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**MULTI-CRITERIA ANALYSIS: A CRITIQUE FROM AN ECONOMIST'S PERSPECTIVE**

Robert Gillespie

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# **MULTI-CRITERIA ANALYSIS: A CRITIQUE FROM AN ECONOMIST'S PERSPECTIVE**

By Robert Gillespie<sup>123</sup>.

## **Abstract**

Multi Criteria Analysis (MCA) is a decision support technique that is increasingly being used to evaluate alternative resource use and policy options, often as an alternative to benefit cost analysis. However, MCA has a number of quite serious potential flaws that are examined here with reference to a MCA of future urban growth options for the Hastings Local Government Area. These flaws arise because MCA has no established theoretical framework or uniform set of principles. Consequently, different analysts can apply different criteria and different methods of ranking options against the criteria and get entirely different results. The method is therefore prone to the arbitrary and subjective judgments of the analyst.

It is concluded that if decision makers are genuinely interested in how alternative resource allocation options compare against economic, financial, environmental and social criteria, then there is no substitute for undertaking separate specific detailed evaluations such as benefit cost analysis, financial analysis, environmental impact assessment and social impact assessment. Attempts to integrate the results of these assessments using the subjective and arbitrary procedures of MCA only serve to obscure the results of individual analyses and the tradeoffs involved between objectives.

## **1. Introduction**

This paper reviews the evaluation technique referred to as Multi Criteria Analysis (MCA). The technique's application and its strengths are briefly reviewed. The weaknesses of MCA are then examined by comparing aspects of the technique to the economic evaluation technique, benefit cost analysis (BCA), for which MCA is increasingly being considered as an alternative. The paper goes on to illustrate some of the theoretical issues with the application of MCA by referring to a specific application of MCA to a land use issue in the Hastings LGA. Conclusion regarding the relative merits of MCA are reached in the final section of the paper.

## **2. What is Multi-criteria Analysis?**

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<sup>1</sup> Robert Gillespie is the Principal of Gillespie Economics, a resource and environmental economics consultancy firm, 13 Bigland Avenue, Denistone NSW 2114.

<sup>2</sup> Gillespie Economics was commissioned by King and Campbell Pty Ltd to review the *Hastings Council Urban Growth Options Assessment under the Principles of Ecologically Sustainable Development* as part of its submission to Council.

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MCA is a decision support technique that is increasingly being used to evaluate resource allocation issues in the policy arena, often as a substitute for BCA. “MCA is an approach rather than a single well defined procedure” (RAC 1992, p. 9) and refers to techniques that include the following three key components:

- a number of alternative plans or options that require evaluation;
- a set of criteria by which the alternatives are to be judged; and
- a method for ranking the alternatives based on how well they satisfy the criteria (RAC 1992, p. 3)

The Planning Balance Sheet, Goals Achievement Matrix, Multi-Objective Decision Support System, Utility Value Analysis are all forms of MCA (BTE 2000; RAC 992). BCA has even been referred “to as a special form of MCA where dollars are used to evaluate the alternatives and a decision is based on some economic indicator such as net benefits or a cost benefit ratio” (RAC 1992, p. 3)

### **3. Reported Strengths of MCA**

Some of the reported strengths of MCA in evaluating resource allocation issues include:

- providing structured data for decision makers (RAC 1992);
- ability to deal with qualitative data, quantitative data or a mixture of both and use a variety of scales (RAC 1992);
- providing flexibility in exploring different ways of reducing evaluation scores to a comparable basis than is available in strict economic analysis (RAC 1992);
- not requiring monetary valuations (RAC 1992); and
- enabling integration of economic, social and environmental considerations i.e. multiple objectives to be considered in one analysis (RAC 1992).

