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TRIPLE BOTTOM LINE ASESSMENT AND SUSTAINABILITY: A METHOD OF PERFORMANCE EVALUATION

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Abstract

This paper describes recently completed research which compared the sustainability of master planned communities against traditional regulatory subdivisions in Australia. The application described in this paper appears to be the first post-development residential performance assessment using a broadly based set of indicators in Australia. The paper is a commentary on the methodology that was used in the performance evaluation. The method is known as the triple bottom line (TBL) approach. The term TBL originated in the corporate sector in connection with socially responsible investing. It is often used as a synonym for sustainability in both the public and private sectors. The TBL analysis uses an approach which embraces environmental, economic and community matters. In this paper we describe the TBL methodology and its origins, the suite of indicators constructed to conduct the performance appraisal and TBL's application to measurement at the scale of the neighbourhood. There were inevitable trialling difficulties experienced but we conclude that TBL is a promising technique for pursuing sustainability.

1. Introduction

Urban development, including housing, can have significant environmental impacts. Over-consumption of resources, drawing down aquifers; water, air and land pollution; and the elimination of habitat and consequent threat to biodiversity are ever-present realities. There is a growing desire to provide housing which offers a comfortable standard of living, reduced environmental impacts and which simultaneously achieves a degree of affordability. Australian governments at federal, state and local levels are beginning to incorporate principles of environmental sustainability into urban development, especially new housing, and both policy and regulations are beginning to reflect those principles. To what extent has that happened in practice?

There were three strands to our research. One brought definitive conclusions about the relative sustainability performance of two of the key Australian development forms - master planned communities (MPCs) and traditional regulatory subdivision (TRS). A second strand led to conclusions about land development policy and practice and identified some of the synergies that can be exploited and the conflicts that are inherent in pursuing sustainability. The third aim of our research directly linked into one of our research questions - *"What social, economic, and environmental indicators are needed to yield a useful picture of the degree of sustainability obtained for differing development types, especially in relation to affordable housing?"* This paper identifies and describes the TBL performance evaluation methodology. It was tested against the two residential development forms using neighbourhood case studies in Sydney, Brisbane and Adelaide. The research confirms the promise inherent in the TBL approach to performance assessment and the paper presents a series of conclusions about the TBL method including a comment on the nature of the indicators.

2. Indicators And Performance Measurement For Sustainability

Sustainability in this research project applies firstly, to the environmental arena, for example reducing the impacts of water and energy consumption or improving water quality in streams by attention to storm water management. Secondly it applies in an economic sense, for example by measuring housing affordability, a theme which spans the inter-relationship between the social and economic domains. It also applies in a more specific economic sense by examining the financial costs associated with the two development forms. Lastly, sustainability applies in a community sense so that shared responsibilities and feelings of neighbourliness may be connected with the nature and form of the development. Making progress towards sustainability means embracing indicators representing all three domains of human activity, linking them purposefully and monitoring until there is sufficient information to justify policy change.

Our pursuit of sustainability has brought many initiatives in the last decade designed to reduce human impact on the planet. Many have been narrowly based on an environmental agenda with standards and codes emerging for specific issues such as energy and water use. In some ways it has been an understandable focus. The environment is very basic to everything we do in working, living and recreating. Figure 1 shows one model of sustainability that mirrors this emphasis. Pursuing an environmental orientation is also more tangible and relatively simpler than taking a holistic approach. However there is one compelling reason for looking at sustainability more broadly. Making decisions exclusively on environmental grounds may impact adversely on some aspect of the economy or a group in society, for example. If we are serious about democratic principles we must explore the ramifications of an action in one sphere on other areas. Benefits and costs must be revealed and decisions made transparently. Transparent decision-making which includes discussion and explanation can gain people's support rather than lose it and making progress towards sustainability will require people's understanding and approval if behaviour change is to happen (Cobb 2000a; Parker 1995).

