Re-evaluating Sustainability Assessment: aligning the vision and the practice

Abstract

Sustainable Development is the core goal of the expanding field of Sustainability Assessment (SA). However, we find that three key areas of debate in relation to SA practice in England and Western Australia can be classified as policy controversies. Through literature review and analysis of documentary evidence we consider the problem of reductionism (breaking down complex processes to simple terms or component parts) as opposed to holism (considering systems as wholes); the issue of contested understandings of the meaning of sustainability (and of the purpose of SA); and the definition of 'inter-generational' in the context of sustainable development and how this is reflected in the timescales considered in SA. We argue that SA practice is based on particular framings of the policy controversies and that the critical role of SA in facilitating deliberation over these controversies needs to be recognised if there is to be a move towards a new deliberative sustainability discourse which can accommodate these different framings.

Keywords

Sustainability Assessment; reductionism; holism; timescales; weak sustainability; strong sustainability; deliberation

Introduction

Sustainable Development has become a principle which all governments seemingly aspire to abide by. Its roots at international policy level are commonly believed to lie in the Brundtland Report (World Commission on Environment and Development, 1987) which itself was a culmination of public attention being directed towards public concerns over poorly planned resource use, popularised by reports such as that produced by the Club of Rome (Meadows *et al.*, 1972) and Rachel Carson's Silent Spring (Carson, 1963). The Brundtland Report coined a definition of sustainable development which is often quoted (but which is by no means the only definition (Bell and Morse, 2008)):

> "*…development that meets the needs of current generations without compromising the ability of future generations to meet their needs*" (World Commission on Environment and Development, 1987, p.9).

The main political driver internationally was originally the Rio Earth Summit which took place in 1992 and set out a series of action points for achieving sustainability, called Agenda 21 (Bell and Morse, 2008). Since that time, governments have developed their own policies on sustainable development, for example, the European Union has recently renewed its Sustainable Development Strategy (Council of the European Union, 2006), as has the UK (HM Government, 2005), and Western Australia (Government of Western Australia, 2003).

In this context of high level political commitment to the principle of Sustainable Development, it is not surprising that Sustainability Assessment (SA) is becoming more common as a decision-making tool intended to anticipate the sustainability implications of proposed actions (policies, plans, programmes or projects)(Pope *et al.*, 2004). A generic

definition of SA that can be interpolated from Hacking and Guthrie (2008) is simply "a process that directs decision-making towards sustainability". Gibson (2006) refers to examples of SA being conducted in Canada, South Africa, Hong Kong and Namibia, and Pope and Grace (2006) refer to SAs undertaken in Western Australia. Sustainability Appraisal of spatial (land use) plans became a legal requirement in England in 2004 through the Planning and Compulsory Purchase Act (United Kingdom Parliament, 2004) with the term 'Appraisal' being used instead of 'Assessment' as a development (to encompass socio-economic issues) of an earlier form of 'environmental appraisal' of development plans. The term 'appraisal' was originally used as it was considered less rigorous than Strategic Environmental Assessment (SEA) (Dalal-Clayton and Sadler, 2005) although there is no suggestion that this is still the case as SEA (in the UK) has been subsumed within Sustainability Appraisal.

Whilst the above examples are far from representing universal adoption of Sustainability Assessment, the use of SEA is globally widespread (Dalal-Clayton and Sadler, 2005) and is often interpreted as having sustainability goals. The authors of the European Union Directive on SEA, for example, argue that one of its key goals is to achieve sustainable development (Feldmann *et al.*, 2001), and many authors make the assumption that this is appropriate (for example, Lawrence, 1997; Nooteboom, 2007; Nykvist and Nilsson, 2009; Partidário, 1999; Sinclair *et al.*, 2009). The Rio Earth Summit pre-dates widespread adoption of SEA practice and use of impact assessment tools to address sustainable development was advocated via Environmental Impact Assessment (EIA). Specifically, Rio's Principle 17 called for Environmental Impact Assessment to be undertaken for proposed activities that are likely to have a significant adverse impact (George, 1999).

Pope *et al.* (2004) review the conceptual roots of SA and find that they are embedded in environmental assessment tools which have a history stretching back to 1970. One of the authors of the original text of the world's first EIA legislation (the National Environmental Policy Act in the USA), Lynton Caldwell, indicated that its objective was "*to enhance the rationality …of the ultimate decision*" (Caldwell, 1991, p.81) which firmly embeds the process as following positivist principles whereby the presentation of better information to decision makers automatically facilitates better decision making.

Thus, a rational approach to EIA was intended to lead to more sustainable decision making. However, a wealth of literature has identified that this rational role for environmental assessment is not a true reflection of the nature of decision making (see, for example, Bekker *et al.*, 2004; Bond, 2003; Cashmore, 2004; Flyvbjerg, 1998; Lawrence, 2000; Leknes, 2001; Owens *et al.*, 2004; Richardson, 2005), although it has continued to provide the basis for methodological development of the tool, and by extension the forms of assessment (such as SEA and SA) that have evolved from it.

Notwithstanding a shared history, it would be inappropriate to suggest that the goals of SA are identical to those of EIA. Gibson *et al.* (2005, p.62) identify the purpose of SA as having "*the double role of vehicles for the general pursuit of sustainability and contributors to defining the specifics of sustainability in particular circumstances*". As such, in order to meet this dual role, the expectation for SA would be that it could operate as the vehicle for deliberation that can define sustainability in its context. This is not consistent with a positivist perspective which would ignore any constructed framings of sustainability and aim to identify the triple bottom line (that is social, economic and environmental implications), expecting decision makers to make sense of the information.