### **4. Weakness of MCA**

However, the techniques is also dogged by a number of weaknesses compared to BCA:

- because there is no methodological requirement, as in BCA, to identify the objective being sought and then specify alternatives that can meet that objective, it is possible in MCA for alternatives to be evaluated that are not all possible of achieving the objective.
- there is no requirement, as in BCA, to only consider the marginal effects of alternatives;

- there are no rules for the selection of criteria against which alternatives are evaluated. Criteria are somewhat arbitrarily selected (e.g. because of ease of measurement etc BTE 2000) and from a BCA perspective may relate to some economic benefits or costs, but rarely all benefits and costs, may relate to secondary effects not included in BCA and often include double counting from a benefit cost perspective. Criteria may also bear no relation to anything that consumers or producers value i.e. would be willing to forego resources to promote (BTE 2000).
- The number of criteria selected relating to different areas e.g. economic, social and environmental concerns, can give an implicit weighting to one area over the others.
- Measures used to judge alternatives against criteria generally don't relate to the measure of consumers' and producers' surplus used in BCA. The measures used in MCA are often physical measures and the same measure may be used to rank alternatives against different criteria.
- Different scoring systems, e.g. ordinal rankings and scoring on a scale, may be used to rank alternatives against criteria with the analyst obtaining totally different overall results depending on the scoring system adopted.
- Scoring systems involve implicit weightings both for the performance of different alternatives against the same criteria and between criteria. Ordinal rankings ignore relativities in the performance of alternatives against criteria and where ordinal rankings are added to determine overall ranking of options, gives each criteria an equal weight. While scoring against a scale can maintain relativities in the performance of alternatives against a single criteria, addition of scores implicitly gives each criteria equal importance. Where some measures are in dollar terms, then non-monetary measures in the analysis, rightly or wrongly, attract an implicit money value (BTE 2000).
- Recognising the problem with each criteria being given equal importance, analysts often specify different weights for each criteria. However, weights selected by consultants, politicians, bureaucrats etc are unlikely to reflect consumers' and producers' aggregate valuations/preferences. Even weights selected by a sample of the community are unlikely to reflect accurately the aggregate preferences of consumers and producers. Local rather than national interests are likely to prevail where local communities are consulted regarding weights or criteria (BTE 2000)
- The treatment of time when considering the performance of alternatives against criteria is often given little attention in the application of MCA (BTE 2000), particularly where physical measures are used to gauge performance.
- The criteria, measurements and scoring/ranking system used in MCA are not common between applications and hence unlike BCA, different MCAs cannot be compared to consider which investment gives the greatest net benefit to society (BTE 2000).

- unlike BCA there is no established theoretical framework or uniform set of principles and as such different analysts can apply different criteria and different methods for ranking options against the criteria and get entirely different results (BTE 2000). The method is therefore very prone to the arbitrary and subjective judgments of the analyst or decision maker and is easily manipulated to result in different outcomes.

Many of these shortcomings of MCA are illustrated with reference to an application in the following section.

## **5. Case Study – Hastings Urban Growth Strategy**

### ***5.1 Background***

In November 1999 Hastings City Council released for public comment its draft *Hastings Urban Growth Strategy* (HUGS) to provide strategic direction for urban expansion in the Port Macquarie area over a 21 year period. This document:

- considered a range of issues of relevance to the future urban growth of the region;
- identified a number of options for accommodating the expected future urban growth; and
- identified a preferred option for accommodating future urban expansion.

The selection of Hastings Council's preferred option was based on the outcome of a separate report prepared for Council titled *Hastings Council Urban Growth Options Assessment under the Principles of Ecologically Sustainable Development* (ERM Mitchell McCotter 1999). This assessment undertook a MCA using a range of ecologically sustainable development (ESD) criteria to make recommendations on the most desirable options for accommodating for future urban growth.

#### Alternative Options for Accommodating Future Growth in the Hastings Local Government Area (LGA)

Hastings LGA is located on the mid north coast of NSW and encompasses the urban centres of Port Macquarie, Lake Cathie, Bonny Hills, Camden Haven, Wauchope, Kendall and Kew.

