – "Use empirical study of planning and policy analysis to produce insightful knowledge and accounts of the context in which SEA has to be integrated" - Devuyst states: "SEA and decision-making take place in "a decision situation" defined by the historical and structural context, which influence how a decision is reached and which decision is taken."

Because the way information is understood and decisions are made depend on human aspects and limitations, and individuals' use of information is inconsistent with "how our theories say information is used," SEA needs the support of "more knowledge about how

people are using information and how they make decisions" if it is to adapt to "the observed characteristics of human nature and policy-making processes." Devuyst argues there is much to learn from organizational theory and policy science as well as from "empirical studies of the use of SEA. He suggests that the effectiveness of integrating environmental considerations at the strategic level relies on acceptance and appreciation that "not all decisions are being carried out in the same way" and on appreciation that "rational procedures have their strengths, but if we put almost all the weight on the rational approach, we more or less reject other procedures for choice; like, for example, the use of intuition or the use of tradition and belief when decisions are made" (Devuyst (ed), 2001, p. 171).

The four theses denote that Devuyst is clearly concerned with **optimising SEA and its ability to facilitate good decision-making, and since SEA is ultimately an information generating and decision-making process, and similarly sustainability depends on exchange and vision, such concerns should be paramount in creating an assessment process that incorporates sustainability principles.**

INTEGRATED ASSESSMENT AND SUSTAINABILITY ASSESSMENT

There are **several countries** making progress on integrated assessment: Hong Kong (TBL of projects), Canada, and the UK (on a local government level) (Annandale and Morrison Saunders, 2002); research into developing integrated approaches for plan and project preparation and appraisal in development cooperation has been undertaken by the Netherlands Commission for Environmental Impact Assessment (see below Post and Scholten)), as well as research into integrating assessments for integrated water management projects in developing countries (see below Kolhoff, Post and Velthuyse). Furthermore, "approaches to integrated planning appear to exist already in countries such as Denmark, New Zealand and Great Britain, although the notion of integration in these cases is somehow more restricted to substantive integration" (Eggenberger and do Rosário Partidário, 2000, p. 204). Although there **has been considerable interest** in integrated impact assessment (IIA), according to Thomas there are **few examples** of where it has been undertaken (Thomas, 2001, p. 72). Nevertheless, this type of assessment (IIA) – which "was conceived to draw together aspects of EIA, SIA [Social Impact Assessment] and TA [Technology assessment]" (Thomas, 2001, p. 72) – can be said to be another form of assessment that is paving the way to an integrative sustainability-based assessment. Integrated Environmental Assessment, which focuses primarily on the analysis of policy, is closely related to IIA (p. 72).

In *Strengthening the Integrated Approach for Impact Assessments in Development Cooperation*, Post and Scholten outline current inadequacies of development cooperation, in particular the inability of development cooperation project design to sufficiently reflect "general policies on poverty alleviation, on social issues like equity and gender and on environment" (Post and Scholten, p. 1). The article identifies the need for thematic policies to be considered in an integrated manner in project formulation and argues that **"an integrated approach to impact assessments would assist in a better implementation of all the thematic policies"** (Post and Scholten, p. 1, 9). Post and Scholten conclude that in overcoming "the weaknesses of the aspect-by-aspect appraisal," an integrated approach would also "lead to more optimal project formulation and would greatly simplify project officers' work" (Post and Scholten, p. 9). The Commission for EIA in the Netherlands, for the Netherlands Development Cooperation programme, has carried out an analysis of available instruments and has concluded that "for appraisal of policies,

plans and programmes a fully integrated instrument should be developed from the best assessment instruments currently available, taking one of them as the core instrument." The analysis recommends (for project appraisal) the identification of a "'leading theme' and other themes of importance (contributory issues)", "that the assessment instrument developed for the leading theme be applied and that assessment of the contributory issues be incorporated in that instrument (Post and Scholten, p. 9).

Similarly, Kolhoff, Post and Velthuyse, in "Towards Integration of Assessments, with Reference to Integrated Water Management Projects in Third World Countries," discuss the inadequacies of current sectoral or 'aspect-by-aspect' approaches and the need for the "development of a conceptual framework for integration of assessments" (Kolhoff, Post and Velthuyse, 1998, p. 49). According to Kolhoff, Post and Velthuyse, because sectoral reports lack the capacity to encompass cross-links between aspects, 'aspect-by-aspect' approaches carry "the risk of misjudgement of impacts which may compromise the quality of the project proposal and its appraisal" (Kolhoff, Post and Velthuyse, 1998, p. 49).

The article draws on Dalal-Clayton's theory of the world as a system with three subsystems (economic, social and bio-physical) functioning and facilitating human existence (Kolhoff, Post and Velthuyse, 1998, p. 50). Thus, Kolhoff, Post and Velthuyse assert that an **integrated impact assessment framework** is needed "to improve the reliability of the information covering the three subsystems on which decision-making for development projects is based" (Kolhoff, Post and Velthuyse, 1998, p. 50). This framework **would qualify and quantify "the effects of proposed and alternative interventions on the three subsystems and their intersystem relations" and aspire "to identify beneficial interventions and to explicate unavoidable trade-offs"**; it would utilise existing assessment methods and analytical tools (Kolhoff, Post and Velthuyse, 1998, p. 50).

Kolhoff, Post and Velthuyse highlight that a major task of integrated analysis is actually managing the interdisciplinary process to keep the team together. They conclude that there are **two important steps to a more integrated appraisal**: a **first** (procedural) step is *coordination* of sectoral studies through organised inter-expert meetings to build awareness of differences in sectoral approaches and adapt contributions accordingly (the manager of the assessment process has a crucial role in this); a **second** step is *integration* of sectoral studies, where, if undertaken at a lower level, a common set of project alternatives is identified from all sectoral studies, and if at a higher level, no sectoral studies are carried out and "an interdisciplinary team of experts produces one single assessment covering all relevant appraisal aspects" (Kolhoff, Post and Velthuyse, 1998, p. 52-3). The higher-level integrated assessment would have to focus primarily on working routines in order to enable sufficient management of the multi-disciplinary process (Kolhoff, Post and Velthuyse, 1998, p. 53). Kolhoff, Post and Velthuyse make the following conclusions and provide the following table of techniques:

> The function evaluation method may be an acceptable basis for analysis for all disciplines, and may thus play an instrumental role in process management. Work has to be done to complement the function evaluation method, for instance, cultural aspects will have to be incorporated. The water sector is an excellent one to focus on in the process of methodology development (Kolhoff, Post and Velthuyse, 1998, p. 53).

Appendix 1. Techniques used in integrated assessment

Assessments potentially considered for integration:

- Environmental impact assessment
- Health impact assessment
- Social impact assessment
- Poverty assessment
- Gender assessment.

Analytical tools available:

- Problem in context analysis (De Groot, 1992)
- Function evaluation (De Groot, 1993)
- Participatory appraisal techniques (Bojanic *et al*, 1995) (rapid rural appraisal, participatory rural appraisal)
- Economic valuation methods (Dixon *et al*, 1988)
  - using market values
  - using surrogate or estimated values
  - contingent valuation methods
  - macro-economic models.

Decision support:

- Objective Oriented Project Planning (Gemeinschaft fur Technische Zusammenarbeit [GTZ, Germany], United Nations Environmental Programme [UNDP])
- Multicriteria analysis (Janssen, 1992).

(*source:* Kolhoff, Post and Velthuyse, 1998, p. 53)

From the various references to **"integrated assessment"** in research, it seems that the **use of the term varies markedly**. However, the **common link is the search for a process to integrate sectors, themes or issues that range from economic to social and to environmental.** Eggenberger and do Rosário Partidário's article "Integration: Development of a Framework to Assist the Integration of Environmental, Social and Economic Issues in Spatial Planning" provides useful comments on existing assessment and the potential for integrated assessment, and proposes a research project with the goals (a) "To contribute to the establishment of an integrated planning framework, which will ensure early consideration of environmental, social, economic and institutional issues, thus enabling more sustainable planning practices", and (b) "To establish the links between SEA and spatial planning" (Eggenberger and do Rosário Partidário, 2000, p. 206).

The article gives a useful overview of EIA: its roots in the appraisal of environmental impacts of project development proposals and the ongoing improvement of techniques; the fact that interpretations of the word "environment" – from a purely "(bio)physical/natural environment" meaning, to meanings including "social and economic issues related to the impact of the proposal" - has depended on the system in place; and the "new streams in the EIA family of tools" that have emerged ("risk assessment, cumulative assessment, health assessment, economic/financial assessment, environmental management systems, and so on") (Eggenberger and do Rosário Partidário, 2000, p. 201).

As discussed earlier, the desire to extend this capacity even further and integrate social, environmental and economic factors has contributed to the recent popularity of SEA and sustainability-based approaches to assessment. Furthermore, Kirkpatrick and Lee assert: "Stimulated by a more sustainability-oriented approach to development, current debate relates to the question of integrating these various assessment streams in the EIA, as much as to the integration of biophysical, social and economic issues, towards a better co-ordination in the decision-making process" (Kirkpatrick and Lee, 1999). Eggenberger and do Rosário Partidário highlight that SEA has led to impacts being addressed "preventatively" and that it identifies "sustainable development opportunities" (p. 202). Moreover, SEA is seen as "an important step towards integrated decision-making" and promotion of sustainable development (p. 202). Kirkpatrick and Lee assert that "Integration has become a favoured means of increasing the effectiveness of environmental assessment and social and economic appraisal in decision-making in order to promote sustainable development" (Kirkpatrick and Lee, 1999). Eggenberger and do Rosário Partidário's article clarifies the relationship between EIA, SEA and integrated assessment: "SEA is seen as a second generation process and intermediate step on the

way to integrated sustainability appraisal, which requires integration of EIA/SEA with other social and economic appraisal methods" (p. 204).

It would seem that these relationships are very close indeed, yet arguably the way in which existing processes are combined and the capacity created for early integration, assessment of alternatives, and openness and public engagement will distinguish existing arrangements from future sustainability-based assessment. Eggenberger and do Rosário Partidário have identified **five different possible forms of integration** related to "development planning and assessment and its impact on our living space":

Forms of integration

1 Substantive

- The integration of physical or biophysical issues with social and economic issues
- The integration of emerging issues such as health, risks, bio-diversity, climate change and so on
- The (appropriate) integration of global and local issues

2 Methodological

- The integration of environmental, economic and social (impact) assessment approaches such as cumulative assessment, risk assessment, technological assessment, cost/benefit analysis, multi-criteria analysis
- The integration of the different applications, and experiences with the use of particular tools such as GIS (geographical information system)
- The integration and clarification of (sector) terminologies (including the element of 'strategic')

3 Procedural

- The integration of environmental, social, economic planning/assessment, spatial planning and EIA
- The integration of sector approval/licensing processes, spatial planning and EIA
- The adoption of co-ordination, co-operation and subsidiary as guiding principles for (governmental) planning at different levels of decision making
- The integration of affected stakeholders (public, private, NGO (non-governmental organisation)) in the decision-making process
- The integration of professionals in a truly interdisciplinary team

4 Institutional

- The provision of capacities to cope with the emerging issues and duties
- The definition of a governmental organisation to ensure integration
- The exchange of information and possibilities of interventions between different sectors
- The definition of leading and participating agencies and their respective duties and responsibilities

5 Policy

- The integration of 'sustainable development' as overall guiding principle in planning and EIA
- The integration of sector regulations
- The integration of sector strategies
- The timing and provisions for political interventions
- Accountability of government

Source: Adapted from Partidário, 1998, and cited in Eggenberger and do Rosário Partidário, 2000, p. 204.

According to Eggenberger and do Rosário Partidário, these forms emerged from everyday experience:

> Integration is something that is done all the time, or that is argued as being done! Whenever there are two professionals with different backgrounds looking at the same problem with similar objectives they are integrating. Whenever there are two different topics that need to be tackled together, there is integration . . . Integrating in fact means a new entity is created where new relationships are established, bearing on individual entities that have specific characteristics and specific dynamics but in combination act in a different way (p. 204).

This suggests that sustainability-based assessment could involve an almost organic combination of processes. Different approaches and techniques, and different combinations of processes and techniques, would apply for different purposes. Sustainability-based procedures and tools would need to be carefully selected (through consensus) and would be subject to continual review.

DECISION-AIDING TECHNIQUES FOR SUSTAINABILITY ASSESSMENT

Introduction

As discussed earlier, a critical issue for sustainability assessment is **how to integrate qualitative and quantitative information into a single assessment;** some decision-aiding techniques in use are able to combine qualitative and quantitative data in a manner accurate and effective for decision-making, but others are problematic in their attempt to combine qualitative and quantitative information through standardisation or conversely the use of symbols (in the planning balance sheet approach) that require decision-makers to take their attention away from the integrative task at hand and refer to additional information (McAllister, 1980, p. 155).

