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Experiences of applying a sustainability assessment model

Jo-Anne E. Cavanagh [a], Bob R. Frame [a,*], Michael Fraser [b], Jeremy Gabe [a]

[a,*] Landcare Research, Private Bag 40, Lincoln 7640, New Zealand.
[b] Victoria University, PO Box 600 Wellington 6140, New Zealand

ABSTRACT

A key challenge in moving towards a more sustainable future is adequately embedding sustainability principles into organisational decision-making. The Sustainability Assessment Model (SAM) has been put forward as one option to highlight and assess sustainability principles within various project decisions. Developed originally in the UK, SAM is a Full Cost Accounting tool designed to produce a graphical display for discussion on the monetised costs and benefits of externalities arising from the social, environmental, resource and economic implications of a project – where a “project” consists of any economic activity for which a scope can be defined and acceptable boundaries laid (e.g. development of an oil and gas field or waste disposal). The primary intention of SAM is in its process: to engage a broader range of stakeholders in order to generate dialogue around indirect impacts of a given project, in turn facilitating broader consideration of options and allowing greater sustainability for that project to be achieved.

This paper discusses the experiences gained through the application of SAM in urban case studies in New Zealand, including assessment of different waste management options, housing and transport projects. In particular, a number of challenges were faced in undertaking the assessments, these include; establishing appropriate boundaries for assessment, data limitations, differing levels of engagement achieved with different stakeholders, and the relationship of SAM to more conventional assessments (including cost-benefit analysis and triple bottom line reporting). Some of these challenges are likely to be applicable to any approach that aims to embed sustainability into organisational decision-making.

Key words: Urban Sustainability, Assessment Tool, full-cost accounting

INTRODUCTION

Increasing attention is being given to tools to assist in decision-making to support sustainable development initiatives. Many of the available tools traditionally have a strong environmental focus and tend to be developed at a more strategic level for policymakers (Dalal-Clayton & Sadler 2004). Fewer tools are available that assist organisations to make sustainable decisions at a project level (Baxter et al 2004; Dalal-Clayton & Sadler 2004). Further, growing recognition of the complex socio-political context that surrounds sustainable development has led to calls for more participative and ideological open approaches to sustainability assessment (e.g. Bebbington et al. 2006).

The Sustainability Assessment Model (SAM) has been put forward as one option to provide a more participative and dialogic approach to incorporate sustainability into organisational project decision-making. SAM was developed in the UK by British Petroleum (BP) and Genesis Limited (UK division) with the University of Aberdeen in Scotland (Baxter *et al*. 2002; Bebbington 2001; Bebbington & McGregor 2005). It follows a Full Cost Accounting (FCA) approach to assess a discrete project (where a "project" consists of any economic activity for which a scope can be defined and acceptable boundaries laid) and considers the full life-cycle, including identification and monetisation of the project's operational impacts. FCA generates information about externalities that are not currently reflected in the open market and which are not likely to be reflected in the market in the near future. Thus, the costs generated by FCA are not 'real' in the sense that they will be borne by the project's owners. Rather, the costs are notional and provide a glimpse of the total costs and benefits to society of an activity over the defined boundary. The primary benefit of FCA is the information on externalities that it generates, which was previously unavailable to decision makers.

SAM typically considers the flow of four capitals within a project: economic capital, resource capital, environmental capital and social capital. These capitals are valued over the life-cycle of that project and ultimately shown as annualized amounts. **Economic capital** is the economic benefit that accrues from the project and notionally represents the money going into society, or the project's contribution to GDP. **Resource capital** includes the cost of using finite supplies of raw materials and land for the given project. **Environmental capital** includes the cost of environmental damage such as emissions into the atmosphere and impacts of wastes generated by the project. It may also include benefits such as improved biodiversity or improvements in environmental quality. **Social capital** captures the potential social benefits arising from the project such as improving quality of life. Potential social costs associated with the project, such as road accidents and workplace injuries are also captured.