Six options for accommodating future urban growth in the Hastings LGA were identified for evaluation:

- Option 1 - Urban consolidation within existing urban centres, with no additional urban land releases;
- Option 2 - Urban expansion into rural land to the west of Port Macquarie on either side of the Pacific Highway, known as Area 13;

- Option 3 – A new Town in Area 13 with higher densities than for Option 2;
- Option 4 – A new Town in land at Lake Cathie and Bonny Hills, known as Area 14, at similar densities to existing;
- Option 5 – Growth in Area 14 (without any rezonings) followed by a new town in Area 13; and
- Option 6 – New towns in Area 13 and Area 14 concurrently.

(Hastings Council 1999, p. 4).

#### Criteria by which alternatives were judged

The criteria or indicators by which alternatives were judged were developed by issuing a draft set of indicators to a group of environmental, development and property interests in the area and then undertaking a half day workshop to discuss and review the indicators (ERM Mitchell McCotter 1999). Economic, social and environmental criteria were identified.

The final indicators used to evaluate the options are provided in the first column of Table 1.

**Table 1 – ESD Indicators and Measures Used to Evaluate Urban Growth Options for the Hastings LGA**

<b><i>ESD INDICATORS</i></b>	<b>Measure for Each Indicator</b>
<b><i>Economic Indicators</i></b>	
Capital cost of infrastructure	\$
Full discounted cost of infrastructure (water sewer)	\$
Full discounted cost (roads)	\$
Cost per additional dwelling/person	\$
Developer contribution	\$
Impact on household rates/charges	\$
Effect on Council debt	\$
Attractiveness (to purchasers)	Land Prices
<b><i>Social Indicators</i></b>	
Accessibility to local shops	Distance (vehicle kilometres)
Accessibility to subregional centre	Distance (vehicle kilometres)
Accessibility to regional & sporting facilities	Distance (vehicle kilometres)

Accessibility to health services	Distance (vehicle kilometres)
Housing affordability	Estimated range of dwelling prices
No. of dwellings / hectare	Estimated no. of dwellings
% of mixed land use	Amount of space provided for retail/commercial and special use activities
Accessibility to public open space	% of population within 1 km of local open space and percentage of population within 15 km of regional open space
Public transport ability	Population density
Distance to public transport node	Measure distance
Frequency of public transport	No. of bus services per day
Accessibility of subregional shops	Vehicle kilometres travelled
<i>Environmental Indicators</i>	
Carbon dioxide emissions	Vehicle kilometres travelled
Expenditure on pollution prevention	Expenditure
Expenditure on water and sewage treatment	Expenditure
Impact on flora and fauna	Loss of habitat
Impact on areas of conservation significance	Loss of significant areas
Extent of habitat fragmentation	Loss of wildlife corridors

Adapted from ERM Mitchell McCotter (1999)

### Method for ranking the alternatives based on how well they satisfy the criteria

The measures identified in the second column of Table 1 were used to rank the alternatives on how well they satisfied the criteria.

Options were given a ranking from one to six on the basis of how well they met each of the criteria, one representing the most preferred option against a particular criteria. Hence the the option that required the least expenditure on pollution prevention was given a ranking of one. Where options were considered to perform equally against a criteria they were given the same ranking. Hence if the two best performing options were considered to be equal they were given a ranking of one, the next best performing option was given a ranking of two.

To determine the overall preferred option, rankings against each criteria were summed. The options with the lowest overall total being the option that ranked the highest overall.

The summary of the MCA rankings is given in Table 2.