In the light of this, the following section provides **a brief overview of a selection of multi-criteria analysis (MCA) techniques that could be utilised for sustainability assessment**. Different techniques could be drawn on for different applications of sustainability-based assessment: projects, plans and programs. There is a **whole range of existing decision-aiding techniques** that could be applied to sustainability assessment some extending upwards from environmental impact assessment and others downwards from policy analysis.[5] The following section discusses a few such techniques, namely, weighted summation, concordance/discordance analysis, planning balance sheet (PBS) and goals-achievement matrix (GAM). Most have been used in urban planning decisions but have had various applications depending on the context. The techniques all have advantages and disadvantages and the suitability of the techniques for sustainability assessment of projects, plans or policies, and their ability to engage communities and other interest groups in the assessment process, depend on the particular initiative in question.

Decision-aiding techniques

"Decision-aiding techniques" - many of which are well-established - are significant techniques available to sustainability assessment. These techniques involve stakeholders coming together to analyse alternatives when a decision has to be made (Annandale and Lantzke, 2001, p. 2-3). Decision-aiding techniques involve:

1. a given set of alternatives
2. a set of criteria for comparing the alternatives

[5] Personal communications with Dr David Annandale.

3. a method for ranking the alternatives based on how well they satisfy the criteria (Annandale and Lantzke, 2001, p. 3).

There are **seven steps** in the process:

1. specifying alternatives
2. specifying criteria
3. scoring alternatives
4. assigning weights to criteria
5. undertaking the computation (using a computer spreadsheet program)
6. dealing with uncertainty (for example, by varying weights and actual methods – basically reviewing)
7. presenting results (Annandale and Lantzke, 2001, p. 10)

A basic decision-aiding model

It is useful to consider a basic decision-aiding model. The following model is taken from Annandale and Lantzke. Consider a waste management policy choice for a local council. There might be three alternatives: (a) traditional landfill, (b) incineration, and (c) composting combined with land-filling of residual waste. Criteria to compare alternatives might be:

- capital cost
- employment potential
- area of land required
- possibility of groundwater pollution

The best alternative may not necessarily be obvious. Incineration may have the lowest groundwater pollution risk but may employ the fewest and cost the most. Composting combined with landfilling may be the cheapest option and employ the most but may require a reasonable amount of land and have groundwater pollution risk. Clearly, this is not a straightforward decision and it would become even more complex with more options and criteria and subsequently greater stakeholder conflict. Annandale and Lantzke assert that "decision-aiding techniques can help in situations such as this by comparing the advantages and disadvantages of each alternative, one against the other" (p. 4). An "effects table" or "impact matrix" can be used (see table below) where "scores" are entered in cells or "expert judgement" (or a panel of community members) sets values (as in the last criterion).

CRITERIA	**OPTIONS**		
	conventional landfill	**incineration**	**composting & residual landfill**
1. Capital cost ($ million)	20	30	10
2. Employment (thousands)	20	10	50
3. Area of land required (ha)	100	10	30
4. Possibility of groundwater pollution	high	very low	low

(from Annandale and Lantzke, 2001, p. 4)

Thus the benefit of this technique is that it allows for measurement in quantitative *and* qualitative terms (amounts and values); "Decision-aiding techniques allow for this type of

input" (p. 4-5). Furthermore, sometimes just putting together an effects table is enough to decide on ranking of alternatives. If not (usually when there are many alternatives and criteria), mathematical procedures can be applied to rank alternatives after the group has weighed the criteria (note, a few different weights can be used to allow for different interest groups) (p. 5). Annandale and Lantzke have highlighted the strengths and weaknesses of decision-aiding techniques. The many strengths include:

- structured decision-making with allowances for when flexibility is needed
- arranges information clearly in complex problems
- allows decision-makers to utilise available data, whether qualitative or quantitative
- weights make opinions/values explicit
- does not depend on assigning monetary values to all factors

Weaknesses include:

- "does not overcome the fundamental problem associated with comparing quantities that some would argue are not comparable, but does provide more flexibility than is available with, say, benefit-cost analysis"
- does not provide guidance on which evaluation methods to use
- "since many of the methods are complex and remain a 'black box' to the decision maker they can lead to either distrust or excessive faith in the results"
- decision makers sometimes neglect to introduce implicit weights at all stages of the analysis because they focus too much on the definition of explicit weights
- "methods for incorporating uncertainty explicitly into the analysis are not yet well developed" (p. 9-10).

MCA and the recent Freight Network Review

There are several examples of multi-criteria analysis (a form of decision-aiding technique) being used for planning in Western Australia. An example is the recent Freight Network Review in which **multi-criteria analysis was used by government, industry and community to help decide on a route**. The review aimed to find the best way to extend the Roe Hwy to cater for greater freight movement. The group found **23 options** – 23 different routes for the extension of Roe Hwy – and then developed criteria. They assessed the options by comparing each criterion for each option and **scoring** them, that is, how each option performed for each criterion. This enabled them to consider the worst and best scores. There were thirty-eight criteria, and it is interesting that ten were deleted because it demonstrates the process has some flexibility and room for negotiation between the group members. The criteria were then **weighted** and data put into a computer spreadsheet program. Through the analysis, the group reduced the options to four, which all involved extending the Roe Highway to the Kwinana Freeway, but linking it up with the freeway south of Fremantle. It was decided the south area would take the increased freight movement/overflow because Fremantle was already too congested.[6]

The following summary of a selection of techniques is taken from personal communications with Dr David Annandale, Environmental Science, Murdoch University. **See attachments** for a more extended overview of decision-aiding techniques relevant to sustainability assessment of projects, plans and programs.

[6] Personal communication with Professor Peter Newman.

Weighted summation

Weighted summation is a form of **multi-criteria analysis** (MCA) and is often referred to as "additive weighting." MCA techniques were developed in the last 30 years in Europe, in reaction to the limitations of cost-benefit analysis. As discussed above, MCA involves a number of alternative plans and options, criteria to judge alternatives and the ranking of alternatives after their comparison with the criteria.

In Australia, MCA approaches have become increasingly used as an adjunct to other assessment processes. MCA was used in decision-making for the second Sydney airport in the 1980s.[7] Examples in **Western Australia** include choosing a public transport option for the Perth-to-Mandurah corridor and ranking nature reserves for a hills local authority.

Weighted summation is matrix-based and is perhaps the **easiest** MCA technique to understand. Alternatives (e.g. no extraction, short-term, medium-term and long-term) are scored for each comparison criteria and then an importance weight is applied to each criterion. Criteria are weighted because they are not equally valued by individuals; what is important to one person is not always to another. Therefore, a range of weights for criteria is produced based upon different interest group concerns. Computerisation of MCA enables as many weights as necessary to be placed on criteria.

Consider **an example** of MCA used in resource extraction decision-making. Here a Project Impact Matrix would show (from left to right) criteria, three columns of weights (depicting the minimum, average and maximum views of an "expert" group of biologists), scores in the alternatives columns and a column indicating whether each criterion is deemed to be a "benefit criterion" (b) (where the highest score is the best outcome) or a "cost criterion" (c) (where the lowest score is the best outcome of the alternatives). Standardisation occurs once alternatives have been scored and weighed. Original scores are standardised by a scale of 0 to 1 (i.e. worst scores are given a "0" and best scores a "1"). This allows all scores to be compared on a common scale, instead of having scores in the different units of the original form (e.g. units might be in dollars but some may be in hundreds of dollars and some in thousands of dollars). After standardisation, columns of weights are multiplied by the standardised score for each alternative. The summed result provides a ranking of alternatives.

Despite its clarity and advantages, the **main problem** with weighted summation is that it uses calculations and ratio-scaling which can make representation of aspects not easily ratio-scaled (such as "social" attributes) difficult.

Concordance/discordance analysis

Concordance/discordance analysis uses **pairwise comparisons** between alternatives and involves a concordance index and a discordance index being calculated for each pairwise comparison. The concordance index is the sum of the weights of the criteria for which the first alternative scores better than the second. Concordance analysis only works if weights are used and is therefore able to be used for mixed quantitative and qualitative data. It indicates the extent to which one alternative is *better* than the other, but not whether one is worse than the other. The discordance index is what indicates if one is *worse* than the

[7] Personal communication with Professor Bryan Jenkins.

other; it is defined as the largest difference in scores amongst the criteria for which the first alternative scores are worse than the second. The discordance index is based on the assumption that there is a limit to which bad performance on one criterion can be compensated for by good performance on the other. Together with thresholds set by the evaluator, the matrix of concordance indices and the matrix of discordance indices produce a ranking of alternatives.

The dependence on ratio-scaled data for the discordance index is the only major disadvantage of the technique.

Planning balance sheet and goals-achievement matrix

In post-Second World War industrialised economies, urban planning has traditionally used **cost-benefit analysis** (CBA). However, in recent times, CBA has been recognised as having **limited** ability to reflect equity issues and environmental impacts (because of problems associated with assigning monetary values).

Consequently, urban planners have **sought other techniques** in order to make complex comparisons between alternative development proposals. Such techniques have included the Planning Balance Sheet (PBS), developed in Britain, and the Goals Achievement Matrix (GAM) approach, used extensively in the USA and Britain.

Planning Balance Sheet (PBS)

PBS has been developed out of CBA and **goes beyond** typical CBA in two ways: it is able to record detailed information on the distribution of costs and benefits among different groups of people affected by a proposal (distinguishing them as either producers and consumers); it formally accounts for intangible impacts, that cannot be monetised, by according them symbols (which allows them to be recorded alongside monetised impacts).

For **example**, if considering alternative plans for a university town, the groups of people might include the local council, residents, vehicle users, car park users, university and students, shoppers and the general public. The PBS would represent the costs and benefits and net calculations for each group to see which groups would be advantaged. A more summarised sheet would then be prepared and the “evaluator” would attempt to make objective judgements concerning the extent of unquantified impacts and subjective judgements concerning the relative importance of each impact to the welfare of society (McAllister, 1980).

The **main problems** with PBS are the difficulty of accurately recording unquantified impacts, the subjectivity involved in differentiating producer and consumer categories, the skill needed to use the method and its subsequent relative inaccessibility, and the costs of preparing an assessment involving a series of options.

Goals-achievement Matrix (GAM)

GAM was developed as a result of the perceived deficiencies of CBA and PBS. It has been used in regional structure plans. GAM is different to PBS in that **impacts are organised under explicitly stated community “goals”** (such as clean air or quiet surroundings), and further categorised according to the community groups affected. A panel of experts then assigns weights to each community goal and affected group. GAM favours quantification, but not monetisation.

The following **example** comes from Westman (1985). Consider two different plans for airport operation: large and small. Affected groups might include air travellers, nearby residents and the natural environmental (represented by green groups). Community goals (airplane travel and quiet neighbourhood) are given different weights on an ordinal scale. Also, the weights for different groups differ depending on the particular community goal (i.e. when assessing the goal of a quiet neighbourhood, greater weight is given to nearby residents, and when assessing the goal of airplane travel (increased numbers of flights), effects on air travellers are given greater weight. Benefits and costs are represented by a score on a five-point ordinal scale ranging from +2 ("maximum progression toward goal") to –2 ("maximum regression from goal"). For both plans the relative costs and benefits and the importance weights for groups and goals do not change, but the smaller airport plan is found to be preferable (it has a lower negative grand index) because the combined costs, and their weights to impacted parties, exceed the benefits to benefiting parties.

The **advantages** of GAM over PBS and CBA are that it does not monetise and the assessor has greater freedom in selecting the impact categories and the community groups to be used in evaluating equity effects.

However, according to Westman and McAllister, the **problems** with GAM is that it scales and relies on interval and ordinal scales which are weighted, multiplied and summed.

Conclusions

The above decision-aiding techniques rely on different circumstances to provide effective and accurate information, with only some being able to sufficiently process both qualitative and quantitative data. Some are more flexible, but generally the **correct technique must be carefully chosen and appropriated for the relevant proposal.**

Methods for sustainability assessment presented in Devuyst (2001)

In *How Green is the City?* Devuyst provides a short section on methods that could be used for sustainability-based assessment including the checklist approach, systems analysis, ecocycles and eco-balancing, action planning, force field analysis and problem-in-context (see Devuyst, 2001, p. 193-200 for a summary of the methods). He asserts that current methods used at local levels **mostly use simple checklists** but that "this simple approach **should be encouraged** because it enables more people to do an assessment themselves, to participate in it, and/or learn more about it." However, he recognises that the **development of a more "advanced methodology** for sustainability assessment could . . . complement the checklist approach and result in additional and useful information" (Devuyst, 2001, p. 193).

EMERGING MODELS FOR SUSTAINABILITY ASSESSMENT

Most of the models below can be used or adapted to apply to project proposals, policies, plans or programs. Some are used for assessment of proposed initiatives and some provide mechanisms for optimising the performance of a program or organisation.

1. ASSIPAC framework for sustainability assessment

ASSIPAC – "Assessing the Sustainability of Societal Initiatives and Proposing Agendas for Change" – is a **sustainability assessment methodological framework** that is being developed by Devuyst at the EIA Centre, Vrije Universiteit, Brussels (Devuyst (ed), 2001, p. 179).