The contested nature of 'sustainable development' was indicated by O'Riordan (2000, p.30) "*there is no clear agreement as to what sustainable development is, every pathway begins and ends at different points …*" and, whilst there may now be broad agreement on the underlying principles of the concept set out in the Brundtland definition, we would argue that important debates still continue which we aim to set out in this paper. We take a position that the use of a decision-making tool like SA is inherently a good thing, but recognise that it is in the formative years of development when practice will be affected by a lack of familiarity amongst practitioners and a lack of capacity which is common when new tools are applied (see for example, Lee (1988) in relation to EIA). To ensure that SA evolves and develops as an effective tool, we believe it is important to identify and summarise the key debates so that they can inform capacity development.

Our objective is thus to demonstrate that if current SA practice is to achieve sustainable outcomes, it needs to acknowledge the fact that different stakeholders have different framings of what the outcomes should be. We take three key areas of debate in relation to SA (although we acknowledge there are many more) which we categorise, following the definitions of Rein and Schön (1993, p.148), as either 'policy disagreements' which "*arise within a common frame and can be settled in principle by appeal to established rules*" or 'policy controversies' which "*cannot be settled by recourse to facts …Because they derive from conflicting frames, the same body of evidence can be used to support quite different policy positions*". We recognise that many debates may not fall neatly into such categories but may, instead, fall somewhere on a spectrum between them. Nevertheless, such a categorisation will help to highlight particular debates which need to be accommodated by the SA process. We provide examples from both England and Western Australia to place current practice in relation to the

areas of debate identified. Whilst many other examples could be used, we argue that this comparison is sufficient to suggest whether certain framings prevail as it includes a system applying SA on a regular basis to plans and programmes (England), and one which applies it to projects (Western Australia). Based on the analysis, we suggest how SA might be conducted in order to recognise and accommodate different framings, thereby improving on current practice.

Reductionism or holism

The first debate we consider is the extent to which SA tends towards reductionism or holism. Sustainability Assessment is commonly associated with the derivation of indicators which can be used as measures of the state of the socio-economic and biophysical environment and therefore used as the basis for predictions where there is a development intervention (Bockstaller and Girardin, 2003; Donnelly *et al.*, 2007). This approach is consistent with the rationalist approach to impact assessment discussed previously whereby complicated systems are broken down into smaller units of analysis for ease of evaluation and decision-making. There is an extensive literature on the development of indicators, some of which examines the best approach for producing complete sets to be used in the assessment (e.g., Donnelly *et al.*, 2006; McCool and Stankey, 2004), whilst other literature focuses on the derivation of indicators specific to particular impacts, for example biodiversity (e.g., Department for Environment Food and Rural Affairs, 2007; Haughton *et al.*, 2009), or social impacts (e.g., Cloquell-Ballester *et al.*, 2006; Valentin and Spangenberg, 2000). However, Bell and Morse (2008) point to a debate over the degree to which an SA should be reductionist, in that it attempts to break down a very complicated natural and anthropogenic system into a few component parts, and the degree to which it should be holistic. Reductionism we define as breaking down complex processes to simple terms or component parts. In the context of SA,

this can be illustrated by the approach taken of using a few selected sustainability indicators to represent the sustainability of a whole system. We base our definition of holism on Bell and Morse (2008) in terms of systems which need to be considered as wholes rather than broken down. Holism understands systems as having complex interactions which can't (currently) be fully understood in terms of the sub-components which make up the full system. Cashmore (2004) recognises the problems created in trying to analyse effectiveness of impact assessment processes and he calls for more holistic research as reductionist research does not analyse the relationship between important variables contributing to effectiveness. As such, we regard this as a policy controversy because holism frames systems in terms of inherent interactions which cannot be analysed through sub-components, whereas reductionism frames systems as being understood by breaking it down into sub-components.

Steinemann (2000, p.640) defines a holistic approach as one which facilitates "*moving away from analyses of isolated risks and toward a broader understanding*". Most of the efforts made towards developing such approaches have come from the application of Health Impact Assessment or Social Impact Assessment, precisely because the reductionist approach requires existing knowledge and understanding amongst affected communities which is often lacking (see, for example, Arquette *et al.*, 2002; Kemm, 2000; Mindell *et al.*, 2001). Both Bell and Morse (2008) and Lawrence (1997) call for a more systems-based approach in order to implement holistic assessment, and this requires a process where communities are systematically involved in defining visions of sustainability and also the means to achieve the vision.

There are different degrees of reductionism whereby complex systems are reduced to ever fewer measures, with the extreme being a single value (e.g., Barrera-Roldán and Saldívar-

Valdés, 2002; O'Regan *et al.*, 2009). Advice in both England (Office of the Deputy Prime Minister, 2005) and Western Australia (Government of Western Australia, 2003) suggests that a number of disaggregated indicators should be used; whilst not reductionism to the extreme of using single indices, this is still a form of reductionism. In England, an Institute of Environmental Management and Assessment forum on SEA met in 2006 to review progress with the Government advice and concluded that too many objectives (each associated with a number of indicators) were being set (Institute of Environmental Management & Assessment, 2006). Cass (2008) analysed the SAs undertaken for core strategies of 38 local authorities in England. To ensure some diversity of sample, she focussed on authorities which were classified either as being 'major urban' or 'major rural' taken from three of the nine administrative regions (chosen because they had at least five local authorities falling within each classification). The classifications are based on definitions provided by the Department for Environment Food and Rural Affairs (Department for Environment Food and Rural Affairs, 2009). She found that the greatest number of indicators used was 151, and the least 24. Overall the average was 78 with a standard deviation of 36, indicating some considerable variation. We recognise that variation in numbers of indicators must be expected because the context varies in different localities and, though we have no opinion on whether fewer or more indicators are preferable, we suggest that the range of variation being greater than a factor of 6 reflects different degrees of reduction taking place in England rather than different contexts.