Table 2 - SUMMARY OF RANKINGS

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#### OPTIONS



<b>Indicator</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>
<i>Economic Indicators</i>						
Capital cost of infrastructure (undiscounted water, sewerage and roads)	1	3	4	2	5	6
Full discounted cost of infrastructure (water and sewer)	1	5	5	2	3	6
Full discounted capital cost of roads	1	2	3	4	5	6
Cost per additional dwelling and person	1	3	4	2	5	6
Developer contribution	1	2	3	4	5	6
Impact on household rates/charges	1	2	3	3	4	5
Effect on Council debt	1	5	5	2	3	6
Attractiveness	1	4	4	2	3	5
<b>Sub Total</b>	<b>8</b>	<b>26</b>	<b>31</b>	<b>21</b>	<b>33</b>	<b>46</b>
<i>Social Indicators</i>						
Accessibility to local shops	1	3	2	2	4	4
Accessibility to subregional centre	1	2	2	3	3	3
Accessibility to regional & sporting facilities	1	3	3	2	4	4
Accessibility to health services	1	3	3	2	4	4
Housing affordability	3	4	2	1	4	4
No. of dwellings / hectare	1	2	2	3	4	4
% of mixed land use	1	4	2	2	3	3
Accessibility to public open space	2	3	3	1	4	4
Public transport ability	1	2	2	3	4	4
Distance to public transport node	1	2	2	5	4	3
Frequency of public transport	1	2	2	2	4	4
Accessibility of subregional shops	1	2	2	3	3	3
<b>Subtotal</b>	<b>15</b>	<b>32</b>	<b>27</b>	<b>29</b>	<b>45</b>	<b>44</b>
<i>Environmental Indicators</i>						
Carbon dioxide emissions	1	4	2	6	5	3
Expenditure on pollution prevention	1	4	4	2	3	5
Expenditure on water and sewage treatment	1	4	4	2	3	4
Impact on flora and fauna	1	2	2	4	3	4
Impact on areas of conservation significance	1	2	2	4	3	4
Extent of habitat fragmentation	1	3	3	4	2	4

<b>Sub total</b>	<b>6</b>	<b>19</b>	<b>17</b>	<b>22</b>	<b>19</b>	<b>24</b>
<b>GRAND TOTAL</b>	<b>29</b>	<b>77</b>	<b>75</b>	<b>84</b>	<b>97</b>	<b>114</b>
Rankings	1	3	2	4	5	6

Source: ERM Mitchell McCotter (1999), p. 9.1.

On the basis of this MCA it was recommended that the Hastings Urban Growth Strategy adopt option 1 (Urban consolidation) and option 3 (Area 13 New Town) as the preferred options for continued urban growth (ERM Mitchell McCotter 1999). The rationale for adopting both options being that that the urban consolidation option was unlikely to be able to accommodate all the urban growth needs over the next 20 years (ERM Mitchell McCotter 1999). The draft Hastings Urban Growth Strategy (1999) subsequently adopted option 1 and 3 (Hastings Council 1999).

## ***5.2 Review of MCA***

### Identification of alternatives

The objective of the Council's planning was to accommodate continued urban growth in the Port Macquarie region to the year 2021. There were six options identified for accommodating future growth of Port Macquarie.

However, the options identified were not each capable of achieving the objective (contrary to one of the fundamental steps in cost benefit analysis). For instance, the option of urban consolidation would be unable to accommodate continued urban growth to 2021, since there is a supply side constraint. That is, there is insufficient urban land of suitable size and with suitably aged existing dwellings, that would be financially feasible to redevelop. This is particularly the case given that substantial urban consolidation has already taken place in Port Macquarie (King and Campbell Pty Ltd 2000). Therefore while continued urban consolidation could be seen as an important element of future growth options it is not a realistic option by itself.

In no part of the analysis was the recommended alternative i.e. urban consolidation together with the new town in Area 13, assessed. It doesn't necessarily follow that the first two ranked options are the best combination of options. Combination options would require different assumptions regarding population growth rates, costs, revenues, environmental implications etc. and should be subject to a full assessment.

### Economic criteria

One of the reported advantages of MCA is its ability to address a range economic, social and environmental issues even where impacts cannot be quantified. However, there is a serious question about the criteria used in MCA.

The MCA of growth options for the Hastings LGA attempted to address economic issues by including a range of economic criteria. However, one of the primary focuses of

economics is the allocation of scarce resources to maximise community welfare (Gillespie 1999). BCA is the main technique that economists used to assess the economic efficiency of alternatives resource allocation options.

The essence of BCA is:

- the estimation of the extent to which a community as a whole is made better off “with” the resource allocation compared to “without” it (i.e. consideration of all the incremental benefits);
- the estimation of the extent to which the community is made worse off “with” the resource allocation compared to “without” it (i.e. consideration of all the incremental costs); and
- a comparison of these two figures.