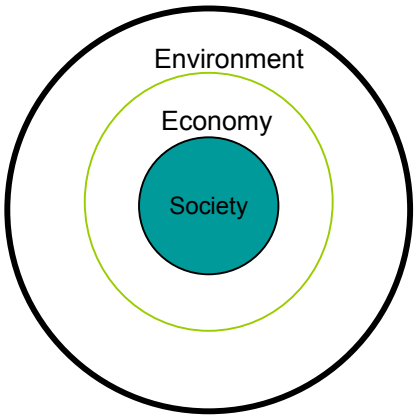

Figure 1: The Encapsulating Model of Sustainability

Sustainability is a call for integrated consideration of ecological, economic, and social matters (Meadows 1998; Gilbert 1996). Most indicators used by society simplify and monitor performance in a system (Spreng and Wils 1996). Suites of indicators have been developed by national governments and international organizations like the United Nations and the World Bank. Indicator programs can be designed to measure specific issues or to monitor quality of life or liveability. Indicator suites are also being used to inform decision-making about sustainability (United Nations 1992). Employing a representative suite of indicators offers the potential to gain an understanding of the ramifications of one action on other domains. Gaining that appreciation means that indicators will be needed of sufficient calibre to trace those relationships, both in depth and across domains.

Sustainability indicators have to be more than an extension of traditional indicators. They need to be more strategic (Nijkamp and Perrals 1994) and since sustainability is a holistic concept, forge links at least between sectors and preferably between the three domains of the sustainability triad. The TBL approach is holistic in that it contains indicators from all three domains so it is representative in that very broad sense. Although there is much agreement (Bean 2000; Parker 1995) on the value of building sophisticated indicators that can speak about patterns and connections, other observers recognize that they may not be able to play such a role (for example Cobb 2000a; Moxey, Whitby and Lowe 1998). Such researchers suggest that finding causal relationships is a troublesome task, that indicators are based on observed phenomena and that root causes can only be identified through inferential modelling. Also relevant is the idea of indivisibility, expressed in the Santiago Declaration of the Montreal Process (Lowe 1995). It is that "no single criterion or indicator is alone an indicator of sustainability. Rather, individual criteria and indicators should be considered in the context of other criteria and indicators." Hodge (1996) has stated much the same opinion.

3. Generating The Indicators

The TBL framework is not original although its application in Australia and much of the western world is very recent (Manaaki Whenua Landcare Research 2002; OECD 1998). The term TBL was coined by Elkington (1997) and originated in the corporate sector in connection with socially responsible investing. It is an attempt to articulate the three prongs of sustainability – environmental quality, economic prosperity, and social justice. Business's bottom line has historically been focussed on finance and profits and has paid limited attention to most environmental, social and economic externalities. However, the preoccupation with the financial bottom line is changing in some companies to include environmental and social concerns (Price, Waterhouse, Coopers 2002; Ecosteps 2002; Westpac 2004; Elkington 1997). Similarly, TBL principles are being applied to assessment of our urban spaces by extending beyond physical matters like energy and water conservation to embrace other environmental media, matters of community importance and the wider economic arena (Landcom 2004; Maroochy Shire Council 2002). The term TBL is thus used in this paper as a synonym for sustainability.

We compiled the set of TBL indicators following an international literature review of performance assessment tools and a review of policy as applied by government agencies. We also consulted the specialized literature on indicators and operating programs such as state of the environment (SOE) reports and community indicator programs (CIPs) as operated in the United States and increasingly in other OECD countries (Christchurch City Council 2002; City of Santa Monica 1999). CIPs are an extension of the SOE report and they are used in some OECD countries, especially the USA, to assess the performance of neighbourhoods, cities and even regions. They have a strong connection with the TBL model, measuring sustainability and especially some of its sub-sets like QOL and liveability.

There are many potential tools available for appraising the sustainability performance of the case study neighbourhoods. We considered economic assessment methods like cost-benefit analysis and contingent valuation; material and energy accounting (life cycle and materials flow analysis and ecological footprint assessment); building assessment tools in the categories of Building Decision Support and Whole Building Assessment; and finally, indicator sets encompassing economic, social and environmental phenomena assembled into purpose-designed suites paralleling the TBL approach. The review of assessment methods clearly pointed towards the use of TBL indicators for this evaluation.

