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TRIPLE BOTTOM LINE: ITS RELEVANCE TO THE CONSTRUCTION INDUSTRY

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ABSTRACT

Environmental economists since the 1960s have advocated the need for public participation for the purpose of achieving a balance between social, economic and environmental values. TBL is a burgeoning discipline using many of the characteristics of these earlier methodologies, but with a greater emphasis on the trimorphic unifying relationships of social, economic and environmental characteristics.

As the major urban centres of Australia are expanding a larger number of buildings are imposing greater impact on all aspects of the environment. The period of a few ‘great’ buildings, normally constructed under the auspices of government, has long passed being replaced by a plethora of high rise commercial buildings and ‘MacMansions’ in the suburbs which encroach on the built and natural environment.

Increased community concerns must be addressed before future environmental imposing developments occur. To this end the Triple Bottom Line Research Initiative [TBLRI], at the University of Western Sydney is researching means of measuring social, economic and environmental values within the context of the construction industry. This paper summarises research into the use of water as an environmental currency or measure, and the social and environmental impacts of re-using water onsite rather than remote disposal.

This research is an extension of value assessment techniques developed over 20 years using TBL techniques for both built and natural environments. In each instance this research has been part of higher degree programs. The purpose of this research is to facilitate a standard of pre and post construction evaluation assessments, incorporating the scientific elements of measurement, replication and prediction.

RESEARCH REVIEW

Brennan [1993] presented an ambitious attempt to harmonise current, uncoordinated and pragmatic approaches to heritage conservation with the analytical framework provided by economics. This work permitted a more rational basis for decision-making by addressing heritage evaluation from the political-philosophical, historical and utilitarian viewpoints. It presented an overview and appraisal of valuation methodologies while examining the theoretical basis for assessing societal heritage values.

In addition to discussing the role of government, its bureaucracy and associated legislative processes in the allocation of resources for heritage purposes, it also identified whether public attitudes (or values) attributed to built and natural heritage items could be objectively measured and ranked using accepted methods and whether these measuring procedures could be scientifically replicated.

The implications for the building and construction industry of the TBL estimation model based initially on the above heritage evaluation process is that it allows for pre and post construction estimations across different eco-systems and where necessary inter-temporally. This composite approach is facilitated by the employment of water, in its various qualities, as a common factor of environmental performance – i.e., the eco-currency. Whereas energy has been spasmodically proposed by economists as an ecological currency from the 1950s or so, its application has not been successful. Water as an ecological currency on the other hand has the advantage of not only being a form of energy, but it also has the capacity to be monitored for changes to ecological quality; a measurement that is difficult to achieve with energy (*vide* for example, Costanza 1991).

Methods of determining community values using non-monetary evaluation methods were appraised to asses the feasibility of collecting and measuring community heritage values. An outcome of this aspect of the research was the development of mathematical models to provide measurement and replication of non-monetary valuation methods. These models utilised the works of Brown [1984], Lancaster [1966; 1971] and Meddis [1984]. The result was the development and testing of a computer-based heritage-ranking model 'HertRank'. An important attribute of HertRank was it facilitation of estimating the relative significance of alternative measures of heritage values. The results of HertRank clearly demonstrated the superiority of this planning tool.

HertRank research was expanded to include environmental and economic attributes over the next decade [Brennan 2001]. This research examined the economic and social outcomes of State Environmental Planning Policy No. 14 - Coastal Wetlands, (SEPP14) 1985 by examining the impact of this environmental policy. Central to the research was the adoption of multi-variant perspectives contained within a common timeframe, based on theoretical, empirical and survey research. This holistic approach identified four main stakeholder groups directly associated with it implementation - landholders, enforcement agencies, government and the broader community and associated outcomes arising from government intervention.

There are two relevant outcomes of this research to the building industry; the first was the formulation of the concept of 'custodial taxation' a theory that provides policymakers with an improved understanding of the benefits and costs implicit with inter-generational bequest issues [passing of environmental benefits from one generation to another] based solely upon property rights transfers, entirely dependant upon ecological criteria.

The second outcome was the advancement of 'attribute analysis' developed in HertRank in its application to the natural environment. The revised ranking model, called EVALUATE, encorporated the philosophy of applying a lateral approach to sustainable development principles [Brennan, *et al*, 1992; Jones and Brennan, 1997]. EVALUATE considered habitat, hydrological and geomorphologic characteristics, consumptive and non-consumptive values and non-physiological attributes.