According to Devuyst, different/specific assessment frameworks need to be applied for different subjects of assessment. However, although **ASSIPAC is designed for assessment of policy proposals in an urban setting**, Devuyst believes that "Similar sustainability assessment instruments can be developed for other types of initiatives." This suggests that the ASSIPAC model could provide useful knowledge for the development of other sustainability-based assessment frameworks such as for projects, plans and programs. Devuyst does, however, note that a sustainability assessment of a project proposal in a developing country would require "a different review framework and a different focus on sustainability principles" from that of a similar proposal in a North American or European city (Devuyst (ed), 2001, p. 179-180). .

ASSIPAC is designed for use in European, North American or Australian urban contexts. **It relates to two types of sustainability assessment: the Sustainability Assessment Check and the Sustainability Assessment Study.** In *How Green is the City?*, Devuyst provides an explanation of each type:

> The sustainability assessment check is a short study, screening the initiative for possible conflict with policies or visions for sustainable development. The sustainability assessment study is a more in-depth examination of sustainability consequences of the initiative (Devuyst (ed), 2001, p. 180).

According to Devuyst, this two-tiered system provides certain flexibility because either a check or a study can be made depending on the nature and development stage of the initiative, the assessor(s)'s experience with sustainability evaluation and the time and resources available. Furthermore, **the two types can be linked: "a decision can be made on the need for a Sustainability Assessment Study on the basis of the results of the Sustainability Assessment Check"** (Devuyst (ed), 2001, p. 180).

Sustainability Assessment Check

The Sustainability Assessment Check **uses a checklist approach and consists of the following 11 steps** (as set out in Devuyst 2001, p. 180-182):

1. Identification of the person or team (the assessors) carrying out the Sustainability Assessment Check. The assessors can be part of the team of the initiator (carrying out a self-assessment) or independent of the initiator (external assessment); they can be from a public or private organisation. It is necessary to explicate the identity of the assessors to make clear their link with the proposed initiative. Assessors should be familiar with the concept of sustainable development and with the basics of scientific research. The assessors carry out the actions in the following steps.
2. Gather information on the initiative studied and on alternatives to the initiative that might have been developed, by completing sections A and B of the Checklist. Assessors should familiarise themselves with the initiative and get to know all aspects of it in detail.
3. Identify sources of information and data that will be needed to complete all requirements of the Checklist.

4. Obtain information on sustainable development policies, visions, or strategies that are in place in the area. Existing sustainability targets or standards should be identified. (See section C of Checklist).
5. If available, the assessors should describe the "best available sustainable development practice" in an international context for the initiative studied, as required in section D.
6. Collect information on the reactions of the public in general and specific stakeholders to the initiative (section E).
7. Following section F, assessors should examine forces existing within society that hinder the attainment of a more advanced sustainable form of the initiative, through a force field analysis.
8. Every item/topic of the Checklist in sections G, H, I, J and K should be systematically considered: assessors should first determine whether each item is applicable. If so, the assessors should gather information on the way the topic is dealt with in the initiative. Topics can be added if necessary.
9. Following section L, assessors should decide if the topics in sections G, H, I, J and K have been sufficiently considered in the development of the initiative. Symbols can be used as an aid here but are not compulsory (the symbols are used to rate how well each topic is integrated into the initiative - see Devuyst 2001 for the list of symbols). It is more important that assessors give a written evaluation for each topic in sections G, H, I, J and K. Assessment should again follow the requirements in step #4. If no such policies, visions, targets or standards for sustainability exist then reference should be made to general principles of sustainable development or policies etc of other jurisdictions. If available best practice of sustainability should be used as a point of reference. Deviations from this "best practice" should be discussed. Sustainability of alternatives (if there are alternatives) should be compared.
10. On the basis of the previous assessment it should become clear which are the weaker and stronger sustainability characteristics of the initiative and its alternatives. Taking into account the positions of the initiator, stakeholders and the public in general, and acknowledging the forces that obstruct the sustainable character of the initiative, proposals of an agenda for change have to be developed. As requested in section M of the Checklist, scenarios should be developed which will increase the sustainable nature of the initiative.
11. Finally, conclusions should be made (section N of the checklist) and a report or discussion document should be written. This should be done in such as way that high-quality information is available to decision-makers and stakeholders for discussing the initiative and its role in the community in a sustainable development context. Assessors should make sure to report in a scientifically correct way, referring to the sources of information and justifying statements made (section O of the checklist).

Generally, the report created should have a similar structure to and environmental impact statement. However, this framework differs because aims to describe characteristics and alternatives of the proposal in terms of sustainability, rather than just focusing on prediction of impact. Devuyst also notes that tests of the checklist have indicated the significance of the person performing the sustainability assessment. See Devuyst, 2001, p. 202 for a full version of the ASSIPAC Sustainability Assessment Checklist.

Sustainability Assessment Study

Devuyst provides a description of the ASSIPAC Sustainability Assessment Study: **the study "requires more research capabilities, time and financial means than the**

Sustainability Assessment Check." It "attempts a more quantitative approach and therefore pays more attention to the identification of a baseline and target against which the initiative and its alternatives can be evaluated." According to Devuyst, a broad process of community participation is needed to develop baseline and target values, because "sustainable development is a very broad concept" and the setting of baseline and target values is not obvious. The experience of North American state and local authorities has shown that the general definition of sustainable development can be translated into a particular vision for the area in question; "detailed goals, action plans, and sustainability indicators and targets" can be developed out of this vision (see Devuyst (ed), 2001,p. 184, for examples of American states). Because sustainability has different meanings for different places and communities, and therefore different places have varying sustainability visions, goals and targets, it is necessary for baseline and target values to be set ("against which the initiative and its alternatives can be evaluated") before a Sustainability Assessment Study can proceed; if visions, goals or targets are not in existence, "the assessors have the delicate task of making a proposal for sustainable development vision, with goals, baseline and target values linked to it;" the report should explain how these have been developed (Devuyst (ed), 2001,p. 184-6).

Community workshops can be organised to set the sustainable development point of reference, depending on time and finances (Devuyst (ed), 2001,p. 186). According to Devuyst, the point of reference can be developed by a particular section within society and "should not always be based on the consensus of a community as a whole." If a section within society is used then the Study should explicate that it is "presenting the ideas and values of that particular segment of the community." Devuyst explains that "(o)nce the sustainable development visions, goals, and targets have been set, indicators can be linked to it" (Devuyst (ed), 2001,p. 186). He outlines the final steps of the process:

- Prediction of evolution of indicators as a result of the initiative
- Assessment of the evolution of the indicators in relations to goals and targets set
- Proposing an agenda for change
- Reporting

(see Devuyst p. 187 for a diagram of the most important steps in the Sustainability Assessment Study).
As well as those mentioned above, the Sustainability Assessment Study involves some steps similar to the Sustainability Assessment Check but with greater depth of research and deliberation.

Examples of ASSIPAC methodology in practice

Devuyst presents **two examples** of where the ASSIPAC Sustainability Assessment Checklist has been applied: compulsory company transportation management plans in Belgium and the Social Impulse Fund and the Mercurius Fund for reviving Flemish city centres. Both negative and positive aspects, in terms of sustainability, were considered in the two examples. The following is presented in Devuyst 2001 and refers to initiatives that had already been introduced when assessment was conducted (Devuyst, 2001, p. 218).

In **the first case**, "a proposal for Belgian law that would force Belgian companies to develop transportation management plans" was assessed. The assessment took place over three days and was conducted by Janssens and Devuyst from the Human Ecology Department, Vrije Universiteit Brussels. It gives an overview of the sustainability issues related to the legislative proposal, and does not extend to detailed information that would be covered in a Sustainability Assessment study. The proposed law was intended to "force all companies with more than 50 employees to develop a plan for the improved organisation of traffic generated by its employees travelling between home and work." Its main goal was to reduce the "car ratio" and "car volume" by 10 percent, "car ratio" being

the ratio of those travelling by private car to the total number of employees, and "car volume" the number of kilometres driven annually between work and home by an individual employee. There were no alternatives proposed for the legislation.

Although public consultation for the proposal was not organised, there were other forces that obstructed the proposal such as political and bureaucratic processes, employers' organisations, the employees who feared their freedom of choice about how to get to work would be threatened, and the media.

The assessment provided a list of positive conclusions (how the proposal furthered sustainable development) and weaknesses of the proposal from a sustainable development point of view. Weaknesses included that the initiative did not propose building partnerships between societal groups, local communities and businesses were not consulted, the proposal did not provide a date for the target and the target was considered too low for sustainability and the initiative did not propose monitoring of the effect of the initiative.

To conclude the assessment, the Sustainability Assessment Check for the proposed law provided specific recommendations on how to improve the sustainability of the draft law. In effect these provided an agenda for change (measures to be reinforced gradually) specific to the proposal (see Devuyst, 2001, p. 211-213 for the recommendations).

The **second example** of the Sustainability Assessment Checklist in practice "deals with existing operational funding systems for reviving Flemish city centres with the Social Impulse and Mercurius Funds." The congested, historic city centres of Flemish cities have been facing declining populations as people have left to live in suburbs where they can move about by car. City centre businesses have been struggling to compete with the huge shopping malls in the suburbs and the city centres are increasingly inhabited by underprivileged elderly people and immigrants. The proposal in the second example aimed to "solve these problems by introducing an urban policy that aims to make living and shopping in the city center more attractive." The initiative comprised two funding initiatives, which were intended to direct financial aid to areas most in need of redevelopment. The Social Impulse Fund focussed on quality of life and environmental quality and the Mercurius Fund on reviving inner city commercial centres.

The Sustianability Assessment Check for this example was mainly illustrative and was a one-day evaluation of the policy initiative. Thus Devuyst provides a commentary of the assessment rather than details of its steps. The Social Impulse Fund was generally found to be a contribution to sustainable development partly because it took an integrated approach, but it and the Mercurius Fund were considered to be poorly linked and not related to a Local Agenda 21. Assessors concluded "more steps could have been taken to form a more closely integrated funding system."

Devuyst makes some **overall conclusions about the two cases**. He points out that the assessments were limited in time and mostly general and qualitative. More detailed study would provide more in-depth assessments. Because the assessments were mainly qualitative, Devuyst asserts that judgements should be substantiated. Devuyst suggests that "synergistic alternatives" and proposals of agendas for change could have been better considered if assessment had taken place before the introduction of the initiatives.

2. Gibson's proposed model for Canada

Robert Gibson, in a study for the Canadian Government, called *Specification of Sustainability-Based Environmental Assessment Decision Criteria and Implications for Determining "Significance" in Environmental Assessment,* provides a key contribution to studies about sustainability assessment. Its focus is project proposals but it can easily be adapted for programmes and policies. Central to the paper is how to improve decision–making by enabling decision-makers to "gain and apply a better appreciation of the potential effects of the available options" (Gibson *et al*., 2001, p. 38). Gibson argues that sustainability-based environmental assessment involves considering the full range of positive and negative "environmental" (in the broad sense of the word) effects, and "aiming not just to avoid serious adverse effects but to identify the most positive ways of meeting sustainability criteria" (Gibson *et al*., 2001, p. 38). **The paper focuses on using analysis of "significance" to determine if a risk or trade-off is acceptable.** It highlights the possible limitations of a sustainability assessment process such as compensations and net calculations being influenced by the different interests of those involved.

As a way to overcome such problems, Gibson proposes that an assessment process involve the formation of a set of general rules for considering compromises and trade-offs and careful selection of associated processes. These rules and processes would be defined according to the context and would rely on the cooperation of all stakeholders (Gibson *et al*., 2001, p.32-34, see attachment 1).

While it is the position of the State Government that sustainability requires the simultaneous achievement of environmental, social and economic goals, there is a recognition that some tradeoffs will be necessary as we make a transition to more sustainable forms of development.

According to Gibson, such an assessment process would necessitate judgements about what is important or significant at almost every step, more so than current environmental assessment processes (Gibson, 2001, p. 35). However, there are many examples in theory and practice of effective methods and processes for determining significance criteria and thresholds with regard to environmental assessment, "(b)ut few significance elaborations and thresholds have been developed with sustainability criteria in mind" (Gibson *et al*., 2001, p. 37).

In response, **Gibson argues that three key areas must be addressed in terms of sustainability: significance of effects, significance of undertakings, and significance of compromises and tradeoffs.** He starts by proposing a set of sustainability-based significance questions, which used in conjunction with indicators to clarify, would guide evaluation of the significance of effects (see attachment 2, table 3). These questions have been adapted from significance criteria in current environmental assessment literature but enable more direct attention to be given to sustainability considerations and thus modify the way in which significance evaluations are done and affect the resulting judgements (Gibson *et al*., 2001, p. 41).