Based on work undertaken to date, economic and social impacts are typically positive values (net benefit to society) while resource and environmental impacts are typically negative values (net cost to society). This largely reflects the notion that money going into society contributes to its well-being and that generally positive social outcomes, which outweigh the negative outcomes, arise from a given project. In contrast, resource and environmental impacts are largely driven by consumption of resources, and negative impacts on the environment (typically arising from consumption of those resources). When presented visually, these categories provide a ‘sustainability profile’ for a given project that can be used to compare and discuss the relative sustainability of different options. A key aspect of the SAM process is engagement of stakeholders during the development of the sustainability profile. This allows the stakeholders to share their knowledge of the project and its outcomes, including aspects of the project that are considered important from a sustainability perspective and allows dialogue around the indirect impacts of the project. This in turn facilitates a broader consideration of options for the project to be undertaken and potentially allows greater sustainability for that project to be achieved. However, it should be noted that it is not known what a truly sustainable project would look like, as such the ‘sustainability profile’ developed through the SAM process more accurately provides a picture of the relative unsustainability, based on our current knowledge, of the given project.

SAM has been presented to various New Zealand businesses and public sector organisations who regarded it as able to assist in developing more sustainable ways of operating (Bebbington and Frame 2003). This paper describes a number of New Zealand case studies that have either been completed or are currently in progress to illustrate the application of SAM, and the experiences gained during that application.

CASE STUDIES

Organic recycling

Preliminary SAM assessments regarding options for the disposal of organic waste was undertaken for the Christchurch City Council. The first alternative was the processing of organic waste through conventional means (a combination of disposal to landfill, disposal via in-sink disposal units, green-waste collection and composting). This conventional alternative was compared to the processing of organic waste in community gardens. Details of the assessments are provided in Cavanagh et al. (2006). The profiles developed for the two scenarios are shown in Figure 1.

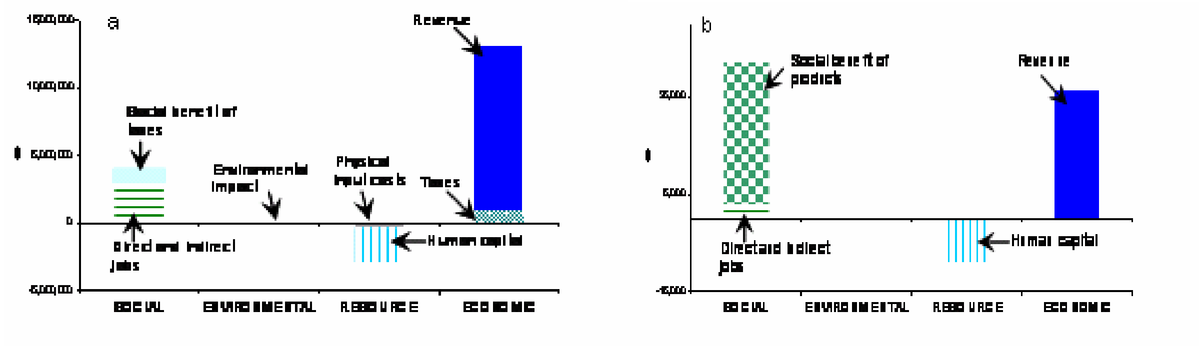


Figure 1. SAM profile for a) disposal of organic waste through conventional means and b) processing through community gardens

The SAM profile developed for organic waste processed via conventional means (Figure 1a) is dominated by the project revenues (economic bar), largely derived from the operational costs associated with the landfill and composting operations. Surprisingly, the expected main environmental impact, air emissions associated with collection of solid and green waste, is minimal. The social benefit of organic waste management is primarily driven by indirect jobs created as a result of the organic waste industry (e.g. machinery maintenance, support services), with limited social benefit generated by the product (e.g. taxes arising from the sale of compost).