HertRank and EVALUATE each were constrained by their dependence on two-dimensional matrix formats. While the models could be used to provide input data for traditional triple column Triple Bottom Line [TBL] analysis, the mathematical structure was not conducive to simultaneous and dynamic analysis as discussed by Brennan and Patterson [2004].

TRIPLE BOTTOM LINE?

At the risk of oversimplification, TBL arises from the Global Reporting Initiative [GRI], whose mission is to develop and disseminate globally applicable sustainability reporting guidelines [Global Reporting Initiative, 2000]. These guidelines can be used by organisations reporting on the economic, environmental, and social dimensions of their activities, products and services, in particular those in the construction industry. Since its inception, the GRI has worked to design and build acceptance of a common framework for reporting on the linked aspects of sustainability in a way that presents a clear picture of:

- human activity;
- ecological impact of business;
- facilitate informed decisions about investments, purchases, and partnerships.

However, TBL is subject to varying interpretations concerning content, evaluation and reporting criteria, a situation not resolved by the Commonwealth Government’s guidelines [Environment Australia, 2003]. Currently TBL applications range from a relatively simplistic triple column accounting process that reflects a historic performance to a complex dynamic forecasting model. The complexities in providing meaningful TBL analysis has long been recognised, particularly regarding environmental valuation criteria [e.g. Krutilla and Fisher, 1976; Knetsch, 1993]. Table 1 exemplifies these complexities by summarising a matrix of conflicts of various community values expressed before the Land and Environment Court of NSW in relation to a north coast development.

Table 1. Conflict-Matrix: NSW Land and Environment Court, 1996

CONFLICT ISSUES	STAKEHOLDERS (a)					
	Resource Users	**Consent Authority (b)**	**Interest Groups**		**Lobbyists**	
	Tagget (Defendant)	**Developer (c)**	**Council**	**Conservat-ion groups**	**NSWFA**	**Members of Parliament**
1. Bund Wall						
remove	s	o	o	o	s	x
raise height	o	s	s	s	o	x
Lower height	o	o	s (d)	o	s	x

2. SEPP14						
Livestock	s	x	o	o	s	s
Drainage	s	x	o	o	s	s
Horticulture	s	x	o	o	s	s
Development	-	s	x	o	s	s
Conservation	o	o	s	s	o	s
3. Existing use rights						
Drainage	s	x	o	o	s	x
Livestock	s	x	s	o	s	x
Cropping	s	x	o	o	s	x
4. Classification Methods	o	x	s	s	o	(e)
Aerial Photography	o	x	s	s	o	x
Soils categorisation	o	x	s	s	o	x
Flora significance						
5. EPA Act						
Devel. consent	o	-	s	s	o	x
Upgrade BLM drain	o	-	s	s	o	x

s= support; o = objection; - no opinion or opinion not expressed, but is interested party; x = not an interest party. (a) the court is considered a stakeholder in all issues; (b) with the concurrence of the Minister; (c) Krekelberg quay development and bund wall development; (d) Council altered its position (TSC 1994); (e) investigation requested by the Minister. Data Sources: Bannon, J. (1992); Tagget (various documents); Frank, R. (1994); Parker, (1993); Mobbs, M. (1992); Brennan and Patterson (1993). [Source: Brennan, 2001].

Notable from Table 1 is the inconsistency of values between parties across the various issues – that is to say, the various values were dynamic and were dependent on factors outside the attributes that related to a particular physical issue. The situation presented in Table 1 becomes more complex when community values are assessed over time. Comparative analysis between two periods was undertaken using a statistical method developed by Brennan [1997].

This method performs temporal comparisons using two dimensional matrices of any size. Brennan [1997] compared two 32 x 32 matrices by deriving an index of frequency distributions on a question-by-question basis employing the statistical principles underlying the Kolmogorov-Smirnov tests. Entitled the Public Prioritisation Index (PPI) it is calculated using the following model:

$$PPI_i = \left(\left(\frac{\left| (Mo_{2i} - Mo_{1i}) - (Me_{2i} - Me_{1i}) \right|}{1 - (K_{2i} - K_{1i})} \right) * (S_{2i} - S_{1i}) \right) * 10$$

Where:

- PPI = Public Prioritisation Index for the temporal period *i*
- i = the ith observation of the n choices
- Mo_x = Mode for period x,
- Me_x = Median for period x

K_x = Kurtosis for period x
S_x = Skewness for period x

Rationale underlying this index includes the change in positioning of the significant frequency distributions, the mode and the median, over two time-periods. Measuring the temporal changes of the mode (highest frequency occurrence) and median (midpoint of frequency occurrence) in absolute terms, this expression is weighted by [a] the change in the kurtosis (a surrogate for variance) and [b] the skewness that shows the direction of the movement.