In other words, the incremental social benefits of a resource allocation are compared with the incremental social costs (Bennett 1996). Where possible, identified benefits and costs are measured in monetary terms. The resource allocation or option with the highest net benefit is considered preferable, on economic efficiency grounds, to other options.

So in terms of economic criteria, economic efficiency would be one of the major criteria of relevance. While a partial BCA of options for accommodating growth in the Hastings LGA was undertaken, the result was not included as a criteria in the MCA. Instead some of the individual cost and benefit items from the BCA were included as separate criteria in the MCA while others were not. This is discussed in greater detail later.

#### Consideration of “with” and “without”

One of the key methodological requirements in BCA is to consider what would happen “with” the implementation of each option and compare this to what would happen “without” the implementation of the option. This methodological requirement ensures that only incremental changes are considered in the analysis and that the different consequences of different options are fully considered<sup>4</sup>.

The “without” or base case scenario is not necessarily static, as even without implementation of an option, changes may occur. One rule suggested by NSW Treasury (NSW Treasury 1997) in identifying the base case is that it is not a spend nothing policy but rather is based on the continuation of current services. So the base case regarding urban growth in the Port Macquarie Region may include a continuation of the operation of existing sewerage and water supply assets<sup>5</sup>, deferral of asset replacement or expansion and continued maintenance. Where asset replacement is absolutely necessary it would only include replacing an asset with that of a comparable standard to that being replaced.

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<sup>4</sup> Often it is necessary to collaborate with other experts contributing information on the physical, ecological, cultural or social consequences of the adoption of different options before these can be considered in monetary terms (James and Gillespie 1997).

<sup>5</sup> Existing infrastructure provides a major limitation on future urban growth.

The base case may therefore include the development profile as expected before HUGS, including development of some land in Area 14 (Area 14A) that is zoned residential. Only the incremental costs and benefits associated with each option should be considered in a BCA. This fundamental principle was not adopted in the implementation of the MCA. For instance, the infrastructure costs criteria, developer contribution criteria, attractiveness etc considered in the analysis were total values rather than incremental values. Hence, the analysis includes both incremental and base case costs and benefits combined.

Another major issue with the MCA undertaken for Hastings Council relates to the assumption made regarding one of the key drivers of the economic costs and benefits of the different options. That is, the population projections made under each scenario. Instead of examining the likely population projections “with” and “without” each of the different growth options, it was instead assumed that population growth would be the same for each option (including the base case).

This assumption is essentially one of fixed *exogenous* demand. That is, it was assumed in the MCA that demand for urban property in the Port Macquarie region is not affected by any decisions taken by Council in relation to the location of Port Macquarie’s future urban growth areas. This assumption can be likened to a “*build it and they will come*” assumption.