The conventional profile contrasts markedly to that generated by processing organic waste through community gardens (Figure 1b). This community garden profile is dominated by the social benefit and economic revenue, leading to greater sustainability as conceptualised within this project. In this case, social benefit also arises from the therapeutic value associated with working in a garden. It is worth noting that scale on the community garden profiles is significantly less than that of the conventional system; this difference needs to be factored into the discussion surrounding the feasibility of the options being considered. In this case, it is unlikely that the community gardens could ever replace the conventional system, but it does provide an alternative option that yields greater sustainability as conceptualised within this project.

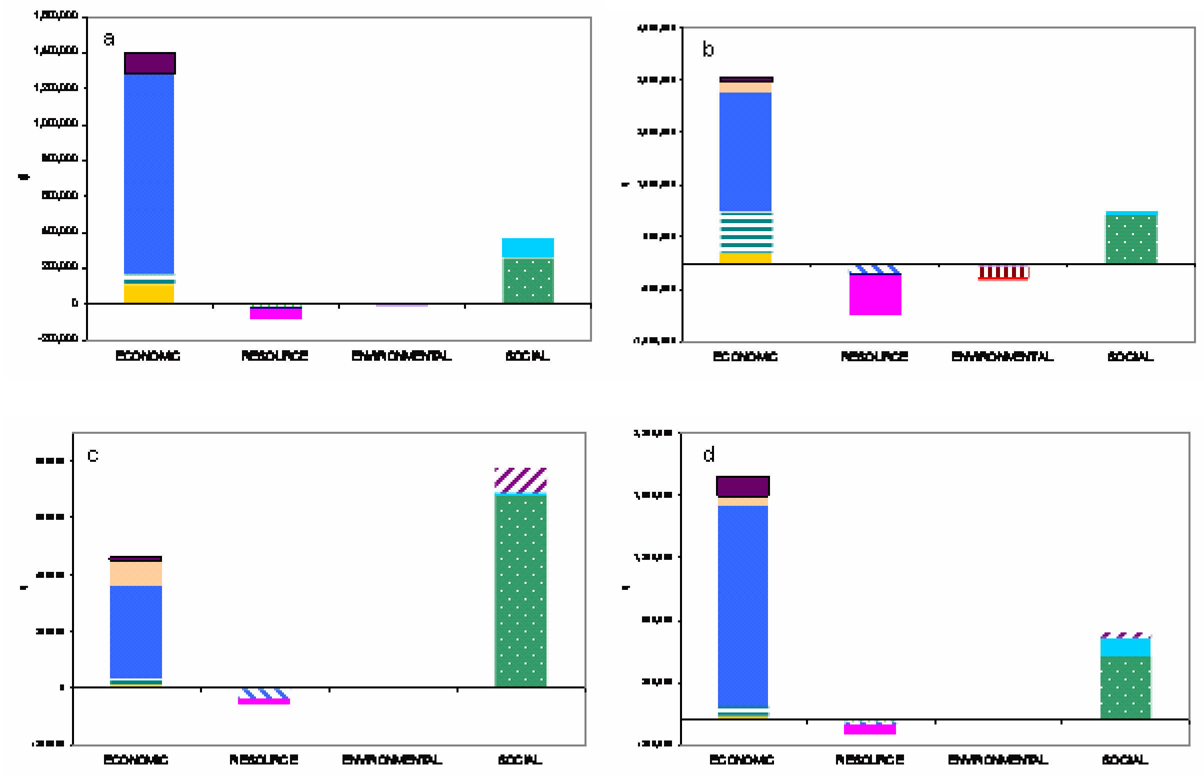
Waste Management

A comparison of the relative impacts resulting from different waste diversion programmes (community-based resource recovery operations, and commercial-scale resource recovery operations) with the alternative of disposal to landfill was undertaken for Environment Waikato (Cavanagh 2005). To undertake the assessment, interviews were held with representatives from organisations considered to represent the spectrum of waste disposal and diversion activities typically undertaken in New Zealand. In addition to conventional monetisation of impacts, surrogate valuations were used on occasion in this project to allow the inclusion of items that were considered to contribute to the overall sustainability of the project but were not readily monetised. Specifically, the social benefit of education in waste minimisation and resource recovery was valued by assuming that additional waste was diverted from landfill through either increased recycling or avoided waste generation. Thus, educational benefit was valued by cost savings associated with sending waste to landfill accrued at a rate of 100 tonnes less per year, valued at $100 per tonne, a typical cost of disposal to landfill.