Attempts to carry out SA in Western Australia have generally been modelled on an expansion of the existing EIA process in use to more explicitly accommodate socio-economic factors (Pope and Grace, 2006). It is worth noting that a weakness of the EIA process used in Western Australia, while considered to have some outstanding characteristics, is that "*it risks*

being reductionist... by breaking each proposal down into discrete parts and assigning environmental objectives to them, it may not adequately represent environmental functions" (Morrison-Saunders and Bailey, 2000, p.270). With respect to explicit SA applications, the State Sustainability Strategy (Government of Western Australia, 2003, p.40) proposes a list of nine general criteria (each split into approaches for 'managing the negative' and 'promoting the positive') that might be applied in any SA. More specifically with respect to prioritising key projects in the planning and infrastructure portfolio, the Government of Western Australia (2003, p.42) presents eight strategic directions for which multiple objectives/outcomes are identified (in total these number 25) but this document does not extend to developing discrete indicators for each. With respect to individual SAs undertaken on major resource projects in Western Australia in recent years a scan of the proponent's Sustainability Reports (or equivalent) revealed the following characteristics:

- for the Gorgon gas field development project, 10 sustainability principles correlating with 26 criteria were established by the proponent that the development should meet (ChevronTexaco Australia Pty Ltd, 2003, p.260-270);
- for the South West Yarragadee water supply development a total of 39 objectives were investigated with respect to potential impacts (Strategen, 2006, p.3.10-3.18);
- for the Fremantle Outer Harbour proposal, nine criteria correlating with 28 sub-criteria were investigated using multi-criteria analysis to compare different harbour configurations (Oceanica Pty Ltd *et al.*, 2006, p.10-11); and
- for a high level sustainability assessment of water supply options for Western Australia, the Water Corporation (2008, p.22) utilised 15 sustainability criteria divided equally between social, economic and environmental categories.

Thus it is appears that lower numbers of sustainability indicators are applied for project type assessments in Western Australia relative to the experience with sustainability appraisal of planning strategies in England.

A particular example from the United Kingdom is the process undertaken by the Committee on Radioactive Waste Management (CoRWM) which undertook a review of the possible long-term management strategies for dealing with the UK's legacy of radioactive waste. The process was undertaken to gain approval of the strategy to be adopted prior to finding an appropriate site and was a response to a failed planning application for a Rock Characterisation Facility as a precursor to the construction of a geological repository at Sellafield, Cumbria, in 1997 (Department for Environment Food and Rural Affairs *et al.*, 2001). CoRWM used a co-operative discourse method whereby they combined a Multi-Criteria Decision Analysis (MCDA) approach with a separate holistic approach as it was recognised that one approach alone might be controversial with some stakeholders. The MCDA used expert scaling combined with stakeholder weighting of a number of issues to come up with a single aggregated score for each alternative strategy (i.e. a highly aggregated reductionist approach). The holistic assessment allowed the alternative strategies to be assessed as a whole based on the experience gained by the eleven CoRWM panel members over three years (CoRWM, 2006). Use of both methods allowed CoRWM to make recommendations to Government on the future strategy to adopt using a method grounded in both approaches, and this demonstrates that it is possible to combine holistic and reductionist approaches to try and draw on the benefits of both. However, the CoRWM process was an expensive exercise and does not reflect the majority of practice in England and Western Australia which our examples have revealed tend to be reductionist.

Understanding of sustainability

The definition of sustainability, or sustainable development, is by no means agreed and is subject to value-judgements (Bell and Morse, 2008). This immediately poses problems for any form of sustainability assessment as there are likely to be differing expectations of the goals of the assessment. Barrett and Grizzle (1999) acknowledge the contested framings of sustainability in suggesting that achieving sustainable policy relies on reconciling divergent views of communities on ecosystem maintenance. Thus we categorise the debate over the understanding of the term 'sustainability' as a policy controversy.

One particular issue is that there are different forms of sustainability, both weak and strong (George, 1999). Cabeza Gutés (1996) draws on the roots of these terms in environmental economics and defines strong sustainability as a condition whereby some natural capital (called critical natural capital) provides functions which are not substitutable by human-made capital – the stock of natural capital handed down to future generations must not be smaller than that enjoyed by the current generation. Weak sustainability, on the other hand, reflects a view whereby natural and human-made capital together comprise total capital; natural capital is considered to be substitutable for human-made capital and weak sustainability occurs whereby the level of total capital passed onto future generations does not decrease. We return to this concept in relation to some specific examples from SA practice later.