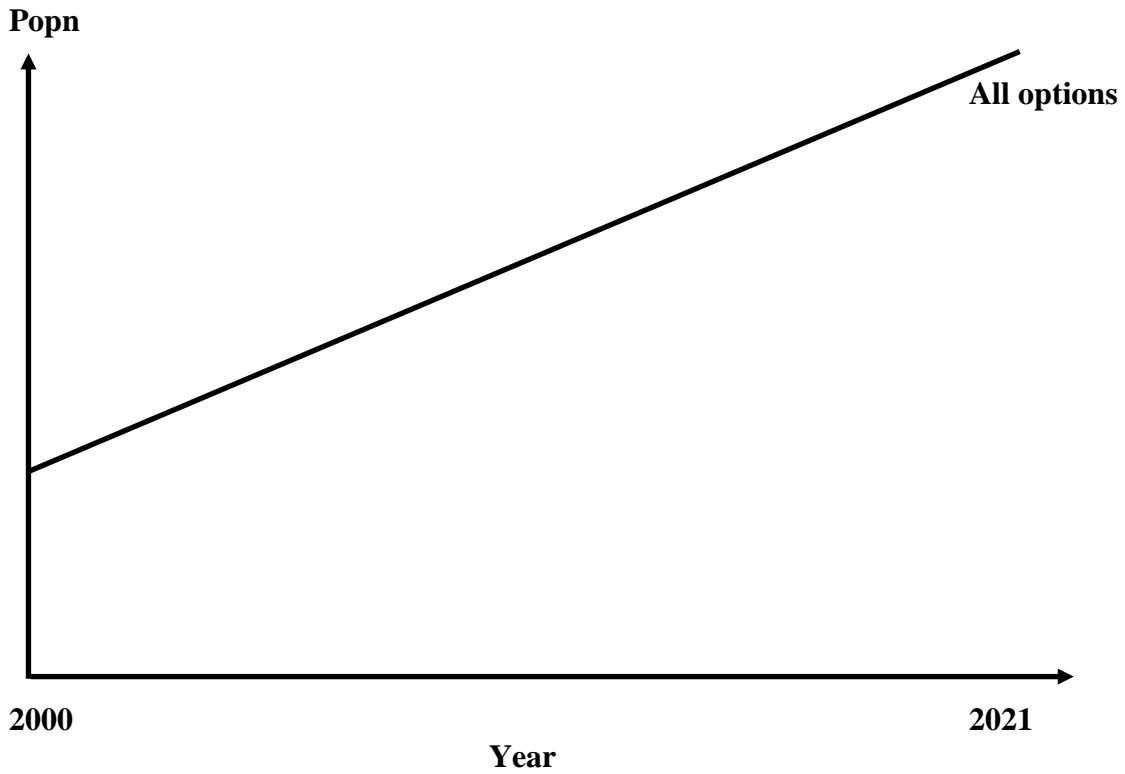
However, the market for urban property, as is the case for all markets, is largely demand driven. That is, while it is the interaction of supply and demand that determines the market price and the quantity demanded, Council through zonings can only directly influence the supply of land. However, the supply of land that is provided, will only be taken up if Council/ developers are providing what is demanded by the consumer.

Property demand by the consumer is a function of a variety of characteristics including the price of the property, price of property in other regions, location of the property, income, expected future prices, population and preferences. There are anecdotal indications that a major attraction of the Port Macquarie region for those migrating into the region, is the ready access to the coastline. That is, those with a demand for urban property in the region have a preference for land close to the coastline. This is acknowledged in the assessment report (ERM Mitchell McCotter 1999), which found that the coast areas of Port Macquarie and Area 14 to have the greatest relative attractiveness to consumers.

If the areas of greatest relative attractiveness preferred by the consumer are not made available through Council’s supply side decisions, it is unlikely that all consumers will simply revise their preferences downwards and express the same demand for land located inland from Port Macquarie. Instead, it is likely that, at least in the first instance, consumers will examine alternative locations to satisfy their demands. These alternative locations would include other areas on the north coast of NSW. It is therefore quite likely that the growth projections for the Port Macquarie region will vary between different