Gibson then goes on to address significance of undertakings. Undertakings, or sets of undertakings, that should be subject to sustainability assessment as those actions "that may have significant implications for sustainability" (Gibson *et al.*, 2001, p. 41) With regard to "significance and sustainability in decisions on process application," Gibson asserts that

determining significance for these undertakings may at first seem simple (for example, greatest significance for assessment can be assigned to undertakings that most threaten progress towards sustainability objectives, and undertakings that involve alternative approaches which can reveal more beneficial options). However, a more comprehensive assessment of undertakings would encompass the significance of effects criteria mentioned earlier and would entail close attention to the specific contexts involved in the undertaking. In addition, this approach would also examine the potential collective significance of undertakings which taken individually might appear inconsequential. (Gibson *et al*., 2001, p.42)

Although these sustainability assessment processes aim to promote efforts that contribute towards sustainability, trade-offs that are sometimes unavoidable will arise. Gibson points out that some trade-offs may even be desirable - short-term reliance on non-renewable resources as a bridge to the development of renewable systems - or contribute to positive outcomes - proponents strengthening ecological or community enhancements as compensation for incomplete mitigation of negative environmental or social effects. (Gibson *et al*., 2001, p. 43-44). In response, Gibson proposes some general criteria for evaluating the significance of trade-offs and compromises in terms of sustainability (see attachment 3, table 4). To supplement this process, he proposes an illustrative list of trade-off decision rules (see attachment 4, table 5).

Attachment 5 presents a summary of Gibson's conclusions on the essential elements of a sustainability framework, and the steps involved in developing such a framework.

3. SAM – full cost accounting model

The Sustainability Assessment Model (SAM) - developed jointly by Tom Baxter (Genesis Oil and Gas Consultants), Jan Bebbington (The University of Aberdeen) and David Cutteridge (BP) – has been developed to assess the sustainability of project developments, though it can be used to assess specific design decisions and also the performance of an organisation. **It is designed to be used by industries to assess the full life cycle positive and negative impacts of projects, taking into account externalities.** The SAM has been **extended from full cost accounting techniques** (tools which "identify all the internal and external costs and benefits associated with a particular action") (Baxter *et al*., 2002, p. 1). However, the authors of the SAM envisage that "the SAM could be used at project sanction as a key indicator of the acceptability of the project" (Baxter, 2002, p. 5). Potential positive and negative impacts of a project are organised into four areas - economic, resource usage, environmental and social – and the data is graphed (using a positive and negative axis) to represent a "signature" of impacts. The impacts are monetised and turned into an index "which provides a measure of how 'sustainable' a project is" (Baxter, 2002, p. 1-5). The method is likely to be limited to sustainability assessment of projects where quantitative data is easily obtained.

4. SPeAR – Arup's spreadsheet and diagram model

Arup, an international consultancy, has developed SPeAR: a sustainability assessment system that has been used by both public and private sector organisations primarily to assess sustainability of project developments. However, it has also been used to assess the sustainability of organisations such as corporate strategy and policy. It is a flexible qualitative tool that employs the central SPeAR diagram to graphically represent an array of issues within four key areas: societal, environment, economic and natural resources (see attachment 6). The project can be assessed at all stages of development and

improvement. The diagram displays both positive and negative results, those closer to the centre being closest to sustainability objectives. The system allows interrelationships between aspects of sustainability to be assessed.

The SPeAR assessment framework works by SPeAR consultants **developing a set of indicators for the particular project or organisation and preparing a spreadsheet (which enables accountability of assessment results).** In the case of projects, comparisons (such as comparing the ecological value of the existing site to the value of the site after development – positive or negative improvement) are fundamental to assessment. Indicators shown on the diagram normally remain constant but if required an indicator can be substituted for a more appropriate one. The indicators on the spreadsheet depend on the context. The framework is versatile and simple to understand, but the assessment processes involved, such as compiling and analysis of indictors, involve specialised knowledge. Arup assert that this is where their consultancy services are important. In any case, Arup hold rights to the use of the software behind the SPeAR sustainability assessment framework. It is therefore not relevant to the Western Australian Government, though Arup's use of a circular diagram and background spreadsheet is a useful idea for the integration process involved in sustainability assessment and for representing results of assessment.

5. DOTIS – sustainability questions model

Another example of a sustainability assessment framework relevant to policy is presented in Devuyst's article 'Linking Impact Assessment and Sustainable Development at the Local Level: the Introduction of Sustainability Assessment Systems' (Devuyst, 2000). The article refers to a system, called DOTIS, which consists of **a set of questions used to determine if a proposed government policy is consistent with sustainability.** The questions are within eight areas of examination: spatial development, economic activity, environmentally conscious performance of households, construction, traffic and transportation, waste management, energy management and water management. Clearly these areas are specific to the region - they were developed for policy concerning the Dutch city of Tilburg - and in terms of Western Australia such areas may be inappropriate and too narrow. Table 1 (see attachment 7) illustrates one area of the DOTIS system and shows how questions for the issue are divided under the headings goals, measures and effects.

Devuyst also presents a system used to provide an overview of the sustainability issues important to a proposed policy, plan or project (see attachment 7, box 2). The Box consists of a set of topics to be considered such as description of the initiative, its characteristics, possible impacts and alternatives, and assessment through comparisons with examples of best practice. The system also uses **development of scenarios to overcome barriers to sustainable outcomes.** Devuyst sees this method as facilitating creative and innovative measures that promote sustainability and advocates participatory approaches to sustainability assessment (Devuyst, 2000, p. 73). He also asserts that a sustainability assessment framework "should clearly state what the assessors consider to be a positive or negative evolution for sustainable development of our societies" (Devuyst, 2000, p. 73).

Devuyst highlights the lack of accepted quantitative methods for sustainability assessment and the reliance on qualitative methods. However, he concludes that sustainability assessment should ultimately be a **communicative process** and that qualitative approaches foster understanding and acceptance of sustainability principles and are

effective in "encouraging people to think about and consider more sustainable scenarios to reach their goals" (Devuyst, 2000, p. 77).

6. IUCN – structured analysis model

The IUCN (The World Conservation Union) Sustainability Assessment Team, has developed a "structured analytical process for assessing progress toward sustainability" (Guijt *et al*., 2001, p. 1). While it has been used to measure people's wellbeing and ecosystem wellbeing, its authors claim its main uses are: to facilitate strategic planning, decision-making and project and programme design for government and non-government organisations; to provide information for impact assessment, evaluation and monitoring; as a source of information for sustainability reporting; to facilitate greater awareness of sustainability objectives and issues (Guijt, *et al*., 2001, p4-5). The IUCN system is intended to complement regular planning, monitoring and evaluation processes and is not a substitute: "It can help **to structure the information needed for informed decisions and provide a method by which stakeholders may be engaged in collecting and interpreting that information"** (Guijt, *et al*, 2001, p. 5).

The IUCN system is adaptable to local circumstances, easy to understand and use and makes stakeholders assumptions transparent (Guijt *et al*., 2001, p. 15). In its full version it is a seven-stage cyclical process that allows for changes over time. IUCN describe the cycle thus:

> The first four stages of the cycle are designed to help users *express a shared vision of sustainability*, which is designed in increasingly specific ways, using dimensions (categories) and related elements (plus their objectives), indicators and performance criteria. These stages aim to express the broadly defined vision as measurable indicators, thus moving participants from a general discussion to specific units that can be analysed more easily
>
> The last three stages help users *to assess overall human and ecological wellbeing* from the indicators, combining them and reviewing the indices (Guijt *et al*., p. 3) (see attachment 8, figure A2, A3, A4, A15).

Stage 1 and 2 of the cycle provide a structured process for the important action of choosing manageable indicators (Guijt, 2001, p. 4). Each stage involves Process Outputs and Data Outputs, the emphasis on which can be varied by the stakeholders (see attachment 8, figure A7). It is not clear how the vital stage of integration of the data actually occurs.

7. Environmental Alliance - matrix approach to sustainability assessment

In *Sustainability Now: Implementing the Government's Sustainability Policy*, the Environmental Alliance discusses possible methodologies for assessment of policy and legislation. In the absence of established sustainability assessment techniques, the Environmental Alliance proposes some **interim approaches such as internal and external consistency checking, impact forecasting and recording of outcomes** (Environmental Alliance, 2001, p. 10). The Alliance suggests the use of a "consistency analysis matrix" for a particular plan or policy, which would optimise a policy's strategy by exploring whether policy elements are inherently consistent (see attachment 9, table 2). After consistency checking, compatibility *between* policies can be assessed via a matrix with axis entries consisting of the policy elements of two different policies. If necessary a revision of one or more policy's elements would occur to make them more compatible. Finally, potential environmental, social and economic impacts of particular policy elements would need to be forecasted using a "policy impact matrix." Attachment 9, table 3 provides

an example of this matrix (illustrating environmental objectives) in the context of the outcomes of impact prediction for a regional development plan (Environmental Alliance, 2001, p. 11). The Alliance also suggests that a matrix approach could be used for comparision of alternatives or analysis of policy scenarios. In this case, policy scenarios would be inserted along one axis and indicators on the other, "with the alternatives' impacts on the indicators registered in the cells" (Environmental Alliance, 2001, p. 11-12). To complete the assessment process the Alliance suggests the recording of outcomes on a "policy record sheet" to manage outcomes.

CONCLUSIONS

1. There are many existing processes and tools that could be used for sustainability assessment. Most of the methods and techniques discussed are relevant to sustainability assessment of projects, policies, plans and legislation and adaptable for various uses. However, many methods are largely **theoretical** and depend on wider application to prove their effectiveness. The learning curve for sustainability-base assessment is building momentum but **more practice is needed before a sophisticated sustainability-based assessment process can be established.**

2. Sustainability-based assessment can be **applied** to policies and programs as well as projects using techniques like multi-criteria analysis and other decision-aiding techniques.

3. The **difficult step of integration** of social, economic and environmental factors is not sufficiently explored by the methods. The Gibson model proposed for Canada comes closest to addressing the question of integration. His emphasis on assessing the significance of any potential trade-offs parallels the present assessment process based on significance of each separate area – environmental, social and economic. Thus it is necessary to weigh up simultaneously whether a project, program or policy is: (i) acceptable environmentally; (ii) acceptable socially; (iii) acceptable economically; and (iv) acceptable without significant trade-offs.

4. Furthermore, although scenario analysis is a possible way to deal with uncertainty, the methods generally do not address the difficulty in identifying the place of the **precautionary principle** in sustainability assessment. The current divergence in interpretation of the precautionary principle may be a barrier to cooperative decision-making. The precautionary principle is currently being adopted by governments and industries in certain parts of the world but doubt remains over the extent to which it should be applied. A sustainability assessment framework for Western Australia will dispel such anxieties by giving adequate guidance on how the precautionary principle would be invoked in particular applications.

5. The **common links** between the sustainability assessment frameworks proposed are the reliance on qualitative processes, the use of overarching areas of concern with associated sets of questions or indicators, and the use of conceptualisation mechanisms such as scenario-building or entrenched engagement between stakeholders. It is important to recognise that sustainability assessment decision criteria would not be free from value judgements and therefore the assessment processes would have to make explicit these assumptions, perhaps through methods such as scenario building/projection of futures. Various proposed sustainability assessment mechanisms involve, or at least recognise the **value of,**

scenario building or projection of futures. Such supplementary processes, though sometimes tenuous, can offer plausible descriptions of consequences of future actions and serve as a foundation for common discourse about issues surrounding a proposal (Taylor *et al*., 1992, p. 24). They can make consultation much more effective by revealing that although stakeholders may bring a range of values to the decision-making process, shared positive futures can be negotiated.

6. A critical issue for sustainability assessment is **how to integrate qualitative and quantitative information into a single assessment;** some decision-aiding techniques in use are able to combine qualitative and quantitative data in a manner accurate and effective for decision-making, but others are problematic in their attempt to combine qualitative and quantitative information through standardisation or conversely the use of symbols (in the planning balance sheet approach) that require decision-makers to take their attention away from the integrative task at hand and refer to additional information (McAllister, 1980, p. 155). **Identifying or developing assessment methods that will enable the integrated assessment of qualitative and quantitative information, while optimising accuracy and understanding of interrelationships between issues, remains a challenge for those considering sustainability assessment.**

7. A sustainability assessment framework for Western Australia would need to determine the necessary institutional arrangements and methodologies. It would also need to determine mechanisms for setting guidelines and criteria and whether, for example, the process would be open to public input at certain stages, like the ERMP level in the EIA process. Most researchers argue that greater and more effective **participation of stakeholders is fundamental** to a sustainability assessment process because it promotes accountability, transparency, forward-thinking and certainty in decision-making.

8. More attention needs to be given to current **patterns of communication** in assessment and decision-making before a sustainability-based process can facilitate comprehensive assessment and effective decision-making.

9. As revealed through the series of workshops on sustainability assessment, another critical issue for sustainability assessment would be in identifying and defining the respective **roles and responsibilities** of proponents, government and community. This is basically a question of **who would carry out sustainability assessment.**

10. In *Environmental Impact Assessment in Australia: Theory and Practice*, Thomas makes some useful general conclusions about the many current forms of impact assessment:

> All the assessment techniques considered previously have insight to offer. In many respects the only differences between them are in the scope of analysis and assessment contemplated, and the will and understanding of the assessors. The methodologies can be combined with one another, so the name used depends largely upon the definition of the terms (eg as in "planning" and EIA) . . . A common theme pervades the assessment approaches discussed. Essentially they are designed to identify potential impacts, and to consider what may be needed to reduce adverse impacts . . . all have basically the same approach, although each may have its own individual language and detailed techniques (Thomas, 2001, p. 72-73).