Debates over the definition of sustainability can be seen to extend to SA. Some authors fear that the transference of ecologically-focussed decision-making tools to SA may lead to further neglect of traditionally undervalued ecological issues. The argument is made that EIA and SEA maintain a much needed advocacy role for the environment, which is jeopardised by broadening the assessment to incorporate social and economic issues (for example, Morrison-

Saunders and Fischer, 2006; Pope *et al.*, 2004; Sheate *et al.*, 2003). Others argue that the goals of EIA and SEA have evolved (or can evolve) such that they have become sustainability tools (Benson, 2003; Bruhn-Tysk and Eklund, 2002; George, 1999; Shepherd and Ortolano, 1996) and the authors of the SEA Directive itself argue that it has an overall aim of sustainable decision making (Feldmann *et al.*, 2001).

Set against this background, an examination of current practice aims to examine the extent to which Sustainability Assessment attempts to deliver weak or strong sustainability. In England, Thérivel *et al.* (2009) examine 45 Sustainability Appraisals conducted in England using the official guidance produced by Government (Office of the Deputy Prime Minister, 2005). Based on categorising the aspirational objectives into social, economic or environmental categories, they conclude that, on balance, the appraisals will lead to beneficial social and economic effects through implementation of the appraised plan, but negative environmental effects. The research focuses mainly on the SA documents and it is acknowledged that the method focuses on the process as documented, rather than on actual environmental, social and economic outcomes (which are rarely measured). Thérivel *et al.* (2009) indicted that none of the 45 SAs investigated specifically referred to any situation where environmental loss had been compensated by socio-economic gain, so it appears unlikely that there was explicit application of weak sustainability principles (although this might be the implicit outcome) and more likely that no sustainability principles were explicitly applied. Haughton *et al.*, (2009), on the other hand, have specifically identified trade offs as being a significant issue which would almost certainly lead to weak sustainability outcomes when applying the same methodology (i.e., Office of the Deputy Prime Minister, 2005) to biomass planting scenarios. Their solution was to use constraints mapping (through

the use of Geographical Information Systems) to exclude all the areas of critical natural capital from the areas to be subjected to planting, and therefore, from the SA.

In Western Australia, in light of the State Sustainability Strategy (Government of Western Australia, 2003) definition of sustainability as win/win/win (encompassing positive environment/social/economic gains), this has been the stated basis for the SAs that have been undertaken (examples listed in previous section). Although proponents of developments subject to SA processes have embraced the rhetoric of strong sustainability, practice is different. This was especially evident in the case of the Gorgon Gas Field development which involved a proposal to construct gas processing facilities on Barrow Island, a Class A Nature Reserve (Pope *et al.*, 2004; Pope *et al.*, 2005), there were ultimately environmental trade-offs in favour of the principally economic benefits that the project would deliver. Likewise, despite rigorous commitments to mitigation and follow-up strategies, the South-West Yarragadee groundwater extraction proposal if implemented would have caused some significant impacts on groundwater dependent ecosystems (Environmental Protection Authority, 2006). Whilst no calculation of total capital was made in either case, we would argue that a weak sustainability interpretation was implicit in the belief that natural capital was substitutable for socio-economic capital. It is possible in these cases, however, that natural capital loss would not be balanced by socio-economic gain and that these examples may reflect unsustainable development.

It is clear that the different interpretations of sustainability, and of sustainability assessment, will create a situation where stakeholder expectations of the outcomes of conducting SA are likely to vary considerably. Inevitably there will be some disillusionment amongst some stakeholders about the ability of the process to deliver sustainability purely because they

understand sustainability differently to other stakeholders. In addition, the Western Australian case shows a clear difference between stated government strategy and actual practice.

Time horizon

Most definitions of sustainability refer to the critical concepts of intragenerational and intergenerational equity (Barrett and Grizzle, 1999) and they are both featured in the Brundtland definition (World Commission on Environment and Development, 1987) and in UK and EU Sustainable Development strategies (Council of the European Union, 2006; HM Government, 2007) and in definitions used in Western Australia (Environmental Protection Authority, 2004; Government of Western Australia, 2003).

We have already seen that two different forms of sustainability are defined; weak and strong. Strong sustainability places the emphasis very much on intergenerational equity as protagonists argue that it is future generations for whom natural capital needs preserving. Barrett and Grizzle (1999), however, refer to those whose concern centres on intragenerational equity and make the argument that protecting natural resources does so at the expense of today's poor. Thus there is some debate surrounding the compatibility of intra- and intergenerational equity. Assuming that this is recognised and that attempts are made to ensure that both intra- and inter-generational equity is assured – what exactly do we mean by a generation? Its meaning has biological origins as it refers to those members of a particular species that are at the same stage of descent. So, grandparents, parents and their children comprise three generations. However, for any one of those generations, time is likely to be measured in terms of their longevity which, again, will vary depending on where you live, estimated at between 84 years in Macau and 32 years in Swaziland in 2008 (Central

Intelligence Agency, 2009). Clearly, then, the time boundaries for intragenerational equity are not clear.

A specific example demonstrating the difficulty of assessments based on intergenerational timescales is the CoRWM process referred to above. This is a unique case of disposing of a waste product which, because of a very long radioactive decay period, needs to remain encapsulated for a period greater than 100,000 years (the length of time it would take High Level Waste to decay to a level where radioactivity was equivalent to background (CoRWM, 2006)). Defining intergenerational equity to span a period greater than 4,000 generations is not itself difficult. However, recorded history only goes back a few thousand years (although spoken language is believed to have developed at least 30,000 years ago) (Simpson, 1990), and a particular difficulty that the CoRWM deliberations faced is the fact that institutional control, the time period over which there might be expected to be a Government in existence with knowledge and resources to handle any issues arising, was assumed to be a period of around 300 years (CoRWM, 2006). Indeed, "*UK regulators are unlikely to accept a safety claim for institutional control for a period of greater than 300 years*" (CoRWM, 2006, p.78). Thus, when someone thinks of intergenerational scales, they tend to imagine periods of time far in excess of what currently constitutes recorded history, or our ability as a Society to manage future implications of current actions. Clearly there are problems associated with predictions on these timescales. Again, we categorise the debate over the relevant timescale to be considered intergenerational or intragenerational as a policy controversy, in common with the findings of Barrett and Grizzle (1999), because we can identify different framings.