The importance of the PPI is that it facilitates measurement of the movement of community values where these community values may be of particular lobby [protestor] groups, clients of developers, or evidence before the environment courts. Such measurement is becoming more critical for residential and civic construction projects as the community is better informed and able to communicate more effectively by use of electronic media such as the Internet and e-mail.

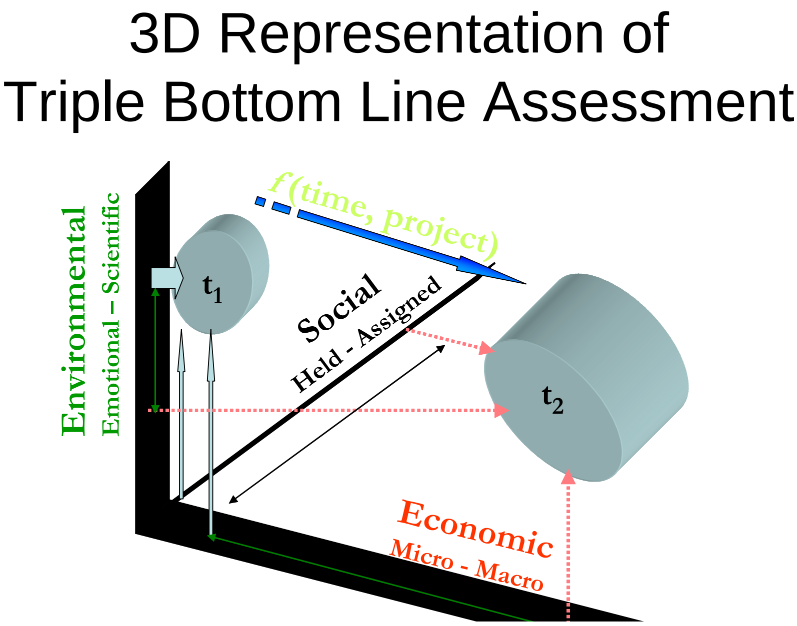


Figure 1: TBL represented as a composite trimorphism illustrating changing values, including environmental ideals [After Brennan and Patterson, 2004].

Valuing the Environment

Combining the developments outlined above it is now theoretically possible to construct the temporal-dynamic TBL model as presented by Brennan *et al* [2004] and illustrated in Figure 1 and apply it to the built environment; it is this model that is used in the remainder of this paper. However, while the economy is relatively easily measured in monetary terms, and social values by numerous inquisitorial techniques, the measuring of environmental values remains a contentious issue. Economists have developed numerous methods over the last half century with some, such as the Environmental Evaluation System and TBL, [albeit in an undefined format] gaining a degree of recognition and popularity. To address the difficulties associated with environmental valuation Brennan *et al* [2003] offer the novel approach of using water as an 'Eco-currency'. They posit that the determination of environmental values should be able to parallel the basic theories developed for the money economy by providing 'common denominator' assessments, based on inter-environmental values whether at the micro or macro levels of analysis [Brennan *et al,* 2003].

Succinctly, they assert that water quality and quantity is the currency facilitating Triple Bottom Line [TBL] environmental assessment in a parallel manner to gold being the natural element that underpinned the monetary system i.e. 'Recognition that non-oceanic water has real economic value is reinforced by governments legislating to control this resource where an economic good is dichotomous to the notion of a Free Good. An extension of these government actions is that water does have value in its own right, as well as providing value to other natural elements [e.g. Brennan and Watson, 2000]'. Table 2 contains a basic comparison of traditional monetary theory with the proposed Eco-currency, indicating that the established monetary theories can be adopted to fulfil a new need, albeit becoming irrelevant in the modern paperless economy.

Table 2: A Simple Comparison of the Monetary System and Eco-Currency

Criteria	Money	Eco-Currency
Legal Tender	Gold standard – based on weight Gold Index – based on weight Gold measured in carats	Water – based on volume, weight, mass Water measured in living support systems
Interest	Return to capital – usually in terms of % return Normally related to risk regarding the return of capital and interest payments – low risk low return	% Change in quantity or variety of living organisms supported and how these relate to risk and health Improved environmental outcomes, including the reduction of risk to flora, fauna and micro-organisms
Capital	Monies used in store for the purpose of security or investment potential	Storage in soils and other natural environments Risk management – drought proofing Potential resource for return – ie water consumption
Trading	Stock Market Futures Market	Water licence trading Carbon Credit type scheme Transfer of Development Rights – move demand from Sydney to other less risk prone areas
Taxation	Direct Indirect	Licences to use, reuse or dispose of water within the ecosystem Monitoring activities and correction requirements

Underpinning Table 2 is the application of traditional monetary theory including that, in the short-term, the supply of money was fixed, with variations to availability being determined by a number of human controlled factors.