Due to the need to maintain data confidentiality, and also to provide an appropriate comparison between the different operations, scenarios were based on generic types of waste disposal or diversion operations for a defined amount of material, were developed:

- Two **disposal** scenarios: activities associated with the disposal of residual waste to landfill, including the operation of a refuse transfer station, 1) in the absence (base case) and 2) presence of waste diversion activities.
- Three **diversion** scenarios: activities associated with 1) small-scale community-based operations; 2) commercial-scale community based operations; and 3) commercial operations.

The profiles developed for each scenario are shown in Figure 2.



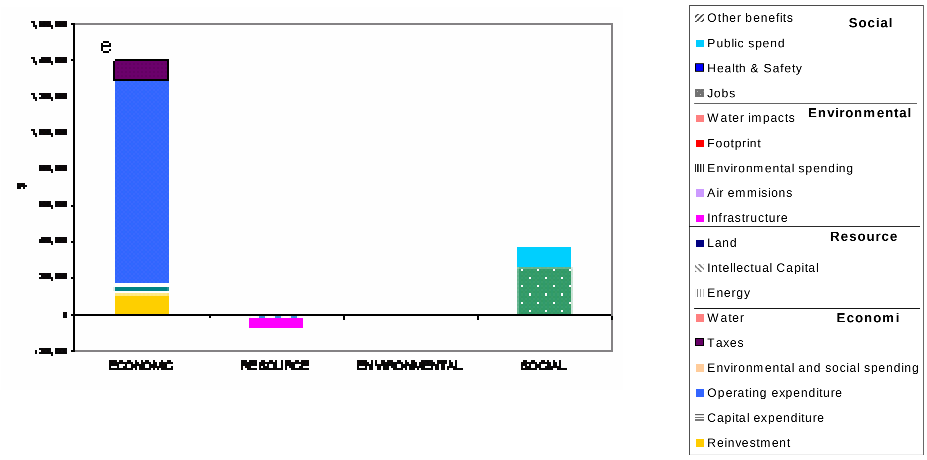


Figure 2: Sustainability profile of a) disposal to landfill with no waste diversion b) disposal to landfill with waste diversion c) small-scale community based resource recovery operation, d) large-scale community based resource recovery operation e) commercial resource recovery operation.

Economic activity (mainly operational costs) and social benefit (mainly benefits of employment) dominate the profiles of all scenarios. Resource and environmental costs were greatest for landfilling operations (including refuse transfer operations), and were typically small (relative to economic activity) for other scenarios. Resource costs were primarily associated with fuel used and infrastructure required. Environmental costs arose mainly from the impact of air emissions and, for landfilling operations, expenditure to mitigate environmental effects. Extension of the life of a landfill as a result of waste diversion activities (Diversion scenario 2) reduced the average annual costs (resources and environment) and benefits (economic activity, social) of waste disposal due to a reduction in the amount of waste being received. Community-based waste diversion operations undertake a greater range of activities (e.g., waste education and awareness programmes, waste exchange) than commercial waste diversion operations and provide a greater focus on employing long-term unemployed or intellectually challenged people.

The social benefit generated by waste diversion activities, in particular community-based operations, are the key difference between waste disposal and diversion scenarios; small-scale community based operations deliver the greatest social benefit per dollar spent on activities. Resource and environmental costs were greatest for landfilling operations (including refuse transfer operations), and were typically small (relative to economic activity) for other scenarios. The impacts associated with collection of waste and recyclables were considered separately to provide a focus on the actual waste and resource recovery activities. These activities can comprise significant additional costs and benefits to disposal or diversion activities (Cavanagh 2005).