We can, again, identify a gap between sustainable development rhetoric and practice in relation to consideration of intergenerational equity. We previously demonstrated an inherent

tendency towards reductionism by local authorities in England with respect to use of indicators, and an analysis of eleven Sustainability Appraisals (a subset of the SAs analysed by Thérivel *et al.*, 2009) demonstrates that most indicators are not associated with a timescale at all which, we assume, means that timescales are considered to be within that of the plan being appraised as shown in Table 1. This table also demonstrates the lack of intergenerational assessment. Sustainability Appraisals in England have to comply with the SEA Directive which requires consideration of "*short, medium and long-term*" environmental effects (European Parliament and the Council of the European Union, 2001, Annex If); however, we see that these timescales are either not specified, or tend to be very much intragenerational.

In Western Australia, the gas processing facilities for the Gorgon gas development proposal in Western Australia designed for an operational lifespan of 30 years (ChevronTexaco Australia Pty Ltd, 2003, p.73), notwithstanding that the proponent indicated that this may be extended (but without specifying for how long), is at odds with the sustainability criteria promising 'long-term' economic growth for the Pilbara region (where the development is situated), the state of Western Australia and Australia alike (ChevronTexaco Australia Pty Ltd, 2003, p.262). Use of the phrase 'long-term' might reasonably be interpreted as 'intergenerational' in a sustainability assessment. In contrast, and as the name itself implies, the *Water Forever* SA is more cognisant of time frames and in light of predicted climate change consequences for Western Australia leading to a gradual but ultimately dramatic reduction in rainfall, some of the water options identified were subject to specific timing with respect to their viability for either commencement or cessation (Water Corporation, 2008). However the consideration of timing was expressed in terms of predicted changes to rainfall patterns over forthcoming

decades (i.e. rainfall dependence) not in terms of future generations. It remains unclear just how long 'forever' means in the context of this SA.

Discussion and Conclusion

Perhaps the most intractable problem we have identified is that of the appropriate timescale over which intra- and intergenerational sustainability should be considered. There is no consensus on what appropriate timescales should be (indeed we suggest that the whole issue tends to get ‘brushed under the carpet’), and intragenerational sustainability timescales appear to be driven by the decision-making context and not by the timescales of generations. The evidence from England and Western Australia suggests that intergenerational equity, whilst a principle enshrined in policy, does not form a significant part of any SA. This clearly means that there is no conscious attempt to achieve a sustainable outcome. We have also identified evidence for policy controversies which, if not addressed through the SA process, have the potential to limit its ability to deliver sustainable development as understood by all stakeholders.

Accepted wisdom on improving the effectiveness of environmental assessment tools is that early involvement of stakeholders and affected citizens is critical (Sadler, 1996). However, we feel that there needs to be more specific consideration of what the objectives of the dialogue should be. We recommend that:

- The policy controversies outlined in this paper (reductionism versus holism; understanding of sustainability; and time horizon) need to be acknowledged at the outset of the SA process.

- Dialogue needs to take place involving stakeholders and affected citizens to reflect on the policy controversies in order to come to an agreement on the appropriate framing for each of them for the duration of the assessment.
- Continual reflection back to the original vision/objective by those undertaking the SA is needed to keep in touch with the agreed goal; that is, the three policy controversies are such that they demand ongoing attention – they cannot be solved through a single intervention or SA process design, but rather warrant an iterative approach allowing for evolution and refinement or other adaptation. The responsibility rests with practitioners undertaking an assessment to actively engage in such reflection through deliberation with colleagues (often drawn from multi-disciplinary teams) during the assessment process and also to disclose or communicate this effectively in assessment documents for the benefit of external stakeholders and citizens.
- SA practitioners and researchers need to recognise the need for such deliberations not just in individual cases but also more broadly and generally in SA studies, and in the development of policies and through decision-making practice.

Thus, we argue that the assessment methods in SA are not flawed; rather the current problem is that SA needs to be seen as a vehicle for deliberation in order to address the policy controversies. The alternative, as at present, is to ignore the controversies and produce conclusions which contain significant biases towards specific framings. As SA begins to develop and becomes more widespread, there is a window of opportunity to redefine SA as a facilitator of deliberation, and to move away from an embedded pragmatist discourse to a new deliberative sustainability discourse. This promises to reduce controversy in the interpretation of SA findings and also to lead to sustainability outcomes accepted by a wider range of stakeholders and citizens.