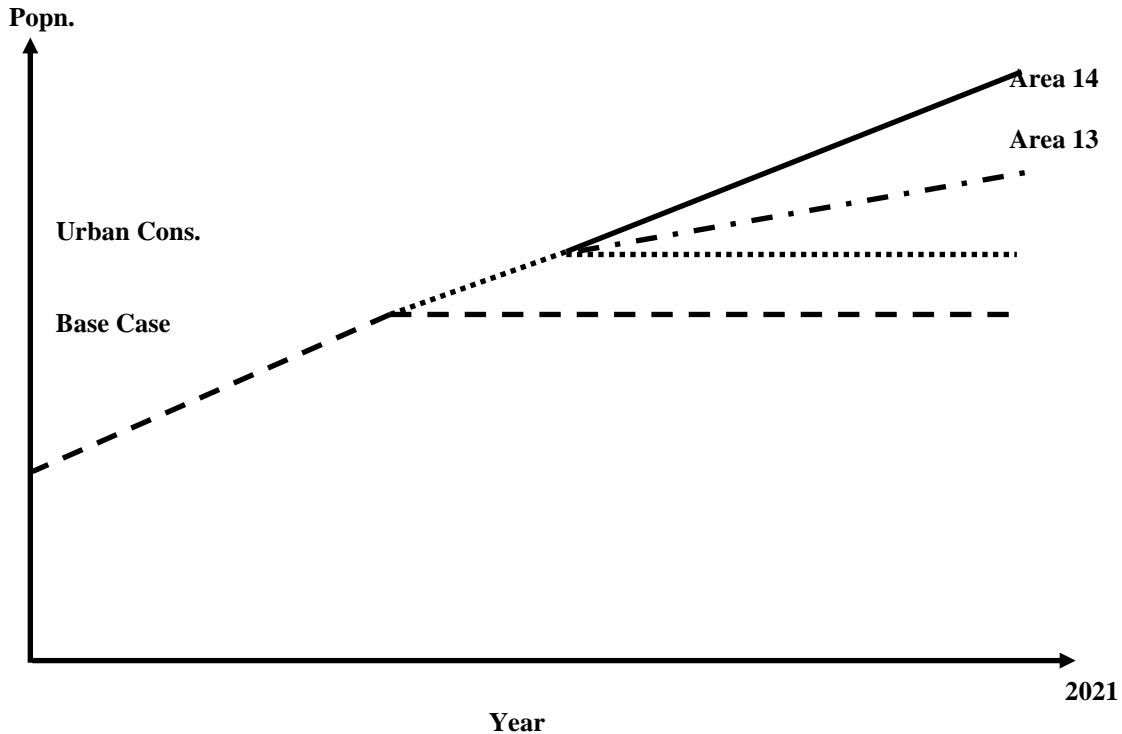
options, with perhaps a lower growth projection applying to the options that incorporate the less attractive potential development areas. Furthermore, growth projections for the urban consolidation option are likely to plateau well before the year 2021 (King and Campbell 2000). This difference in the growth assumption made is illustrated by the following two diagrams.

**Figure 1 - HUGS Growth Assumption**



The HUGS population growth assumption is the same for each option with no consideration of the base case or “without” option scenario.

**Figure 2 – Illustration of Need to Consider Different Growth Assumptions between Options**



The likelihood of different demand profiles between different options has significant implications for just about every criteria used in the analysis but particularly with respect to infrastructure cost, revenues, time frames of costs and revenues etc.

#### Omission of relevant criteria

In BCA, it is necessary to identify the costs and benefits over time of the different options relative to the identified base case. These costs and benefits include those to Council, State Government, households and developers.

There are many guidelines for identifying benefits and costs in BCA such as:

- include only costs and benefits that change the net benefit to society;
- include only incremental benefits and costs of alternatives;
- exclude sunk costs and benefits that do not change net social benefits of alternatives;
- exclude transfer payments;
- avoid double counting;
- exclude or include taxes and subsidies on inputs and outputs as appropriate;
- include government costs at their true opportunity costs;

- consider changes in asset value over the life of the project;
- include all externalities; and
- exclude secondary costs and benefits (Sinden and Thampapillai 1995).

The criteria used in HUGS were arbitrarily selected, albeit through community consultative processes, and did not include all the economic benefits and economic costs of alternatives. For instance, the MCA undertaken for Hastings Council included the capital and operating costs of water and sewerage infrastructure and the capital costs of road improvement. However, economic costs not incorporated in the MCA included:

- maintenance costs of road infrastructure;
- the capital and operating cost of other infrastructure such as stormwater. The options assessment report (ERM Mitchell McCotter 1999) identified that the cost of storm water drainage would be highest in Area 13, however this cost did not feature in the MCA.
- the net development benefits (producer surplus associated with land and house development) under the base case from development of Area 14A that would not occur under all the options apart from Option 4 (Area 14).
- social costs associated with new town Area 13 options, since neighbourhood retail and services will lag development until critical thresholds for viability are reached.

There were also a number of market economic benefits of options that were not included in the MCA such as:

- the producers' surplus benefits from development under the various options;
- additional revenues received by Council in the form of rates and developer contributions that are incremental to the base case; and
- the residual value of infrastructure at the end of the evaluation period.

Therefore from an economic efficiency perspective the MCA did not address all the costs and benefits that are relevant from a net community welfare perspective.