It was not possible to include the wider benefits and costs associated with resource recovery (e.g. offsetting the use of virgin materials, offsetting the production of new products, energy used for remanufacturing of recovered materials) within the scope of the project. The apparently negligible resource and environmental benefit of diversion activities probably arises from the exclusion of these activities from those scenarios.

Urban Transport

Assessment of alternative transport options is currently being undertaken and preliminary SAM assessments comparing a ‘business-as-usual’ scenario with an alternative preferred transportation option have been developed. The preferred transportation option involves the introduction of bus priority lanes with a view to providing a better public transport service which would induce people to switch to from private cars to public transport, thereby reducing overall congestion and travel time. Operational data metrics include the number of vehicles, distance travelled, and time taken to travel that distance. Many of the parameters considered in this SAM assessment are included in the LTNZ Project Evaluation Manual (LTNZ 2005) and these valuations were used in the SAM project. The two profiles are shown in Figure 3. The most obvious impact of the preferred transport option is the potential time savings benefit while there is minimal impact on the environmental impact. However, there is still a significant environmental impact arising from the preferred transportation options suggesting that more radical options need to be considered to reduce the environmental impacts associated with transportation.

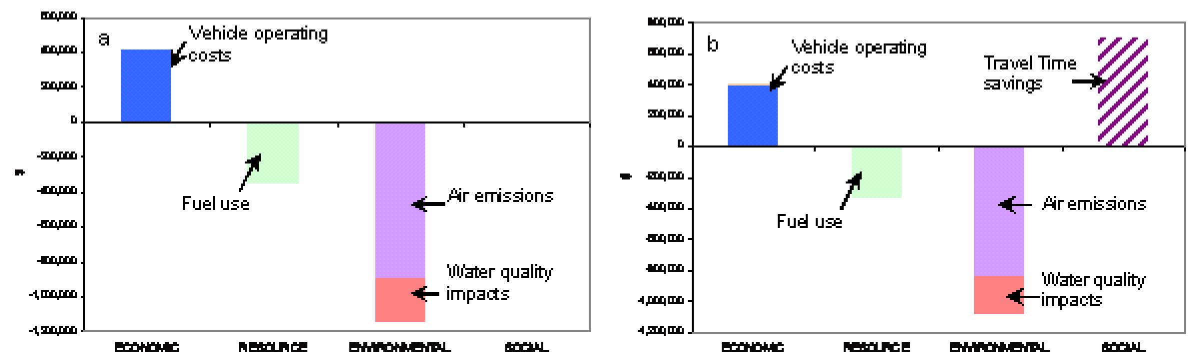


Figure 3: Sustainability profile of a) business-as-usual and b) preferred transportation option.

Housing Development

Two projects on the sustainability assessment of housing are currently underway with different stakeholders. One project is a proposed housing development that aims to achieve a high level of sustainability, while the other project is the redevelopment of a small number of houses used as social housing. An overarching sustainability framework has previously been written for the proposed housing development to provide some guiding principles and indicators to achieve the high level of sustainability. The framework identifies four pillars of sustainability: economic, environmental, social and cultural. In keeping with these groupings, the SAM assessment has been modified to fit these categories. To date, no assessments have been completed although the criteria to be included in the assessment include, economic – local employment, projects costs, household expenditure; environmental – air emissions from transport and energy use, energy use, biodiversity, water use and quality; social – social inclusion, quality of life; cultural – community participation, custodianship.

The second project on the assessment of the renewal of social housing uses the conventional SAM categories. Criteria for inclusion in the assessment include, economic –projects costs, market rent; resource – construction materials, energy use; environmental – air emissions from transport and energy use, energy use, water use and quality; social – health, crime, rental subsidy.