Similarly, water supply is fixed (all natural resources are finite - as illustrated by the water cycle), but, has the capacity to measure changes in the supply at a particular time and space – i.e. dams relocate water from one use to another, with associated opportunity costs [loss of free flowing rivers], returns to capital [drought proofing] and depreciation [alteration to adjoining land uses]. While it is argued that water is not a homogeneous product, neither is money with real and well defined hierarchy of national currencies as illustrated by the international exchange rate. However, each currency functions within their respective environments fulfilling the critical role of facilitating exchange of value. What money is to the economy, water can be to environment valuation as it is the common dominator that becomes 'stronger' with good eco-systems and 'weaker' in degraded eco-systems. This characteristic allows natural resource valuation to occur in both natural and urban areas, or in combination, specifically for the purposes of this paper to the built environment and its associated construction industry, a characteristic not catered for in previous methods [e.g. Winter and Lockwood, 2004].

TBLRI Estimation Model

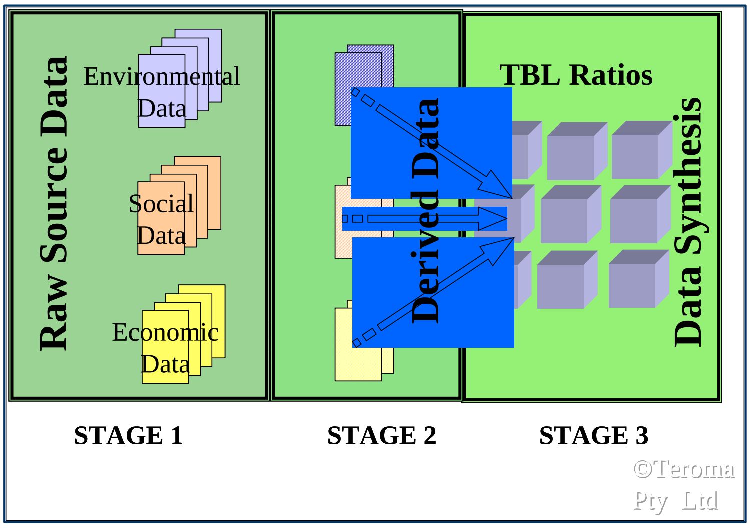
Over the last two years the Triple Bottom Line Research Initiative, University of Western Sydney, has been developing a TBL estimation model that encompasses the one and half decades of research outlined above. The format of this research is summarised in Figure 2. Stage 1 comprises research into the availability of raw data sources, while Stage 2 utilizes the algorithms developed by HertRank and EVALUATE. Stages 1 and 2 have also initiated research into methods of deriving alternative data, including the innovation and development of the 'eco-currency' concept.

Stage 3 is the modification of sophisticated multi-dimensional software to perform the complex multi-array raw-attribute and derived ranked data into an analytical format that facilitates temporal and sensitivity ['what-if'] estimation that in a variety of formats provides stakeholders with reliable information that is relevant to their needs and interests including for construction developments. This process is symbolically represented in Figure 3.

CONCLUSIONS

It has been noted above that there is need to collect data for each of the main TBL classifications, including temporal series and inter-geographic levels, as well as from landowners, developers and the wider community. This part of the analysis requires a sophisticated computer 'black-box' processing ability, as each part of the process has the likelihood of interacting with any of the other parts.

Figure 2: Diagrammatic representation of the collection, derivation and application of data within the TBL framework.



The implications for the building and construction industry of the TBL estimation model presented is that it allows for pre and post construction estimations across different eco-systems and where necessary inter-temporally. This composite approach is facilitated by the employment of water, in its various qualities, as a common factor of environmental performance – i.e. the eco-currency.

While community values estimation techniques are incorporated into the TBLRI model, it has the additional advantage that community attitudes can be measured over two time periods. This form of measurement is of importance for large and/or controversial projects such as the Australian Defence Industries [ADI] site at Penrith in New South Wales where community support/objection appears to vacillating over time.

Figure 3: The complex multi-dimensional structure undertaken by sophisticated computer processing to provide TBL inter-temporal and multi-resource analysis.

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