These assessment processes clearly have commonalities, have much to offer and could be combined and adapted to bring about sustainability-based assessment.

However, a **fundamental difference** between sustainability-based assessment and these processes is that sustainability-based assessment would **promote the positive** rather than merely managing the negative. Who would be responsible for promoting the positive and whether it can be achieved in practice (for example, as the proponent's obligation or as a negotiation between stakeholders—government, industry and community—to maximise sustainability) is a real **challenge** for sustainability assessment.

11. As a general conclusion, in the absence of an established integrative sustainability assessment mechanism, **there are many existing processes, methods and techniques that can be adapted and used for sustainability-based assessment but techniques need to be carefully chosen for particular proposed initiatives**. There is **no single preferred model** that has emerged from worldwide studies so Western Australia needs to adapt its unique history and legislative base in impact assessment to incorporate the new approaches. However, **practice and continued refining is required** before sustainability-based assessment can be a truly integrative and effective process.

REFERENCES

Australian Bureau of Statistics. (2000). *National Headline Sustainability Indicators.* http://www.abs.gov.au/websitedbs/c311215.NSF/22b99697d1e47ad8ca2568e30008e1bc/36f96955a6e59068ca2568f2001ae1cb/$FILE/Commonwealth%20paper5.pdf

Annandale, D. Personal communication.

Annandale, D. and Morrison Saunders, A. Personal communication.

Annandale and Bailey. (1999). *Asian Development Bank Strategic Environmental Assessment Report.* Perth, Western Australia: Institute for Environmental Science, Murdoch University.

Annandale, D. & Lantzke, R. (2001). *Making Good decisions: A Guide to Using Decision-Aiding Techniques in Waste Facility Siting.* Supported by a grant from the Western Australian Waste Management and Recycling Fund.

Arce, R. & Gullón, N. (2000) "The Application of Strategic Environmental Assessment to Sustainability Assessment of Infrastructure Development." In *Environmental Impact Assessment Review*, vol 20, no. 3, pp 393-402. Cited in Thomas, I. (2001. *Environmental Impact Assessment in Australia: Theory and Practice.* Sydney: Federation Press.

Arup Environmental. *SPeAR - A Sustainability Assessment Model*. Current information from Arup consultants.

Baxter, T. et al. (2002). *The Sustainability Assessment Model (SAM).* Paper presented at the SPE International Conference on Health and Safety and Environment in Oil and Gas Exploration and Production held in Kuala Lumpur, Malaysia, 20-22 march 2002.

Bennett, M. (2002) Personal communication.

Dalal-Clayton, B. (1992). "Modified EIA and Indicators of Sustainability: First Steps Towards Sustainability Analysis." In *Proceedings of the Twelfth Annual Meeting of the International Association for Impact Assessment.* 19-22 August 1992. Washington DC: International Association for Impact Assessment. Cited in Devuyst, D. (ed). (2001). *How Green is the City?: Sustainability Assessment and the Management of Urban Environments.* New York: Columbia University Press.

Dalal-Clayton, B. & Sadler, B. (2002). *Strategic Environmental Assessment: A Rapidly Evolving Approach.* http://www.nssd.net/References/KeyDocs/IIED02.pdf

DETR (2000b). *Planning Policy Guidance Note 11: Regional Planning.* London: The Stationary Office Ltd). Cited in Smith, S. & Sheate, W. (2001) "Sustainability Appraisal of English Regional Plans: Incorporating the Requirements of the EU Strategic Environmental Assessment Directive." In *Impact assessment and Project Appraisal* vol 19, no. 4. Guildford, UK: Beech Tree Publishing.

Devuyst, D. (2000). 'Linking Impact Assessment and Sustainable Development at the Local Level: The Introduction of Sustainability Assessment Systems.' In *Sustainable Development,* 8, 67-78, New York: John Wiley & Sons Ltd and ERP Environment.

Devuyst, D. (ed). (2001). *How Green is the City?: Sustainability Assessment and the Management of Urban Environments.* New York: Columbia University Press.

DHV Environment and Infrastructure BV. *Strategic Environmental Assessment: Existing Methodolgy.* EU: Prepared by DHV Environment and Infrastructure BV under a research contract with Directorate General for Environment, Nuclear safety and Civil Protection (DGXI).
http://europa.eu.int/comm/environment/eia/sea-studies-and-reports/sea-methods.pdf

DHV Environment and Infrastructure & S. Nooteboom. (1999). *Environmental Assessments of Strategic Decisions and Project Decisions: Interactions and Benefits.* The Netherlands: Ministry of Housing, Spatial Planning and the Environment.
www.vrom.nl/international

Eggenberger, M. & do Rosário Partidário, M (2000). "Integration: Development of a Framework to Assist the Integration of Environmental, Social and Economic Issues in Spatial Planning." In *Impact Assessment and Project Appraisal*, vol 18, no. 3, pp 201-207. Guildford, UK: Beech Tree Publishing.

Environmental Alliance Sustainability Focus Group. (2001). *Sustainability Now: Implementing the Government's Sustainability Policy.*
http://members.iinet.net.au/~conswa/ea/sustainabilityWA.pdf

Gibson, R. et al. (2001). *Specification of Sustainability-Based Environmental Assessment Decsion Criteria and Implications for Determining "Significance" in Environmental Assessment.* http://www.sustreport.org/downloads/Sustainability,EA.doc

Guijt, I. et al. (2001). *IUCN Resource Kit for Sustainability Assessment: Part A: Overview*. Gland, Switzerland: IUCN.

ICLEI (2002). http://www.iclei.org/anz/tbl/toolkitcontents.htm
http://www.iclei.org/anz

International Association for Impact Assessment (IAIA). (2002). *Strategic Environmental Assessment Performance Criteria*.
http://www.iaia.org/Publications/sp1.pdf

Jenkins, B. Personal communication.

Kirkpatrick, C. & Lee, N. (1999). "Special Issue: Integrated Appraisal and Decision-making." In *Environmental Impact Assessment Review*, vol. 19, no. 3. Cited in Eggenberger, M. & do Rosário Partidário, M (2000). "Integration: Development of a Framework to Assist the Integration of Environmental, Social and Economic Issues in Spatial Planning." In *Impact Assessment and Project Appraisal*, vol 18, no. 3, pp 201-207. Guildford, UK: Beech Tree Publishing.

Kolhoff, A. Post, R. & Velthuyse, B. (1998) "Towards Integration of Assessments, with Reference to Integrated Water Management Projects in Third World Countries." In *Impact assessment and Project Appraisal*, vol. 16, no. 1, pp 49-53. Guildford, UK: Beech Tree Publishing.

Lawrence, D. (1997). "Integrating Sustainability and Environmental Impact Assessment." In *Environmental Management* 21, 1, pp23-42. *Cited* in Devuyst, D. (ed). (2001). *How Green is the City?: Sustainability Assessment and the Management of Urban Environments.* New York: Columbia University Press.

McAllister, D. (1980). *Evaluation in Environmental Planning: Assessing Environmental, Social, Economic, and Political Trade-Offs.* Cambridge: MIT Press.

Newman, P. Personal communication.

Noble, B. (2002). "The Canadian Experience with SEA and Sustainability." In *Environmental Impact Assessment Review,* vol 22, pp 3-16.

Parkin, J. (1993). *Judging Plans and Projects : Analysis and Public Participation in the Evaluation Process.* Aldershot, England: Avebury.

Petts, J. (ed). (1999). *Handbook of Environmental Impact assessment*, vol 1. Oxford: Blackwell Science. (Thérivel, R. & Brown, L. "Methods of Strategic Environmental Assessment").

Post, R. & Scholten, J. (Date not available – see website). *Strengthening the Integrated Approach for Impact Assessments in Development Cooperation*. The Netherlands: Commission for Environmental Impact Assessment.
http://www.eia.nl/site-os/pdfs/art/sch-pos.pdf

Rees, W. (1988). "A Role for Environmental Assessment in Achieving Sustainable Development." In *Environemtnal Impact Assessment Review* 8, pp 273-291. New York: Elsevier. Cited in Devuyst, D. (ed). (2001). *How Green is the City?: Sustainability Assessment and the Management of Urban Environments.* New York: Columbia University Press.

Sadler, B. (1998). *Strategic Environmental Assessment: Institutional Arrangements, Practical Experience and Future Directions.* International Workshop on Strategic

Environmental Assessment, organised by the Japan Environment Agency, Tokyo, Nov. 26-27, 1998.
http://www.eic.or.jp/eanet/assessment/sea/ws/wssiryou/s-p31.pdf

Smith, S. & Sheate, W. (2001) "Sustainability Appraisal of English Regional Plans: Incorporating the Requirements of the EU Strategic Environmental Assessment Directive." In *Impact assessment and Project Appraisal* vol 19, no. 4. Guildford, UK: Beech Tree Publishing.

Sydney Water. (2002). *Towards Sustainability.*
http://www.sydneywater.com.au/html/tsr/introduction/introduction.html

Taylor, N. et al. (1992). *Social Assessment: Theory, Process & Techniques*. New Zealand: Centre for Resource Management.

Therivel, R. (1993) "Systems of Strategic Environmental Assessment." In *Environmental Impact Assessment Review*, vol 13, no. 3, pp 145-168. Cited in Thomas, I. (2001. *Environmental Impact Assessment in Australia: Theory and Practice.* Sydney: Federation Press.

Westman, W. (1985). *Ecology, Impact Assessment and Environmental Planning.* New York : Wiley.

World Economic Forum/Global Leaders for Tomorrow Taskforce. (2002). *Pilot Environmental Sustainability Index.* Davos, Switzerland.
http://www.ciesin.org/indicators/ESI/ESI2002_21MAR02tot.pdf

World Trade Organisation (WTO). (2002). Sustainability Impact Assessment (SIA) of proposed WTO Multilateral Trade Negotiations.
http://www.europa.eu.int/comm/trade/miti/envir/sia.htm

APPENDIX

Decision-aiding techniques relevant to sustainability assessment of projects, plans and programs

There are many well-developed techniques that can be utilised for sustainability-based assessment. Different techniques could be drawn on for different applications of sustainability-based assessment: projects, plans and programs.

The following is based on personal communications with David Annandale, Environmental Science, Murdoch University.

A whole range of techniques or methods have been used by different disciplines for the purposes of decision-aiding. They have been alternatively described as evaluation methods, multi-objective decision support, decision analysis, optimisation methods or multi-criteria analysis. These techniques have been used primarily for project development, urban planning, business planning and natural resource planning/EIA. The following section outlines the use of decision-aiding techniques in these four areas.

PROJECT DEVELOPMENT

Project development has typically used cost-benefit analysis (CBA) or if the decision is primarily financial, a discounted cash flow (DCF) method. DCF does not allow for consideration of ecological issues so it will not be outlined here. CBA has been used frequently for the appraisal of multiple-objective natural resource projects.

According to McAllister, CBA:

> . . . attempts to solve the evaluation dilemma by calculating a grand index of the social welfare implications of proposed actions. The ratings that form the index are measured by the willing-ness to pay criterion. Benefits are measured by reference to market information on the willingness-to-pay to acquire desired items and avoid undesired items. Costs are measured by market information reflecting the willingness-to-pay for resources sacrificed and undesired items received (McAllister, 1980, p. 140).

Research into CBA has concentrated on developing willingness-to-pay measures for things not typically traded in the market such as conservation or visual amenity. The strengths of CBA are that it uses monetary units that are understandable to both decision-makers and the public and that it is able to represent the values of all people rather than a select few.

URBAN PLANNING

In post-Second World War industrialised economies, urban planning has traditionally used CBA. However, in recent times, CBA has been recognised as having limited ability to reflect equity issues and environmental impacts (because of problems associated with assigning monetary values).

Consequently, urban planners have sought other techniques in order to make complex comparisons between alternative development proposals. Such techniques have included the Planning Balance Sheet (PBS), developed in Britain, and the Goals Achievement Matrix (GAM) approach, used extensively in the USA and Britain.

Planning Balance Sheet (PBS)

PBS has been developed out of CBA and goes beyond typical CBA in two ways: it is able to record detailed information on the distribution of costs and benefits among different

groups of people affected by a proposal (distinguishing them as either producers and consumers); it formally accounts for intangible impacts, that cannot be monetised, by according them symbols (which allows them to be recorded alongside monetised impacts).

For example, if considering alternative plans for a university town, the groups of people might include the local council, residents, vehicle users, car park users, university and students, shoppers and the general public. The PBS would represent the costs and benefits and net calculations for each group to see which groups would be advantaged. A more summarised sheet would then be prepared and the "evaluator" would attempt to make objective judgements concerning the extent of unquantified impacts and subjective judgements concerning the relative importance of each impact to the welfare of society (McAllister, 1980).

The main problems with PBS are the difficulty of accurately recording unquantified impacts, the subjectivity involved in differentiating producer and consumer categories, the skill needed to use the method and its subsequent relative inaccessibility, and the costs of preparing an assessment involving a series of options.