The core research team and the externally-based project steering committee helped distil a long list of 80 indicators into the final suite. We elected to use several themes in the three-fold TBL classification to group the 45 indicators identified for the performance assessment. The environmental theme has 5 sub-themes. Some indicators are themselves made up of more than one measure. The distribution of the indicators is in Table 1 and the full set in Table 2. The distribution seems to give insufficient importance to "Community". This is not the case for most of the Economic measures have very strong social dimensions and some of the environmental indicators, too (eg potable water supply).

Table 1: Distribution of Indicators in the TBL Suite

TBL Theme	Number of Indicators	Nature of the Indicators
Environmental Environment	16	5 sub-themes of biodiversity (2 indicators), energy (6), other resources (4), waste and storm water disposal (2) and water conservation (2)
Economic Housing Affordability Transportation	 16 7	 All indicators are socio-economic and cover median income, expenditure on housing and house price issues Focussed on transport alternatives to car travel
Community Sense of Community Satisfaction with Neighbourhood	6	Two of the 6 indicators in this theme - *sense of community* and *satisfaction with neighbourhood* - are underpinned by eight and nine separate measures respectively.
Total	**45**	

A key line of enquiry for the research used a questionnaire to provide data for about one third of the TBL indicators. The instrument had 31 primary questions, many with sub-questions. Part 1 asked eight questions connected with neighbourhood satisfaction. Part 2 enquired about sense of community. Neighbourhood satisfaction and sense of community are two of the TBL indicators that rely heavily on resident input through the questionnaire to gauge the success of the two development forms. Part 3 of the questionnaire consisted of 14 questions seeking environmental data on energy, water and other resource matters.

4. Results

The conclusions we reached about the TBL model and its indicators are based on the literature and policy reviews as well as data collected through the research process. The main findings are summarized below.

1. General Findings

The TBL performance approach is conceptually robust and the over-riding conclusion is that the suite of social, economic and environmental indicators for the comparative assessment of suburban residential neighbourhoods has worked well. The TBL approach to assessment is valuable and if there is

commitment to monitoring and feedback into policy, it can be a highly effective device for improving governance.

A related conclusion is that although the TBL suite has been used for a cross-sectional comparative assessment, it has great potential for longitudinal monitoring. Further, although the focus of this project was at relatively small neighbourhood scale, the health of entire cities or even regions could be tracked, much like SOE reporting. Adjustments to the mix of indicators could be made like inserting economic measures for city-scale or regional monitoring in addition to the economic/social housing affordability indicators.

2. Flexibility and Core Indicators

The ability to remove and add indicators means that the TBL model has enough flexibility to be adapted to different circumstances and to produce a suite with a different emphasis. Over-much flexibility across space and especially across time may present problems, however, since longitudinal monitoring is usually necessary to justify policy modification. Longitudinal monitoring requires constancy of measures. However, an important goal of the indicator program movement is to provide core indicators within a primary suite. It can encourage comparability across different jurisdictions and scales like LGAs, regions and states in Australia. Flexibility is thus possible - and desirable - outside the core program. A core suite of indicators at this point is a long term goal since TBL reporting in Australia is minimal even though data exist from which to draw core measures.

3. Size of Suite and Mix of Indicators

The TBL suite used in this research project is similar in size to multi-dimensional collections of indicators used elsewhere. Average program size (in the USA) has been established at 45 indicators in a typology of CIPs examined by Blair (2002) though the range is large. If the sub-indicators present in the survey instrument are counted the TBL suite swells a little from 45 to 60. The larger the number of indicators the greater the cost of acquiring data and maintaining a monitoring program. Reinforcing the advantage of compactness is the fact that it can be given useful additional dimension by using the same indicators more than once in different themes. It optimises use of data but more importantly helps define connections between domains and highlights the potential for synergies between phenomena. An example would be the indicator for pedestrian and bicycling activity (Indicator 32), a measure of alternative means of mobility and also an expression of feeling secure on neighbourhood streets.