While the environmental and resource impacts are relatively easily to identify, there are fewer obvious quantifiable and monetisable outcomes of achieving a socially and culturally sustainable development. Factors typically considered important in achieving social sustainability in relation to housing include social inclusion, connectivity, community participation, accessibility and sense of place (Friesen 2006). Health is often not viewed as an indicator for social sustainability, yet it is increasingly recognised that meeting that 'desired' social sustainability objectives such as connectivity, inclusion etc. can result in improved physical and mental health (Ewing 2006). Further, the design of the Built Environment can also have an influence on physical activity of residents, and hence their physical and mental health (TRB 2005). In addition, there are relationships to reduced crime if factors such as community participation, inclusion etc are met. As such, indicators, such as GP visits and crime rates provide a means to quantify and monetise potential social (and cultural) benefits of a given development. Suicide has also been used as an indicator of mental health and emotional well-being (Quality of Life 2003), although stakeholders may have a negative perception about the use of this indicator in assessments.

SAM assessments of housing developments have a wide potential application as there is currently considerable interest in sustainable urban development, and the relationship between health and housing. Several agencies in New Zealand associated with housing have developed or are developing building rating systems (e.g. BRANZ Greenhome Scheme[1], TUSC – site tool[2], Home Energy Rating

[1] http://www.branz.co.nz/main.php?page=Greenhome%20Scheme

Scheme[3]) that include elements of sustainability. However, these schemes are primarily focussed on environmental impacts while SAM explicitly includes economic and social elements and therefore potentially offers a broader assessment of sustainability.

APPLICATION OF SAM

In undertaking SAM assessments for the case studies described above, and additional projects, a number of challenges were faced. These challenges include differing levels of engagement achieved with different stakeholders, establishing appropriate boundaries for assessment, data limitations, and the relationship of SAM to other assessments (including cost-benefit analysis, and triple bottom line reporting).

Levels of participation by stakeholders

Varying levels of participation were achieved with different stakeholders. Some stakeholders were "only interested [in the assessment] if it gives us the answer we want". This runs counter to the intention of SAM, which seeks to generate conversation around expanding potential options for achieving sustainability in order to achieve greater progress. This full potential of the SAM process has not yet been realised – even with stakeholders who were more willing and eager to engage in the process. In these cases, generally only a limited number of potential stakeholders (primarily local council staff or housing development staff) were involved in the initial SAM assessment, which has the potential to unduly influence the resulting discussion. Furthermore, the researcher/consultant is still viewed as providing the "correct" answer when providing the initial SAM assessments. The goal of the process is to use these assessments to stimulate further discussion with a wider group of stakeholders on potential options to improve sustainability.

Further, there were markedly different views on the usefulness of SAM by the two agencies involved in assessment of the housing projects. In one case SAM is viewed favourably as a means to 'extend' the existing financial model upon which decisions are currently based, to include social and environmental aspects. In the other case, the attractiveness of the SAM assessments is the perceived potential application for benchmarking their project – largely because of the presentation format. This is not the intention of SAM, and this process would arguably fail to achieve the appropriate level of discussion around how best to achieve greater sustainability for a given project. At this stage of SAM development, this aspect has not been more closely examined.

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[2] http://www.tusc.org.nz/index.cfm/home

[3] http://www.eeca.govt.nz/residential/home-energy-rating-scheme/indexnew.html

Boundaries for assessment

Establishing appropriate boundaries for assessment is an integral part of undertaking a SAM assessment. This includes both establishing the relevant time-frame for analysis – the life-cycle of the project, and specifying the impacts to be included in the assessment. In the case of the waste assessment project the life-time was assumed to be 35 years – the length of time often covered under resource consent. For the housing development, a life time of 90 years (with major refurbishment at 45 years) is currently being used based on the life-time considered by Housing New Zealand Asset managers. In both cases, the actual life-time of the given project may extend past these initial estimates. The life-time of the project impacts most significantly on the relative impacts associated with the initial 'start-up' (e.g. construction) of the project as these are amortised (currently assuming 0% discount, Bebbington et al 2006) over the life-time of the project. Thus, the longer the life-time of the project, the less significant the 'start-up' impacts may be relative to those arising from operational activities.