Goals Achievement Matrix (GAM)

GAM was developed as a result of the perceived deficiencies of CBA and PBS. It has been used in regional structure plans. GAM is different to PBS in that impacts are divided under explicitly stated community "goals" (such as clean air or quiet surroundings), and further categorised according to the community groups affected. A panel of experts then assigns weights to each community goal and affected group. GAM favours quantification, but not monetisation.

The following example comes from Westman (1985). Consider two different plans for airport operation: large and small. Affected groups might include air travellers, nearby residents and the natural environmental (represented by green groups). Community goals (airplane travel and quiet neighbourhood) are given different weights on an ordinal scale. Also, the weights for different groups differ depending on the particular community goal (i.e. when assessing the goal of a quiet neighbourhood, greater weight is given to nearby residents, and when assessing the goal of airplane travel (increased numbers of flights), effects on air travellers are given greater weight. Benefits and costs are represented by a score on a five-point ordinal scale ranging from +2 ("maximum progression toward goal") to –2 ("maximum regression from goal"). For both plans the relative costs and benefits and the importance weights for groups and goals do not change, but the smaller airport plan is found to be preferable (it has a lower negative grand index) because the combined costs, and their weights to impacted parties, exceed the benefits to benefiting parties.

The advantages of GAM over PBS and CBA are that it does not monetise and the assessor has greater freedom in selecting the impact categories and the community groups to be used in evaluating equity effects.

However, according to Westman and McAllister, the problems with GAM is that it scales and relies on interval and ordinal scales which are weighted, multiplied and summed.

The Overlay Method

The McHarg Overlay Method provides a graphical output based on the concept of spatial, physical constraints. This constraint mapping "sieving" approach is adaptable and has

been improved by computerised GIS systems. Basically, a separate "sheet" is produced for each impact being assessed. The greater the intensity of coloured shading, the greater the significance. The use of computerised GIS in the overlay method has enabled many more impacts to be included than were possible using a manual approach. Computerised overlay method has been used to select "corridor" routes for powerlines and transport corridors.

Overlay methods are useful because they are able to depict impacts spatially as well as in other ways, and they can include weighting systems to identify the more important variables. However, some problems are the incapacity in dealing with impact probability, time and reversibility and the tendency to strictly define boundaries even when boundaries, such as between vegetation and soil types, may be problematic to define.

BUSINESS PLANNING

Business planning has provided a productive environment for the development of techniques which assist company investment decisions, such as plant siting and product development (involving multiple objectives). In this productive environment, operations research, a branch of mathematics, has led to the development of techniques such as goal programming (extended from linear programming) and methods based on matrix algebra such as the analytic hierarchy process (AHP).

Goal Programming

Goal programming, and operations research technique, extends from linear programming. According to Parkin, linear programming involves the optimisation of a single prior determined objective in order to allocate resources. The optimisation of the objective is subject to a set of constraints or minor objectives (Parkin, 1993, p. 78). An example of an objective that might need to be optimised is cost. The goal would be to minimise the cost within constraints, such as an agreed area of forest that would be lost in a mining operation.

Goal programming does not require a common unit of measurement for all variables. There are different priority levels for objectives, and at these levels, low-level objectives are considered only after higher order goals have been satisfied.

Mathematical programming tools like goals programming have been heavily used in business planning but there are also many examples of their use in problems of natural resource allocation such as timber harvesting and forest management (particularly in the USA). However, a limitation of goal programming is that it relies on functional relationships in the problem being linear, additive, divisible and deterministic.

Analytic Hierarchy Process (AHP)

Because AHP has also been used extensively for business purposes and also involves using value trees or "analytic hierarchies" to structure problems, it is similar to goal programming. However, it is quite different in its use of pairwise comparisons at each level of the value tree, rather than optimisation.

According to Parkin, AHP attributes are divided into alternatives to be evaluated, instead of simply being defined in terms of scales. Each level in the hierarchy refers to a given composite entity in the system. Each level is typically comprised of a few elements. The

important question is whether the factors at the lowest level of the hierarchy affect the goals at the top (Parkin, 1993, p. 78).
AHP can be used to aid decision-making such as in flow regulation strategies in a multi basin watercourse. This example would involve the problem of analysing three management strategies (daily regulation, monthly regulation or no regulation) and deciding which is the most feasible for each of three reservoirs. The highest level (the basins), the next level (their uses) and the lowest level (the management strategies) are represented in a diagram showing the hierarchy. Lines between them (pairwise comparisons) depict the relationships. Comparisons involve prioritising (identifying which reservoir uses are more important). The uses of the reservoirs are compared after they are scored on a scale of 1 to 9; if one use is definitely more important than another then it will be given a score of 9. Pairwise comparisons are then made in a similar way between management strategies and uses (the next level down the hierarchy). After comparisons are made, matrixes are produced for each reservoir to order priorities overall.

AHP has been used successfully in business planning and the above example shows how it could be used for natural resource management problems. However, some of the disadvantages are that it may be difficult to conceptualise for people not familiar with matrix algebra, the mix of aspects and alternatives many be confusing to some, all alternatives must be defined to be included in the hierarchy (in some cases, if a new alternative emerges during analysis, the process must start from the beginning again) and AHP is difficult to adapt to stochastic systems.

NATURAL RESOURCE PLANNING/EIA

Like business planning, natural resource management has provided a fertile ground for the development of an extensive range of decision-aiding techniques that can be used in areas such as water resource planning, land use planning, timber harvesting, and significance valuations in EIA of projects. The following techniques are discussed because they are particularly useful: the Leopold Matrix Approach, the so-called Environmental Evaluation System (EES), Weighted Summation, and Concordance/Discordance Analysis.

Leopold Matrix

This matrix approach was developed in the 1970s for the US Geological Survey and is one of the earliest and simplest natural resource management decision-aiding techniques. The approach involves listing of possible project actions on one axis and human and natural environment elements on the other. Levels of impact are scored on a ten-point scale; positive and negative impacts are signified with a "+' or no sign, respectively. Separate scoring occurs for the importance, extent or scale of the impact, that is its "magnitude" (an aspect which gives this matrix approach an advantage over techniques which simply checklist and identify impacts). Magnitude is then multiplied by importance for each cell in the matrix and an overall "grand' score is calculated. Consequently, impacts of different proposals on common environmental elements can then be compared.

Limitations of the Leopold Matrix include the fact that the differing values of various communities are not reflected because the single grand score aggregates public values, and the multiplication of magnitude and importance data is mathematically problematic.

Environmental Evaluation System (EES)

EES was originally developed for water resource projects. Westman describes EES as the measurement of the environmental impact of actions on 78 environmental components, where values are converted to common units using "scalars," scaled impacts are weighted by importance values, and the products are summed to calculate a grand score (Westman, 1985, p. 149). This score can be compared to that of environmental baseline conditions. Weights are determined by a panel of experts and add up to 1000.

The EES has the advantage of converting environmental measurements into common units (an "environmental quality scale"), unlike the Leopold matrix, which only converts units to mathematically dubious, ordinally-scaled magnitude and importance scores. Although the EES conversion system is better than that of the Leopold matrix, it is still scientifically problematic because it compares aspects that are not able to be related or compared.

Weighted Summation

Weighted summation is a form of multi-criteria analysis (MCA) and is often referred to as "additive weighting." MCA techniques were developed in the last 20 years in Europe, in reaction to the limitations of cost-benefit analysis. As discussed above, MCA involves a number of alternative plans and options, criteria to judge alternatives and the ranking of alternatives after their comparison with the criteria.

Australia has only recently adopted MCA approaches and examples in WA include choosing a public transport option for the Perth-to-Mandurah corridor and ranking nature reserves for a hills local authority.

Weighted summation is matrix-based and is perhaps the easiest MCA technique to understand. Alternatives (e.g. no extraction, short-term, medium-term and long-term) are scored for each comparison criteria and then an importance weight is applied to each criterion. Criteria are weighted because they are not equally valued by individuals; what is important to one person is not always to another. Therefore, a range of weights for criteria is produced based upon different interest group concerns. Computerisation of MCA enables as many weights as necessary to be placed on criteria.

Consider an example of MCA used in resource extraction decision-making. Here a Project Impact Matrix would show (from left to right) criteria, three columns of weights (depicting the minimum, average and maximum views of an "expert" group of biologists), scores in the alternatives columns and a column indicating whether each criterion is deemed to be a "benefit criterion" (b) (where the highest score is the best outcome) or a "cost criterion" (c) (where the lowest score is the best outcome of the alternatives). Standardisation occurs once alternatives have been scored and weighed. Original scores are standardised by a scale of 0 to 1 (i.e. worst scores are given a "0" and best scores a "1"). This allows all scores to be compared on a common scale, instead of having scores in the different units of the original form (e.g. units might be in dollars but some may be in hundreds of dollars and some in thousands of dollars). After standardisation, columns of weights are multiplied by the standardised score for each alternative. The summed result provides a ranking of alternatives.

Despite its clarity and advantages, the main problem with weighted summation is that it relies on calculations and ratio-scaling and is not appropriate for aspects such as "social" attributes.

Concordance/Discordance Analysis

Concordance/discordance analysis uses pairwise comparisons between alternatives and involves a concordance index and a discordance index being calculated for each pairwise comparison. The concordance index is the sum of the weights of the criteria for which the first alternative scores better than the second. Concordance analysis only works if weights are used and is therefore able to be used for mixed quantitative and qualitative data. It indicates the extent to which one alternative is *better* than the other, but not whether one is worse than the other. The discordance index is what indicates if one is *worse* than the other; it is defined as the largest difference in scores amongst the criteria for which the first alternative scores are worse than the second. The discordance index is based on the assumption that there is a limit to which bad performance on one criterion can be compensated for by good performance on the other. Together with thresholds set by the evaluator, the matrix of concordance indices and the matrix of discordance indices produce a ranking of alternatives.

The dependence on ratio-scaled data for the discordance index is the only major disadvantage of the technique.

ATTACHMENT 1 – Gibson's proposed model for Canada

We are not in a position here to set out a consistent and comprehensive list of potentially acceptable general rules. The following list merely illustrates some of the possibilities:

- compromises and trade-offs in (all or specified) sustainability-related matters are undesirable unless proven otherwise; the burden of proof falls on the proponent of compromise and trade-off;

- only undertakings that are likely to provide neutral or positive overall effects in each principle category (e.g. no net efficiency losses, no net additional inequities) can be acceptable;

- no significant adverse effects in any principle category can be justified by compensations of other kinds, or in other places (this would preclude cross-principle trade-offs such as ecological rehabilitation compensations for introduction of significantly greater inequities);

- no displacement of (significant, net, any) negative effects from the present to the future can be justified;

- no enhancement can be accepted as an acceptable trade-off against incomplete mitigation if stronger mitigation efforts are feasible;

- only compromises or trade-offs leading to substantial net positive long term effects are acceptable; and/or

- no compromises or trade-offs are acceptable if they entail further declines or risks of decline in officially recognized areas of concern (set out in specified official national or other sustainability strategies, plans, etc.).

In effect, the key rule may be that no significant compromises and trade-offs are permitted. This begs the big question of what then qualifies as "significant". We will return to that matter in the next chapter.

Because any conceivably acceptable set of such rules will provide limited guidance, processes for case-, region-, sector- and agency-specific clarifications will be needed. The key considerations here, and in the setting of the general rules for that matter, are how the issues are presented, debated and resolved and by whom. There are no easy answers to these questions. However, some central considerations seem clear enough:

- while expertise and technical tools can be very helpful, these are essentially and unavoidably value-laden decisions;

- open and effective involvement of all stakeholders (those representing sustainability-relevant positions as well as those potentially affected) is necessary;

- informed clarification of rules about possibly acceptable compromises and trade-offs depends on reasonable agreement on the context-specific sustainability objectives and on reasonable awareness of the relevant conditions and influences (this favours use of scenario-building and system depiction methods);

- because clarifications are needed to guide the planning of undertakings from the outset, anticipatory processes at the strategic level (though environmental assessment and equivalent planning and other processes) and early deliberations at the project level are desirable; and

- because understandings and possibilities evolve, processes for clarifying objectives and acceptable compromises and trade-offs must be iterative, with tentative positions revisited throughout planning, decision making and implementation.

ATTACHMENT 2 – Gibson's model continued

For comparison and integration, Table 3 outlines sustainability-based criteria directly related to the seven principles identified in this paper. Each of these considerations needs clarification and elaboration, for example with indicators of potential threats to ecological integrity, key elements of material security equity, and characteristics of adaptive design. The generic list nevertheless indicates the nature of the broad considerations involved.

Table 3: Generic sustainability-based criteria for evaluating the significance of effects

1. Could the effects add to stresses that might undermine ecological integrity at any scale, in ways or to an extent that could damage important life support functions?

2. Could the effects contribute substantially to ecological rehabilitation and/or otherwise reduce stresses that might otherwise undermine ecological integrity at any scale?

3. Could the effects provide more economic opportunities for human well-being while reducing material and energy demands and other stresses on socio-ecological systems?

4. Could the effects reduce economic opportunities for human well-being and/or increase material and energy demands and other stresses on socio-ecological systems?