The mix of indicators in the TBL suite is problematic – there is overlap and redundancy, for example between Indicators 17 and 18 and the composite indicators that draw upon this basic data (eg 19/20 and 21/22). Further, some of the indicators are mediocre but this offers opportunity to trim the set of indicators to a leaner and more manageable (and cost-effective) size. If most redundant and some mediocre indicators are removed from the suite in Table 2; those which present serious data collection difficulties and some of the highly specialized measures (eg Indicator 42), the suite diminishes from 45 to 32. This is the suite that responds to the primary research question posed in the introduction to the paper. The issue of mediocre and sophisticated indicators is discussed further below.

We also recommend adding two environmental indicators. One is to track impermeable surface cover. It can trace connections between water quality, urban heat island effects and natural groundwater recharge potential. The second measure is a water quality indicator for surface streams and groundwater, a perennially important issue.

4. Targets

The suite also contains indicators that are inherently valid but which cannot be compared against norms or standards. They can cause interpretation difficulties because it is difficult to know what is “enough” and so should be used with caution.. However, most indicators are non-normative at this stage. Some in the environmental arena are matched with norms or standards (eg water or air quality standards) but most measures in the social and economic spheres lack standards. Non-normative indicators are still of some value in a permanent monitoring program, especially if they are used longitudinally. Federal and state research work to identify norms would be highly beneficial in providing standards and targets for additional indicators.

5. Data Availability and Reliability
Collecting data was difficult for some measures, partly connected with privacy concerns (eg individual household energy expenditure data) and in a few cases connected with commercial confidentiality (eg

detailed energy use and charges from utility companies). Where this drawback coincides with redundancy, removal of "difficult" indicators from the suite is made easier.

Obtaining quality data is a challenge but there are tangible side-benefits to operating indicator programs. Their initial construction requires liaison and networking within sections of the same government agency and between agencies, both local and state as well as with NGOs and the private sector. Indicator programs also require extensive inter and intra-agency cooperation. It is a process which is valuable for establishing communication lines, it raises awareness among participants and it can lead to better coordinated policy between different levels of government and with NGOs.

6. Adjustments to the Suite

Some of the housing affordability measures are not suitable for a CIP or TBL program whether at neighbourhood or city scale. It is difficult to say, for example, whether more or less development subsidy (Indicator 30) or greater or lesser rent assistance (Indicator 25/26) influences sustainability positively or negatively. Neither indicator is particularly useful for the TBL suite. Better might be an indicator that enquired about basic clothing and food needs and whether they were being satisfied in lower income groups. Similarly, performance ranking the number or proportion of public housing units (Indicator 25/26) is not meaningful because it is unclear whether there are targets in use at local scale and if so, what their rationale might be. Consequently, the presence or absence of public housing units in a particular suburb will not necessarily reflect need or social sustainability. Such measures will be vital as internal indicators for the state housing agency, however.

Several of the community indicators (40, 41, and 43) may be useful for a specialized monitoring program but for a general TBL suite they are not recommended. They are simple input measures and produce interpretation difficulties in the absence of norms. Indicator 42 is retained since it is normative. Indicator 42 (no. of people using public spaces) is too specialized for a general TBL suite. Its value does not reflect the resources needed to collect the data. There is also little point in monitoring if the purpose of the parks is not clearly understood by Council. The same principle applies to Indicator 33 (number of pedestrians and cyclists) although the data might gain in value if used in longitudinal monitoring.

Indicators 6 and 7 are concerned with the passive solar design (PSD) of site and building respectively. They could be merged since the concept of PSD does not lend itself to a site and building split. Lastly, a revised solid waste indicator (Indicator 9) is recommended, one that measures recycling participation via the composition of the waste stream using audit techniques. Simply recording whether or not there is recycling is unhelpful when the performance evaluation is conducted in the same LGA. Whether a MPC would record better recycling participation rate than a conventional subdivision is unclear but if the service provider is the same there is likely to be little difference in participation levels.