We have seen that SA has been developed based on an EIA process conceived as a tool to support rational decision making, but evidence indicates that decision making is not rational and we have argued that policy controversies exist which will remain intractable if SA continues to be conducted in its current form. Dryzek (1993, p.228) argued that policy analysis must involve "*open communication and unrestricted participation*" if it is to remain defensible. He goes on to emphasise that there is no suggestion that the place of science should in any way be rejected but that it should be subjected to free debate. Open dialogue is certainly favoured in the rhetoric of SA systems, and international drivers like the Århus Convention on access to information, public participation in decision-making and access to justice in environmental matters (United Nations Economic Commission for Europe, 1998) which has significantly strengthened public participation requirements relative to pre-exiting national legislation (Palerm, 1999). SA practice in England requires participation at a number of stages, starting with scoping (where the sustainability issues to be appraised are decided) (Office of the Deputy Prime Minister, 2005), however, we argue that the key debates considered in this paper have already been framed before consultation takes place, and therefore there is no opportunity for 'frame-reflective discourse' which might provide some opportunities for resolution of policy controversies (Rein and Schön, 1993). A similar bias has been identified by Svarstad *et al.* (2008) in relation to the application of the Drivers–Pressures–State–Impacts–Responses (DPSIR) framework for investigation of environmental issues, whereby the framework was found to favour particular discourses and not to provide the neutral knowledge claimed.

In relation to the issue of intergenerational equity in particular, an opportunity for early discourse might lead to recognition of what Rein and Schön (1993, p.163) term "cognitive

dissonance" where there is a mismatch between beliefs and behaviour; that is, it might become apparent that despite a belief that intergenerational equity is important, it is not being considered in the SA.

References

Arquette M, Cole M, Cook K, LaFrance B, Peters M, Ransom J, Sargent E, Smoke V, Stairs A. Holistic Risk-Based Environmental Decision Making: A Native Perspective. Environmental Health Perspectives 2002;110:259-264.

Barrera-Roldán A, Saldívar-Valdés A. Proposal and application of a Sustainable Development Index. Ecological Indicators 2002;2:251-256.

Barrett CB, Grizzle RE. A Holistic Approach to Sustainability Based on Pluralistic Stewardship. Environmental Ethics 1999;21:23-42.

Bekker MPM, Putters K, van der Grinten TED. Exploring the relation between evidence and decision-making: a political-administrative approach to health impact assessment. Environmental Impact Assessment Review 2004;24:139-149.

Bell S, Morse S. Sustainability Indicators: Measuring the immeasurable? London, Sterling, VA: Earthscan, 2008.

Benson J. What's the alternative? Impact assessment tools and sustainable planning. Impact Assessment and Project Appraisal 2003;21:261-266.

Bockstaller C, Girardin P. How to validate environmental indicators. Agricultural Systems 2003;76:639-653.

Bond AJ. Let's not be rational about this: response to Benson. Impact Assessment and Project Appraisal 2003;21:266-268.

Bruhn-Tysk S, Eklund M. Environmental impact assessment-a tool for sustainable development?: A case study of biofuelled energy plants in Sweden. Environmental Impact Assessment Review 2002;22:129-144.

Cabeza Gutés M. The concept of weak sustainability. Ecological Economics 1996;17:147-156.

Caldwell L. Analysis-Assessment-Decision: The Anatomy of Rational Policymaking. Impact Assessment Bulletin 1991;9:81-92.

Carson, R. *Silent Spring* (London: Hamish Hamilton, 1963.

Cashmore M. The Role of Science in Environmental Impact Assessment: Process and Procedure versus Purpose in the Development of Theory. Environmental Impact Assessment Review 2004;24:403-426.

Cass B. How appropriate are Local Authority sustainability indicators? UEA, 2008. Available at http://www.uea.ac.uk/env/all/teaching/eiaams/pdf_dissertations/2008/Cass_Bernadette.pdf.

Central Intelligence Agency. Life expectancy at birth. CIA, 2009. Available at https://www.cia.gov/library/publications/the-world-factbook/fields/2102.html.

ChevronTexaco Australia Pty Ltd. Environmental, Social and Economic Review of the Gorgon gas Development on Barrow Island. Perth, Western Australia: ChevronTexaco Australia Pty Ltd, 2003.

Cloquell-Ballester V-A, Cloquell-Ballester V-A, Monterde-Díaz R, Santamarina-Siurana M-C. Indicators validation for the improvement of environmental and social impact quantitative assessment. Environmental Impact Assessment Review 2006;26:79-105.

CoRWM. Managing our Radioactive Waste Safely, CoRWM's recommendations to Government, 2006. Available at

http://www.corwm.org.uk/Pages/Current%20Publications/700%20-%20CoRWM%20July%202006%20Recommendations%20to%20Government.pdf.

Council of the European Union. Renewed EU Sustainable Development Strategy, 2006. Available at http://ec.europa.eu/sustainable/docs/renewed_eu_sds_en.pdf.

Dalal-Clayton B, Sadler B. Strategic Environmental Assessment. A Sourcebook and Reference Guide to International Experience. London: Earthscan, 2005.

Department for Environment Food and Rural Affairs. Biodiversity indicators in your pocket 2007. Department for Environment Food and Rural Affairs, 2007. Available at http://www.jncc.gov.uk/pdf/2010-BIYP2007.pdf.

Department for Environment Food and Rural Affairs. Rural Definition and Local Authority Classification, 2009. Available at http://www.defra.gov.uk/rural/ruralstats/rural-definition.htm.

Department for Environment Food and Rural Affairs, Department of the Environment, National Assembly for Wales, Scottish Executive. Managing Radioactive Waste Safely. Proposals for developing a policy for managing solid radioactive waste in the UK. Department for Environment Food and Rural Affairs, 2001. Available at http://www.ni-environment.gov.uk/ra_waste.pdf.

Donnelly A, Jennings E, Mooney P, Finnan J, Lynn D, Jones M, O'Mahony T, Thérivel R, Byrne G. Workshop approach to developing objectives, targets and indicators for use in SEA. Journal of Environmental Assessment Policy and Management 2006;8:135-156.