5. Could the effects increase equity in the provision material security and effective choices, including future as well as present generations?

6. Could the effects reduce equity in the provision material security and effective choices, including future as well as present generations?

7. Could the effects build government, corporate and public incentives and capacities to apply sustainability principles?

8. Could the effects undermine government, corporate or public incentives and capacities to apply sustainability principles?

9. Could the effects contribute to serious or irreversible damage to any of the foundations for sustainability?

10. Are the relevant aspects of the undertaking designed for adaptation (e.g. through replacement) if unanticipated adverse effects emerge?

11. Could the effects contribute positively to several or all aspects of sustainability in a mutually supportive way?

12. Could the effects in any aspect of sustainability have consequences that might undermine prospects for improvement in another?

ATTACHMENT 3 – Gibson's model continued

Again as we have seen, only some guidance for such significance judgements can come from generic sources. Clarification of sustainability objectives and implications at various levels will help. But much will also depend on context-specific possibilities and local aspirations. Determining significance of trade-offs, or at least developing a supportable basis for such determinations, is best considered as a matter of public choice, closely associated with deliberations about current conditions and possibilities, desired sustainable futures, and ways of getting from here to there. Approaching significance evaluations and decisions in this way can incorporate, but also goes well beyond the useful work done on significance applications so far.

That said, some general criteria can be developed for significance evaluations of elements on both the positive and adverse sides of proposed trade-offs. An illustrative list is provided in Table 4.

Table 4 Generic criteria for evaluating the significance of trade-off elements

Will the positive effects to be gained in a proposed trade-off

- reduce stresses on ecological integrity at any scale;

- increase economic opportunities for human well-being;
- reduce material and energy demands and other stresses on socio-ecological systems;
- increase equity in the distribution of material security and effective choices;
- strengthen government, corporate and/or public incentives and capacities to apply sustainability principles; and/or
- develop complementary efforts to serve different aspects of sustainability

in ways that

- are or may be great in intensity, magnitude, scale, extent, duration or frequency;
- are or may be permanent and irreversible (or at least sustainable for the foreseeable future);
- preserve or enhance highly valued ecological or socio-economic qualities;
- may combine with the effects of other undertakings for more positive cumulative results;
- avoid potentially dangerous uncertainties and prepare for surprise;
- earn a high level of public approval;
- encourage performance beyond levels anticipated in regulatory standards and/or public policies;
- enhance international relations; and/or
- set important precedents.

Might the adverse effects to be accepted in a proposed trade-off

- damage ecological integrity at any scale in ways or to an extent that could damage important life support functions;
- reduce economic opportunities for human well-being;
- increase material and energy demands and other stresses on socio-ecological systems;
- reduce equity in the distribution of material security and effective choices;
- involve or introduce important uncertainties and/or risks;
- undermine government, corporate or public incentives and capacities to apply sustainability principles;

• build tensions between efforts to serve different aspects of sustainability

in ways that

• are or may be severe in intensity, magnitude, scale, extent, duration or frequency;

• are or may be permanent or irreversible;

• involve rare, scarce, unique or otherwise highly valued ecological or socio-economic qualities;

• may combine with the effects of other undertakings for more adverse cumulative results;

• have indirect adverse effects that may also undermine prospects for improvement in another aspect of sustainability;

• stir a high level of public controversy;

• contravene important regulatory standards and/or public policy positions;

• damage international relations; and/or

• set important precedents.

ATTACHMENT 4 – Gibson's model continued

Table 5: Trade-off decision rules incorporating significance considerations (a tentative and illustrative list)

1. Trade-offs in (all or specified) sustainability-related matters are undesirable unless proven otherwise; in other words the burden of proof falls on the proponent of the trade-off.

2. No significant trade-offs with adverse sustainability effects are acceptable. These include

• trade-offs of permanent losses against temporary gains;

• trade-offs of nearly certain losses against highly uncertain gains;

• significant compromises to ecological integrity;

• significant increases in inequity of opportunity and influence;

• significant increases in energy and material flows, except where the gains address serious deprivation and inequity;

• trade-offs where the adverse effects are uncertain and the undertaking is not designed for adaptive response; and

• trade-offs where more than one aspect of sustainability may suffer adverse effects.

3. Only undertakings that are likely to provide neutral or positive overall effects in each principle category (e.g. no net efficiency losses, no net additional inequities) can be acceptable.

4. No significant adverse effects in any principle category can be justified by compensations of other kinds, or in other places (this would preclude cross-principle trade-offs such as ecological rehabilitation compensations for introduction of significantly greater inequities).

5. No displacement of (significant, net, any) negative effects from the present to the future can be justified.

6. No enhancement can be accepted as an acceptable trade-off against incomplete mitigation if stronger mitigation efforts are feasible.

7. Only compromises or trade-offs leading to substantial net positive long term effects are acceptable.

8. No compromises or trade-offs are acceptable if they entail further declines or risks of decline in officially recognized areas of concern (set out in specified official national or other sustainability strategies, plans, etc.).

Quite clearly more work will be needed, not just on this decision rules list, but also on incorporation of sustainability-based considerations in significance decisions throughout the environmental assessment process. On the whole, however, the current significance literature provides a suitable and in some ways strong foundation for more explicit and comprehensive attention to sustainability principles.

ATTACHMENT 5 – Gibson's model continued

The key process design elements of sustainability-focused environmental assessment processes are

- explicit commitment to sustainability objectives and to application of sustainability-based criteria;

- broad definition of environment or other means of ensuring attention to social, economic, cultural and cumulative as well as individual biophysical effects, and all their systemic interrelations;

- mandatory justification of purpose;

- mandatory evaluation of reasonable alternatives;

- attention to positive as well as negative effects and enhancements as well as mitigations;

- provisions for adaptive design and adaptive implementation of approved undertakings;

- links with other sustainability-defining and applying processes; and

- provisions for transparency and effective public involvement throughout the process.

All of these are already present in various incomplete combinations in existing environmental assessment processes in leading jurisdictions (see Background Paper #2). Putting them all together, consistently or at least compatibly, even just in Canadian jurisdictions, is a daunting but not unrealistic task.

In addition to these process implications, incorporating sustainability entails two further roles for environmental assessment:

- as a process for specifying the general sustainability principles – and associated values, objectives and criteria – for specific contexts, through informed choices by the relevant parties (stakeholders); and more particularly

- as a process for
  - identifying appropriate purposes and options for new or continuing undertakings;
  - assessing purposes, options, impacts, mitigation and enhancement possibilities, etc.;
  - choosing (or advising decision makers on) what should (or should not) be approved and done, and under what conditions; and
  - monitoring and learning from the results.

Next Steps

The evolution of environmental assessment so far has not followed any rational ideal. The processes that have been adopted are wildly diverse; implementation has often been inconsistent and some of the most admirable advances have come more from accident than intent. No doubt this will continue. The underlying differences of interest, preference and context, complicated by the usual jealousies and suspicions, will frustrate hopes of tidily consistent and nicely coordinated sustainability frameworks. And perhaps such diversity is more valuable than is commonly recognized. Nevertheless, we will outline here a set of general steps to build a somewhat clearer and better integrated approach to adopting sustainability-based criteria in environmental assessment.

This is a large topic and we will not attempt to be comprehensive or detailed. But sooner or later we will need four broad accomplishments:

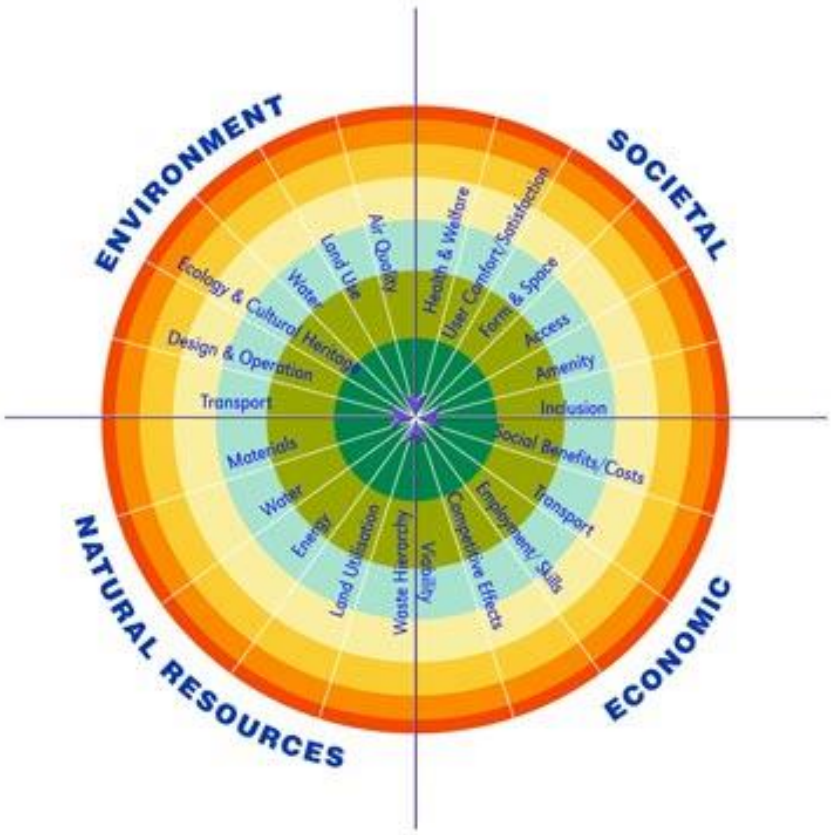
- explicit and effectively imposed requirements for careful, open attention to sustainability principles in the conception, planning, approval and implementation of all important undertakings at the strategic and project levels, in all jurisdictions;

- strong generic guidance on the relevant sustainability objectives, priorities and criteria, for all the main kinds of undertakings and locations, including clarification of implications for purposes and alternatives, effects evaluation, mitigations and enhancements, acceptable compromises and trade-offs in approval decisions, and means of ensuring continuous improvement through adaptive implementation;

• well developed process guidance for the development of case-specific, contextual frameworks for applying sustainability objectives, priorities and criteria, and understanding their implications for the relevant decisions; and

• a rich collection of well tested methodologies for sustainability deliberations, plus baseline data, indicators, systems depictions and desired future scenarios.

ATTACHMENT 6 – The SPeAR Diagram



ATTACHMENT 7 – DOTIS and Devuyst's methods

Table 1. An example of an issue considered in DOTIS (summary and translation) (Smaal and Wiersinga, 1997)

Sustainable urban spatial development	
Goals.	Does the policy proposal lead to enhanced spatial coherence and/or quality of different functions; improving environmental quality, nature in the city and public spaces; flexibility/ inclusion of future (innovative) forms of traffic infrastructure, waste collection, energy supply, underground constructions; increasing spatial quality?
Measures.	Are the following measures included in the policy proposal: using open spaces in the city; building along the outskirts of the city; adding new functions to a monofunctional area; differentiation of types of living quarters, industries and shops; increasing the amount of green spaces; increasing coherence between green spaces; compensating loss of green spaces; moving, cleaning up, zoning and screening off of environmentally harmful activities; improving the identity of the urban space through coherent square structure, pluriform architecture and strong structural lines; increasing social safety through involvement of the citizens, attractiveness of the surroundings, limiting physical vulnerability?
Effects.	Will the policy proposal have an effect on: the number of functions in the city/ neighbourhood; number of kilometres driven by cars and trucks; number of kilometres driven by public transportation; number of kilometres driven by bicycles; number of residences bothered by noise, smell and/or risks; percentage area with soil pollution suspected; area and coherence of green spaces; safety?

Box 2. Topics to be considered in a sustainability assessment report

A. Description of the initiative
include information on the initiative in general, its long-term goals, the reputation of the initiator for initiatives in a sustainable development context; and description of partnerships

B. Description of alternatives for the initiative
include information on a 'most sustainable' alternative and other possible alternatives

C. General characteristics of the initiative and its alternatives which could be favourable to sustainable development
include the examination of: integration in strategic visions for sustainable development; integration and co-ordination with other related initiatives; integration across different sectors; partnerships across traditional borders within society; empowerment of and co-operation with the local community; keeping options open, caution and reversibility; budgetary and financial implications.

D. Environmental characteristics of the initiative and its alternatives which could be favourable to sustainable development
include the examination of: introduction of an environmental care system; limiting the use of natural resources, materials and the production of waste; protection of biodiversity, limiting pollution; restoration and maintenance of ecological cycles.