7. Multi-Dimensional Indicators

Many of the indicators in our TBL suite are simple quality of life (QOL) measures. Few are sophisticated, outcome indicators at this juncture and few are multi-dimensional in nature. The housing affordability and impermeability indicators are two exceptions. In general, simplistic indicators that reflect a state of affairs or a uni-dimensional matter are unlikely to be able to do little beyond measure QOL though that is an achievement in itself. The literature distinguishes between simple, uni-dimensional indicators and multi-dimensional ones (eg Friend 1996; Meadows 1998). Simple indicators ignore complexity and the existence of relationships in a system. The latter are analytic and are aimed at measuring sustainability but are difficult to construct and require much more data than simple input indicators.

Examples of elementary measures are the number of stormwater best practices, water consumption and median income. Expressing "numbers" of stormwater best practices in operation (Indicator 14) is helpful to a degree but not penetrating. Knowing the number of kilolitres of water consumed (Indicator 15) does not reveal if the resource is being depleted or replenished. Similarly, measuring median household income (Indicator 18) is one-dimensional. It is a statement about economic, not social condition because it ignores the distribution of that income. It also tells us very little in the absence of meaningful benchmarks related to income levels. A more searching indicator directly linking the social and economic legs of the triad would be the percent of the median income needed to pay for the basic needs of a person in the community.

It is generally accepted that the more sophisticated or analytic the individual indicators are, the more they will contribute to our knowledge of sustainability in a system. So, is enhancement needed if the holistic nature of sustainability is to be measured? First, the indicator examples above may be simplistic but this does not invalidate them. Second, it is not always possible or even desirable to develop more profound

multi-dimensional indicators. Pragmatically, not all issues can be encapsulated by a single complex indicator. Clustering several "simple" measures around the same issue and gauging the relationships intuitively may be as valuable as having a single multi-dimensional indicator. This tactic may not lead to linkages between phenomena being revealed, let alone causal relationships but there is no guarantee that causal links will result from defining and using complex indicators. Inferential modelling is probably needed to guarantee that. Thus traditional indicators may be useful as long as they are numerous enough to derive weight.

Obtaining comprehensiveness and dealing with complexity are difficult undertakings but one factor offers potential to developing integrated approaches to performance evaluation. In practice, the set of TBL indicators in Table 2 inextricably link the three domains of human activity – social, economic and environmental. The links are sometimes weak, sometimes strong. Most indicators, including the TBL suite, emphasize one domain but they are simultaneously connected to at least one of the remaining two domains. All of the environmental indicators have direct and indirect influences in either the social or economic domains and in some cases, both. In other cases an indicator might have relatively equal influence in all three domains. Indicator 3 in Table 2 illustrates the point. Energy use affects the environment, the economy and society to roughly equal degrees. In the environmental domain, there are impacts on the land and on biodiversity. In the economic domain there are direct financial costs and in the societal domain, noxious emissions affect people's health. The vast majority of indicators cross domains and issues. The phenomenon encourages indicators to be used more than once, a significant advantage very rarely used in indicator programs. The inter-connections encourage synergies to be developed but also conflicts to appear, an issue which is explored in a forthcoming paper.

8. Community Participation

Comments received from residents during questionnaire drop and field work suggest that community participation in TBL suite compilation and even the measurement process is important if progress is to be made towards sustainability. This position is heavily supported by the international literature (eg Redefining Progress et al 1999; Hodge 1998 and Hodge 1996). Resident input into TBL suites and operational assistance is feasible and will generate stakeholder interest even with city-scale programs. At neighbourhood level it should be a pre-requisite.

5. Conclusions

There are three overall conclusions that can be reached from the application of the TBL methodology. The first is that it appears as a very promising tool for checking the relative performance of residential neighbourhoods and progress towards – or away from – sustainability. The second conclusion is that TBL analysis appears as a credible tool for sustainability performance evaluation generally and at a wide variety of scales from an individual neighbourhood through to city, region, state and national scale. A third equally strong finding is that the TBL technique has great value as a long term monitoring tool, tracking the condition and performance of many aspects of a geographical area, typically at the scale of the city, but spanning neighbourhoods through to regions and states.