The impacts included in the assessment may be constrained for logistic reasons, by what is considered appropriate for comparison between options or data limitations. For example, in the case of the waste management project, a limited amount of resources were available to undertake the assessment. Thus, it was not possible to include the wider impacts of resource recovery (such as reduced consumption of virgin materials, reduced manufacture of products) in the assessment. Further, in order to provide a focus on the key activities (disposal to landfill vs resource recovery), the collection of waste and recovered materials was considered separately. In an overall assessment of the relative sustainability of a waste management system all of the above items should be included. Organisations often hold detailed information on operational aspects for a given project and are the key source for this information. However, some data pertinent to quantifying the impacts e.g. the amounts of raw materials used, are not necessarily available and need to be sought from the available literature. Confidentiality requirements may restrict the way in which provided data can be used; this occurred in the waste assessment project and resulted in the formulation of generic scenarios for the SAM assessments. Further, data from different sources (e.g. financial accounts from different organisations) may be provided in different ways (e.g. itemised differently) making consistent treatment of the data difficult.

Another difficulty arising from developing a boundary on a SAM project is how to constrain and account for larger-scale effects that affect the system. For example, economic data is most available at large scales, typically national, but occasionally regional. Research attempting to scale down national or regional economic data to be applicable to small scales, such as a city-scale (which is still larger than the scope of SAM assessments), have found the need to estimate based on estimated ratios;

therefore the numerous sources of error in estimating national economic indicators are only compounded at smaller scales (Costanza et al. 2004).

Finally, an imaginary boundary must exist to identify the limit of impacts prior to the project. For example, in the housing case study, the overall sustainability impact of the development would arguably need to take account of the relevant impacts of residents prior to moving within the physical boundaries. Data on these former impacts would likely be unavailable, thus a boundary would be necessary to constrain these impacts prior to the project into a base scenario from which the considered alternatives diverge. This boundary becomes difficult to draw when an alternative being considered is to not take any action; in this example, this boundary would be difficult to apply if a SAM alternative was not to construct the proposed housing development.

Data limitations

Monetisation of impacts remains the most contentious issue in the SAM process. Where possible, the SAM assessment uses credible literature sources to provide the valuations. For example Booz, Allen, Hamilton (2005) provides damage costs estimates for key air pollutants, Land Transport New Zealand (2005) provide valuations relevant to transportation including accidents costs, XX provides data on the costs of crime. However, in some cases data is not available, and surrogate measures need to be developed – this is where the participation of the stakeholders is critical, both in understanding where subjectivity exists in the assessment, and providing input on the appropriate valuation. An important step in this process is establishing what the influence of significantly different valuations for a given measure may be on the SAM profile (sensitivity testing). In some cases changing the valuations may make a negligible difference. For example, for the organic waste assessment (Figure 1a) and the waste assessments (Figure 2) increasing the damage cost estimates of air emissions by several orders of magnitude would make minimal difference to the SAM profiles. As such, the sensitivity testing assists in establishing the most significant variables. If a high level of uncertainty exists around a significant variable then further information may be sought, or that level of uncertainty, and its impact on the profile is accepted.

The relationship to alternative approaches

Differences between other assessment and decision-making tools such as triple bottom line (TBL) reporting and cost-benefit analysis (CBA) can lead to different expectations of what is represented in a SAM assessment. For example, in a TBL analysis of the Australian economy, employment is used as a social indicator (Foran et al. 2005). In contrast, employment (direct and indirect) is most often considered an economic benefit in CBA and other economic analyses. In SAM, direct employment has conventionally been considered as an economic benefit, while indirect employment has been considered a social benefit (Bebbington & McGregor 2005; Bebbington et al. 2006). Further differences lie in the allocation of the costs of the project; in SAM the costs of the project are considered as part of the economic benefit – as this represents money going into society. This contrasts with CBA which more often differentiates between the 'costs' of a given project (to an organisation) from the benefits of the project.