E. Social and cultural characteristics of the initiative and its alternatives which could be favourable to sustainable development
include the examination of: empowerment and emancipation of groups within the community; limitation of social polarisation between groups within society; strengthening local cultural identity and diversity; protection and improvement of the health of the population; improvement of possibilities for education and training of the local population; improvement of possibilities for local employment, increasing possibilities for social, cultural and recreational exchanges between members of the local population, the sustainability of lifestyles; the strengthening of values of a democratic community; independence of the local community

F. Economic characteristics of the initiative and its alternatives which could be favourable to sustainable development
include the examination of: strengthening and diversifying the local economy; encouraging and supporting private entrepreneurship; supporting environmentally conscious and ethically responsible trade

G. Planning and design characteristics of the initiative and its alternatives which could be favourable to sustainable development
examine: promotion of development patterns which reduce the demand for transport; promotion of development patterns which take into account the functions of the natural ecosystem

H. Discussion of the reactions to the initiative and its alternatives
discuss the reactions which were noted during public consultation

I. Best available practice in an international context for the initiative and its alternatives
describe on the basis of international literature, interviews with experts and experience what is the best available practice for sustainable development of the initiative and its alternatives

J. Obstacles to the achievement of a more advanced sustainable development
examine forces which hinder a more advanced sustainable development of the initiative. Develop scenarios which lead the way out of an unsustainable society

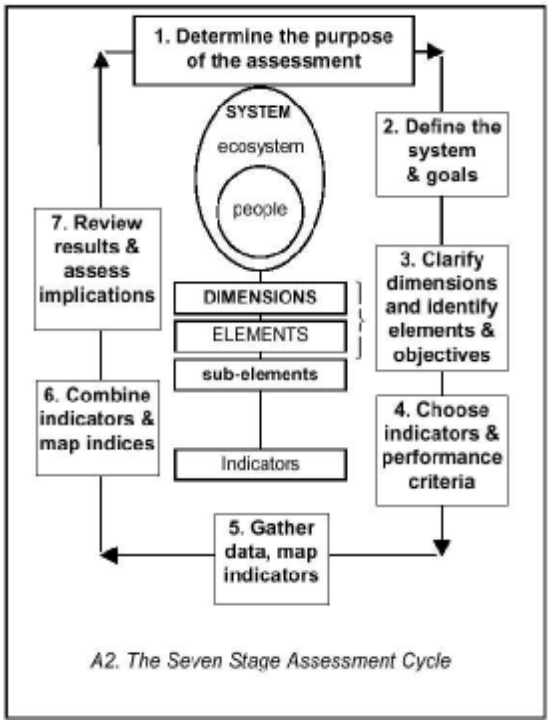
K. Assessment of the sustainable character of the initiative and its alternatives
assess the sustainable character of the initiative and its alternatives in a comparative way. Discuss the pro's and cons of the different alternatives. Check how the initiative and its alternatives relate to the best available practice.

L. Conclusion

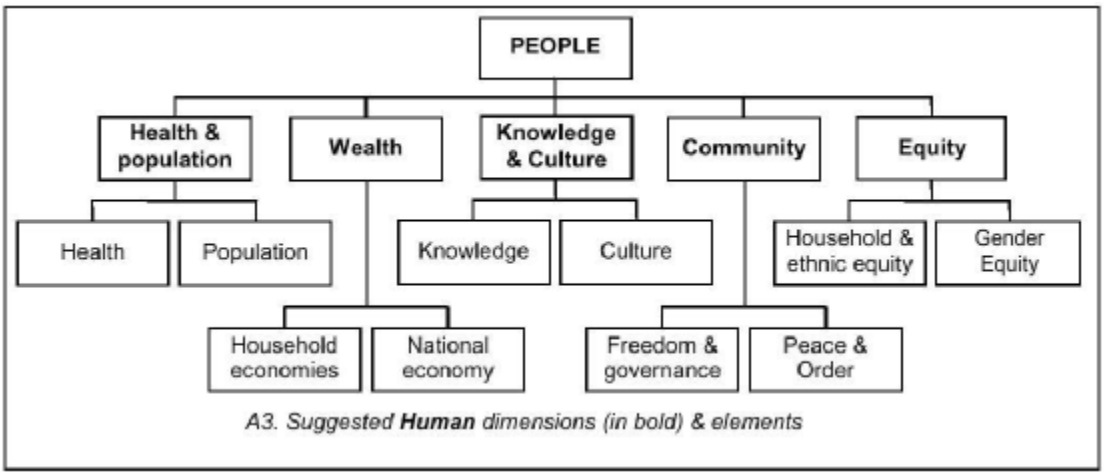
M. List of references

Annexes
list of scientific methodology used in the different phases of the sustainability assessment

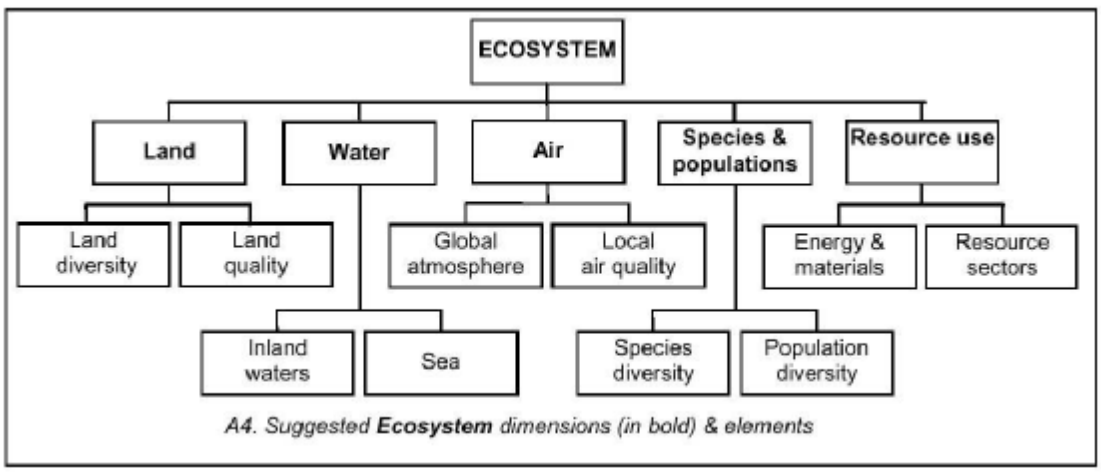
ATTACHMENT 8 – IUCN methods



A2. The Seven Stage Assessment Cycle



*A3. Suggested **Human** dimensions (in bold) & elements*



*A4. Suggested **Ecosystem** dimensions (in bold) & elements*

A15. A Framework of Dimensions: Human Populations and Ecosystems

The IUCN Sustainability Assessment Method suggests a framework of five human and five ecosystem dimensions (see A16 and A17). The dimensions were chosen after development and testing in a variety of field sites, and are intended to provide a common starting point for all assessments. Within this framework, users select their own elements and indicators. The framework of dimensions is helpful to ensure that important elements are not missed in the assessment process.

The framework is designed to combine a wide range of elements into a few major groups of roughly equal importance. The dimensions of these groupings are comprehensive enough to accommodate the majority of concerns of most societies: any issue regarded as significant for wellbeing and sustainable development has a place in one of the dimensions. They represent non-technical and accessible concepts (wealth, water, etc.). Because they are equally important, they are easily combined into indices of human and ecosystem wellbeing. A common framework of dimensions allows assessments to be tailored to local conditions and needs and at the same time makes comparison with other Sustainability assessments easier.

A fairly comprehensive sample of possible elements in each dimension includes:

- *Health and population*: physical and mental health, disease, mortality, fertility, population growth.
- *Wealth*: the economy, income, material goods, infrastructure, basic needs for food, water, clothing and shelter.
- *Knowledge and culture*: education, state of knowledge about people and the ecosystem, communication, systems of belief and expression.
- *Community*: rights and freedoms, governance, institutions, peace, crime, civil order.
- *Equity*: distribution of benefits and burdens between males and females and among households, ethnic groups and other social divisions.
- *Land*: the diversity and quality of land ecosystems, including their modification, conversion, and degradation.
- *Water*: the diversity and quality of inland water and marine ecosystems; modification by dams, embankments, pollution, and water withdrawal.
- *Air*: local air quality and the global atmosphere.
- *Species and populations*: status of wild species and wild and domesticated (crop and livestock) populations.
- *Resource use*: energy and materials, waste generation and disposal, recycling; resource sectors such as agriculture, fisheries, timber, mining, and hunting.

The method permits users to choose their own dimensions, based on their knowledge of the geographic area under consideration. Sections B5, B6 and B7 contain examples of cases where the recommended set of dimensions were used, and also where a new set was chosen. There are advantages and disadvantages to either choice. The recommended set of dimensions emerged from much testing around the world and should be broad enough to include virtually any element in the framework. However, in some areas specific concerns tend to have critical importance over others while in other areas the process of defining critical dimensions may be essential for finding consensus on what, locally, constitutes sustainability. The IUCN Sustainability Assessment Method can accommodate such differences in dealing with dimensions.

Dimensions are clusters of similar elements. It is important to ensure that dimensions are as mutually exclusive as possible. Try to make sure that elements are not placed on two or more dimensions, since the double- or triple counting will skew the results. If you choose to create your own dimensions, identify elements as you would normally would, eliminating duplication and trying to relate them to the vision. Then, cluster them into categories, checking that elements are not double-counted. It is entirely possible that the clustering exercise will take several rounds to refine. Allocate enough time for this task.

To assess human and ecosystem wellbeing equally, there should be an equal number of dimensions for each subsystem. We suggest using five dimensions for mathematical reasons. However, it is possible to use three to seven. But is vitally important to use an equal number of dimensions for each subsystem. Otherwise the weight given to particular dimensions may be diminished.

More guidance on this topic is offered in Stage 2 and Section B3.

A7. List of Outputs per Stage in terms of Process and Data

	Process Outputs	*Data Outputs*
Stage 1. Determine the purpose of the assessment	• Agreement to undertake the assessment and enthusiasm and commitment from stakeholders (time and other resources) • Clarity amongst stakeholders about the expectations regarding the assessment, its main purpose and scope • Clear agreements on roles of stakeholders in the process • More interaction amongst stakeholders who may have worked in isolation • Deeper understanding about abstract notions like sustainability, development, participation	None
Stage 2. Define the system and goals	• Agreement on the exact scope of the assessment, enhanced familiarity with the assessment area • More understanding about divergence and agreement on what sustainable development means. Perspectives more inclusive of both human wellbeing and ecosystem wellbeing • Goals that form a common reference point for the stakeholders and the area being assessed and can trigger activities	• Base maps of the system being assessed
Stage 3: Clarify dimensions, Identify elements and objectives	• More integrated appreciation of the need to think through both aspects of sustainable development • Agreement on what locally relevant elements are within the local vision of sustainable development and will be considered specifically as part of the assessment	• A meta-database, with sources of data identified (statistical, reported, mapped) • Data gaps identified
Stage 4: Choose indicators and performance criteria	• Deeper understanding of the complexity of assessing progress towards sustainability • Appreciation of the role and limitations of numbers • More detailed definition of what is considered acceptable performance for the indicators • More awareness of the wide variety of ways in which change can be assessed • Appreciation for the significance of certain kinds of data • Skills built in working with performance indicators	• List of indicators for all elements and sub-elements. • Performance criteria and scales for each indicator.
Stage 5: Gather data and map indicators	• Appreciation of the consequences of data gaps • Agreement on initial assessment of performance against indicators	• Database • Scores for indicators • Mapped performance of indicators
Stage 6: Combine indicators and map indices	• A growing understanding of overall performance of the system being assessed • Critical appreciation of the contribution and limitations of quantitative indices	• List of performance indices for the hierarchy • Visual representations of performance
Stage 7: Review results and assess implications	• Greater contact between stakeholders who previously worked in isolation • Agreement about priority actions for improving performance towards sustainable development • Appreciation of overall contribution of assessment process to quest for sustainable development • Motivation to fill data gaps plus clarity about where critical gaps lie	• An analysis (report) of patterns of performance • An analysis (report) of priorities for action • An analysis of each major theme (dimension) in the assessment

ATTACHMENT 9 – Environmental Alliance methods

Table 2: Testing the Consistency of Policy Elements (in this case, of a hypothetical land-use plan)

	Economy	Culture and language	Natural environment	Built environment	Energy	Pollution
Economy	–					
Culture and language	✓?	–				
Natural environment	✓?	✓?	–			
Built environment	✓?	✓?	✓	–		
Energy	X?	O	✓	✓	–	
Pollution	X?	O	✓	✓?	✓	–

✓, compatible; ✓?, probably compatible; X?, probably incompatible; O, no relationship.

Table 3: Example of a Policy Impact Matrix for Forecasting

Environmental Objectives →	**Global Sustainability**				**Natural Resources**				**Local Environmental Quality**		
Policy Elements ↓	Transport energy: Efficiency; trips	Built environment: Energy efficiency	Renewable energy potential	Rate of CO_2 fixing	Air quality	Water conservation and quality	Land and soil quality	Landscape and open land	Urban liveability	Cultural heritage	Public access to open space
To provide a network for open space corridors	•	•	•	✓	✓	•	✓	✓?	✓	✓	✓
To concentrate residential development on an existing public transport corridor of the city	•	✓	•	•	x	•	•	✓?	✓	✓?	x
To concentrate residential development on a new rural "green" settlement	x	✓	✓?	✓?	•	✓?	x	x	✓	✓?	x

Legend:

• No relationship, or insignificant impact	✓ Significant positive impact	✓ ? Likely, but unpredictable impact	X Significant negative impact	? Uncertainty of prediction or knowledge