The application of the TBL methodology described in this paper appears to be the first post-development residential performance assessment using TBL indicators in Australia. The concept aims to embrace all three domains of sustainability. Triple bottom line methods can accommodate sustainability principles by exploring the multiple dimensions of an issue and some of the inter-relationships. Indicator suites possess several advantages over other assessment methods. The flexibility and pointedness of the indicators that can be used in TBL analysis and reporting is a major benefit. While the flexibility advantage has to be used with caution, specific indicators can be abandoned or introduced depending on circumstances like data reliability or data availability. This advantage particularly applies if thee is a core set of indicators that can provide comparability across geographic scale and over time. Indicator suites are also useful in organizing data, their contribution to problem solving is valuable and they are applicable to any spatial scale of enquiry. Indicator suites can be focussed readily on particular issues. Finally, they can be constructed in a single dimension or elaborated as multi-dimensional measures. These advantages are all supportive of the TBL approach to performance evaluation.

Nevertheless, there are two particular drawbacks to the performance evaluation technique though they are not peculiar to TBL analysis. First, indicators can only *represent* the state or condition of phenomena or systems. They are not reality in themselves. Second, realizing the full potential of the TBL technique requires cooperation in government and even in democracies there is much competition which can inhibit openness. However, in favourable circumstances they can contribute immensely to the process of good governance by helping to justify policy change. Indicators cannot of themselves implement action. That is both an administrative and political decision by government.

Table 2: The Trialled TBL Indicators and a Possible Final Suite

Indicators (Abbreviated)	**Indicators That May not be Useful in Some TBL Suites (Highlighted in Col 1)**
Environment *Biodiversity* 1. Area/proportion of site retained as native bushland	
2. Management strategies and habitat plans	
Energy 3. Total energy use per dwelling and per occupant	
4. Proportion of renewable to non-renewable energy used	
5. GHG emissions per capita and per dwelling	
6. Application of Passive Solar Design (site)	
7. Application of Passive Solar Design (building)	
8. Materials of lower embodied energy	Difficulty in identifying data
Other Resources 9. Solid waste (recycling participation)	Revised indicator recommended
10. Net residential density (dwellings/ha)	
11. House size range and average (sq m)	
12. Lot size range and average (sq m)	
Wastewater/Stormwater 13. Wastewater treatment (ecological v. conventional)	
14 WSUD for stormwater – number of best practices applied	
Water Supply 15. Water consumption/dwelling and /occupant/year	
16. Use of best practice water conservation techniques	
Economy *Housing Affordability* 17. Median house prices (per m^2)	
18. Median household income	Of little value except in longitudinal work
19. Housing costs (%weekly median income – rent)	
20. Housing costs (%weekly median income-mortgage)	
21. Percent home prices below LGA median – rent	
22. Percent home prices below LGA median-mortgage	
23. Prop. homes paying over 30% income on rent	
24. Prop. homes paying over 30% income on mortgage	
25. Rent assistance - privately rented housing	Difficulty in interpreting data
26. Rent assistance – publicly owned properties	Difficulty in interpreting data
27. Development costs: subdivision (7 dimensions, cost per lot	Difficulty in identifying data for reasons of commercial confidence
28. Development costs – housing (per m^2)	
29. Development costs (per m^2) green homes v. conventional	
30. Maintenance costs of public domain (4 dimensions)	
31. Nature and degree of public subsidy	Interpretation difficulty
32. Return on investment (average for the n'hood)	Difficulty in identifying data
Transportation 33. No. of pedestrians and cyclists	
34. Design-oriented safety assessment	Requires significant resources to obtain data
35. Non-auto transport: bus route density	
36. Non-auto transport: bus frequency	
37. Length of pedestrian and bike paths per dwelling (kms)	
38. No. riding bikes/walking and leaving the n'hood	
39. Percent homes within 400 metres walk (selected facilities)	
Community *Neighbourhood, Community* 40. No. of n'hood newsletters, local meetings, events	Interpretation difficulties
41. Participation in meetings, projects, events	Interpretation difficulties
42. No. and area of parks, public open spaces	
43. No. of parks and public spaces and people using them	Requires significant resources to obtain data
44. Psychological sense of community	
45. Satisfaction with neighbourhood	

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