The use of monetisation in SAM, including the visual presentation of costs and benefits, gives further rise to the perception that SAM is a form of CBA. Hence, many of the criticisms levelled at SAM are the same as those levelled at CBA in relation to monetisation of impacts. However, SAM comes from the perspective that if economic rationalism dominates management decisions, then providing an alternative information set built around monetization provides a means to ensure consideration of sustainability issues (Bebbington et al. 2006). Further, SAM seeks to make explicit the subjectivity surrounding monetization; Bebbington et al. (2006) elaborate further on the differences between SAM and CBA.

CONCLUSIONS

The Sustainability Assessment Model has been applied to a number of case studies in New Zealand. The initial assessments have generally not been used to their full potential in stimulating further conversation around potential options to further sustainability for a given project. However, the process of developing the assessments has provided material for future improvements. In particular, defining appropriate boundaries, obtaining relevant data for monetisation and distinguishing the purpose of SAM as a multi-criteria-based decision making tool are key areas for further exploration. Defining the appropriate boundaries can prove challenging as impacts associated with a given project may extend beyond the boundaries for which data is readily available.

SAM includes monetisation of impacts in the assessment from the perspective that it provides a means to ensure sustainability issues are considered, if it assumed that economic rationalism dominates management decisions. SAM aims to make the subjectivity and assumptions associated with monetisation explicit. However, often when an assessment is presented there is a tendency to 'forget' these subjective elements and assumptions and focus on the absolute figures. Participation of the stakeholders is critical in order to create awareness of the subjectivity inherent in the monetisation process. Further, it is critical that stakeholders recognise the value of the monetisation process is in establishing the potential range of the magnitude of a potential impact in order to identify which impacts may be significant and therefore could be changed to improve the sustainability of the project.

Gaining an appropriate level of participation by stakeholders is likely to remain a challenging aspect of the SAM process as this requires a shift from a traditional researcher/contractor –client relationship to a more participatory process. Further, there is a need to clarify the process and purpose of SAM to participating stakeholders in order to achieve active stakeholder participation in developing alternative options to what may have originally been proposed. A key aspect in achieving this participation is recognition that the technical and data-intensive aspect of SAM is secondary to its role as presenting a debate into sensitivity of not only what the stakeholder believes to be important, but also the importance of societal externalities that may not have been considered.

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6 TABLES, FIGURES AND EQUATIONS

Figure 1: SUE – MOT consortium partners.

All figures should be numbered consecutively and captioned. The caption title should be written in 10pt Arial, Centered. 12pt spaces should separate the figure from the surrounding text.

7 FORMAT OF REFERENCES

- References should be quoted in the text by referring to the author's name (without initial) and year of publication and grouped together at the end of the paper. Publications by the same author(s) in the same year should be listed as 2006a, 2006b,etc.
- Examples: "According to Horner (2000)...". "such a finding has also been confirmed by others (Hardcastle and Price, 2000; Bebbington, 1995)".

- If reference is made in the text to a publication written by **more than two** authors, the name of the first author should be used followed by "et al." However this designation should be avoided in the reference list where the names of all **authors and co-authors** should be mentioned.
- The list of references should be arranged alphabetically on authors' names, and chronologically per author. If an author's name in the list is also mentioned with co-authors, the following order should be used: publications of the single author, arranged according to publication dates; publications of the same author with one co-author; publications of the author with more than one co-author. The reference list should be written in 10 pt. Arial, Centered. Different references should be separated by a 10pt space between them.
- Sample reference style for journal papers, chapters in edited tomes, conference papers and books are included below. References in the reference list should be separated by blank lines.

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