Donnelly A, Jones M, O'Mahony T, Byrne G. Selecting environmental indicators for use in strategic environmental assessment. Environmental Impact Assessment Review 2007;27:161-175.

Dryzek JS. Policy Analysis and Planning: From Science to Argument. In: Fischer F, Forester J, editors. The Argumentative Turn in Policy Analysis and Planning. Durham: Duke University Press, 1993. pp. 213-232.

Environmental Protection Authority. Towards Sustainability, Position Statement No. 6. Perth: Environmental Protection Authority, 2004.

Environmental Protection Authority. South West Yarragadee Water Supply Development, Water Corporation, Report and Recommendations of the Environmental Protection Authority, Bulletin 1245. Perth, Western Australia: Environmental Protection Authority, 2006.

European Parliament and the Council of the European Union. Directive 2001/42/EC of the European Parliament and of the Council of 27 June 2001 on the assessment of the effects of certain plans and programmes on the environment. Official Journal of the European Communities 2001;L197:30-37.

Feldmann L, Vanderhaegen M, Pirotte C. The EU's SEA Directive: status and links to integration and sustainable development. Environmental Impact Assessment Review 2001;21:203-222.

Flyvbjerg B. Rationality & Power: Democracy in Practice. Chicago: University of Chicago Press, 1998.

George C. Testing for Sustainable Development through Environmental Assessment. Environmental Impact Assessment Review 1999;19:175-200.

Gibson RB. Sustainability assessment: basic components of a practical approach. Impact Assessment and Project Appraisal 2006;24:170-182.

Gibson RB, Hassan S, Holtz S, Tansey J, Whitelaw G. Sustainability Assessment: Criteria, Processes and Applications. London: Earthscan, 2005.

Government of Western Australia. Hope for the Future: The Western Australian State Sustainability Strategy. Department of the Premier and Cabinet, 2003. Available at http://www.dec.wa.gov.au/component/option,com_docman/Itemid,/gid,2638/task,doc_download/.

Hacking T, Guthrie P. A framework for clarifying the meaning of Triple Bottom-Line, Integrated, and Sustainability Assessment. Environmental Impact Assessment Review 2008;28:73-89.

Haughton AJ, Bond AJ, Lovett AA, Dockerty T, Sünnenberg G, Clark SJ, Bohan DA, Sage RB, Mallott MD, Mallott VE, Cunningham MD, Riche AB, Shield IF, Finch JW, Turner MM, Karp A. A novel, integrated approach to assessing social, economic and environmental implications of changing rural land-use: a case study of perennial biomass crops. Journal of Applied Ecology 2009;46:315-322.

HM Government. Securing the future: delivering UK sustainable development strategy. Cm 6467. Norwich: The Stationery Office, 2005.

HM Government. Planning for a Sustainable Future. WHite Paper; Cm 7120. Norwich: HMSO, 2007.

Institute of Environmental Management & Assessment. SEA Forum Report. Institute of Environmental Management & Assessment, 2006. Available at http://www.iema.net/stream.php/download/readingroom/article/2006%20SEA%20Report.pdf.

Kemm J. Can Health Impact Assessment fulfil the expectations it raises? Public Health 2000;114:431-433.

Lawrence DP. Integrating Sustainability and Environmental Impact Assessment. Environmental Management 1997;21:23-42.

Lawrence DP. Planning theories and environmental impact assessment. Environmental Impact Assessment Review 2000;20:607-625.

Lee, N. Training requirements for environmental impact assessment, in Wathern, P (editor) Environmental Impact Assessment: Theory and Practice. London: Routledge, 1988. pp. 143-158.

Leknes E. The roles of EIA in the decision-making process. Environmental Impact Assessment Review 2001;21:309-334.

Meadows, DH, Meadows, DL Randers J and Behrens WW. *The Limits to growth. A report for the Club of Rome's project on the predicament for mankind*. New York: Universe Books, 1972.

McCool SF, Stankey GH. Indicators of Sustainability: Challenges and Opportunities at the Interface of Science and Policy. Environmental Management 2004;33:294-305.

Mellor M. Women, nature and the social construction of 'economic man'. Ecological Economics 1997;20:129-140.

Mindell J, Hansell A, Morrison D, Douglas M, Joffe M. What do we need for robust, quantitative health impact assessment? Journal of Public Health Medicine 2001;23:173-178.

Morrison-Saunders A, Bailey J. Transparency in environmental impact assessment decision-making: recent developments in Western Australia. Impact Assessment and Project Appraisal 2000;18:260-270.

Morrison-Saunders A, Fischer TB. What is wrong with EIA and SEA anyway? A sceptic's perspective on sustainability assessment. Journal of Environmental Assessment Policy and Management 2006;8:19-39.

Nooteboom SG. Impact assessment procedures for sustainable development: a complexity theory perspective. Environmental Impact Assessment Review 2007;27:645-665.

Nykvist B, Nilsson M. Are impact assessment procedures actually promoting sustainable development? Institutional perspectives on barriers and opportunities found in the Swedish committee system. Environmental Impact Assessment Review 2009;29:15-24.

Oceanica Pty Ltd, M P Rogers & Associates Pty Ltd, ACIL Tasman, Pember Wilson and EftosQ & Communications Group, Murdoch University, GHD Pty Ltd. Fremantle Ports/Department for Planning and Infrastructure Fremantle Ports Outer Harbour Project Strategic Assessment Report. Perth, Western Australia: GHD Pty Ltd, 2006.

Office of the Deputy Prime Minister. Sustainability Appraisal of Regional Spatial Strategies and Local Development Documents. ODPM, 2005. Available at http://www.communities.gov.uk/documents/planningandbuilding/pdf/142520.pdf.

O'Regan B, Morrissey J, Foley W, Moles R. The relationship between settlement population size and sustainable development measured by two sustainability metrics. Environmental Impact Assessment Review 2009;29:169-178.

O'Riordan T. The sustainability debate. In: O'Riordan T, editor. Environmental Science for Environmental Management. Harlow: Prentice Hall, 2000. pp. 29-62.

Owens S, Rayner T, Bina O. New agendas for appraisal: reflections on theory, practice, and research. Environment and Planning A 2004;36:1943-1959.

Palerm JR. Public Participation in Environmental Decision Making: Examining the Aarhus Convention. Journal of Environmental Assessment Policy and Management 1999;1:229-244.

Partidário MR. Strategic Environmental Assessment - Principles and Potential. In: Petts J, editor. Handbook of Environmental Impact Assessment - Vol.1 Environmental Impact Assessment: Process, Methods and Potential. Oxford: Blackwell Science, 1999. pp. 60-73.

Pope J, Annandale D, Morrison-Saunders A. Conceptualising sustainability assessment. Environmental Impact Assessment Review 2004;24:595-616.

Pope J, Grace W. Sustainability Assessment in Context: Issues of Process, Policy and Governance. Journal of Environmental Assessment Policy and Management 2006;8:373-398.

Pope J, Morrison-Saunders A, Annandale D. Applying sustainability assessment models. Impact Assessment and Project Appraisal 2005;23:293-302.

Rein M, Schön D. Reframing Policy Discourse. In: Fischer F, Forester J, editors. The Argumentative Turn in Policy Analysis and Planning. Durham: Duke University Press, 1993. pp. 145-166.

Richardson T. Environmental assessment and planning theory: four short stories about power, multiple rationality, and ethics. Environmental Impact Assessment Review 2005;25:341-365.

Sadler B. Environmental Assessment in a Changing World: Evaluating Practice to Improve Performance. Ottawa: Minister of Supply and Services Canada, 1996.

Sheate WR, Dagg S, Richardson J, Aschemann R, Palerm J, Steen U. Integrating the Environment into Strategic Decision-Making: Conceptualizing Policy SEA. European Environment 2003;13:1-18.

Shepherd A, Ortolano L. Strategic environmental assessment for sustainable urban development. Environmental Impact Assessment Review 1996;16:321-335.

Simpson G. Writing Systems: A Linguistic Introduction. Stanford: Stanford University Press, 1990.

Sinclair AJ, Sims L, Spaling H. Community-based approaches to strategic environmental assessment: Lessons from Costa Rica. Environmental Impact Assessment Review 2009;29:147-156.

Steinemann A. Rethinking human health impact assessment. Environmental Impact Assessment Review 2000;20:627-645.

Strategen. South West Yarragadee Water Supply Development: Sustainability Evaluation/Environmental Review & Management Programme Volume 1: Introduction, sustainability overview, methodology and conclusions. Leederville, Western Australia: Strategen, 2006.

Svarstad H, Petersen LK, Rothman D, Siepel H, Wätzold F. Discursive biases of the environmental research framework DPSIR. Land Use Policy 2008;25:116-125.

Thérivel R, Christian G, Craig C, Grinham R, Mackins D, Smith J, Sneller T, Turner R, Walker D, Yamane M. Sustainability-focused impact assessment: English experiences. Impact Assessment and Project Appraisal 2009;27:155-168.

United Kingdom Parliament. Planning and Compulsory Purchase Act. HMSO, 2004. Available at http://www.opsi.gov.uk/acts/acts2004/20040005.htm.

United Nations Economic Commission for Europe. Convention on access to information, public participation in decision-making and access to justice in environmental matters. Geneva: United Nations Economic Commission for Europe, Committee on Environmental Policy, 1998.

Valentin A, Spangenberg JH. A guide to community sustainability indicators. Environmental Impact Assessment Review 2000;20:381-392.

Water Corporation. Water Forever Sustainability Assessment. Leederville, Western Australia: Water Corporation, 2008.

World Commission on Environment and Development. Our Common Future. Oxford: Oxford University Press, 1987.

Table 1 Timescales specified in a sample of English Sustainability Appraisal Reports

Local Authority	SA report published	Core Strategy duration	Number of indicators in SA framework	Percentage indicators assessed using explicit timescale	'Short-term' definition	'Medium-term' definition	'Long-term' definition
Ashford	2006	2021	233	12%	Not specified	Not specified	Not specified
Blaby	2006	2016	101	4%	Not specified	Not specified	Not specified
Blackburn	2007	2024	112	0%	Not specified	Not specified	Not specified
Charnwood	2006	2021	70	0%	Not specified	Not specified	Not specified
Chelmsford	2006	2021	60	8.3%	Within timescale of plan	Within timescale of plan	beyond the timescale of the plan
Doncaster	2005	2021	150	0%	Not specified	Not specified	Not specified
Great Yarmouth	2006	2021	106	0%	1-3	5	10+
Guildford	2006	2026	137	0%	Not specified	Not specified	Not specified
Scarborough	2006	2021	133	12%	Not specified	Not specified	Not specified