Some social issues also received little attention. Area 14 already has existing neighbourhood facilities and services. Consequently, future population growth that is accommodated in Area 14 would have immediate access to these facilities and services. These services and facilities would then grow incrementally as the thresholds of demand for each service were exceeded. In contrast, neighbourhood facilities and services in Area 13 are likely to lag urban development by many years, making it necessary for inhabitants to travel to Port Macquarie for even basic services and facilities.

### Double counting

While the HUGS MCA omitted a number of relevant economic and social costs and benefits it also considered a number of issues more than once i.e. there was double counting.

The first four economic indicators are all different ways of looking at the cost of infrastructure. The first economic indicator related to the undiscounted capital cost of infrastructure (i.e. water, sewerage roads). The second economic indicator examined the total discounted capital and recurrent costs of water and sewerage. The third indicator related to the total discounted capital costs of roads. The final indicator converted the overall total discounted costs (sewerage water and roads, excluding recurrent costs of roads) to a per additional dwelling and per additional person ratio.

The following three economic indicators are all different ways of interpreting the cost of infrastructure in terms of charges that will need to be applied to recoup the costs e.g. anticipated developer contributions per lot/dwelling, impact on household rates/charges, and effect on Council debt and assets.

Consequently, double counting occurred. Infrastructure costs featured seven times in the MCA. Of the seven criteria relating to infrastructure costs, only discounted water and sewerage costs and discounted roads are relevant from an economic efficiency perspective (although other discounted infrastructure costs should be included in a BCA).

Double counting also featured in the social and environmental criteria that were used. For instance, three of the social criteria related to public transport i.e. public transport ability (as measured through population density), distance to a transport node (measured in kms) and frequency of public transport. Of the environmental criteria, three criteria related to area of habitat affected i.e. impact on flora and fauna, impact on areas of conservation significance and extent of habitat fragmentation.

### Measures of value

While some criteria were measured in a qualitative manner others were measured in dollar terms. Those measured in dollar values were often measured inappropriately from an economic efficiency perspective.

In BCA, costs are measured in terms of opportunity costs and benefits are measured in terms of willingness to pay. The net benefit to consumers is referred to as consumers' surplus and the net benefit to producers is referred to as producers' surplus.

The measure to judge the performance of alternatives against the criteria *relative attractiveness* was based on standardised land prices per type of dwelling. In a BCA the correct measure of benefit to developers would be that of producers' surplus i.e. price received by developers less the costs of development having regard to the time frame of construction and release of the land and houses.

Similarly for criteria such as *impact of flora and fauna* which were measured based on the area of loss of habitat, the correct measure of impact in a benefit cost framework would be consumers' surplus. That is the amount that households would be willing to pay to prevent the loss of habitat.



### Consideration of Time

In BCA, discounting of costs and benefits is undertaken to ensure that they are being compared on a common basis i.e. present values.

In the MCA of HUGS, some criteria that were measured in dollar terms such as “capital cost of infrastructure” were measured in undiscounted terms, meaning that there can be no meaningful comparison between the options since they involve different time profiles of costs.

Furthermore, some criteria that were measured in monetary terms were discounted (e.g. full discounted cost of infrastructure) while others were not (e.g. capital cost of infrastructure) further complicating the comparison of alternatives.

With respect to some qualitative criteria, consideration of time in measuring the performance of alternatives against criteria was given little consideration. For instance, against the criteria of *Carbon dioxide emissions*, Option 2 ranks higher than Option 4 on the basis of forecast total vehicle kilometres travelled by area in the year 2021. However, it may take over 10 years for the regional centre planned for Area 13 (Option 2) to develop i.e. population levels to exceed critical thresholds. Hence, in the first 10 years or so vehicle kms travelled are likely to be greater for Area 13 than Area 14, which already has a local centre.

### Implicit weights

The selection of criteria results in implicit weighting of the importance of different issues and groups of issues.

The fact that the MCA included 8 economic criteria, 12 social criteria and 6 environmental criteria gave an implicit weighting in the analysis towards the social criteria, followed by economic criteria, and then environmental criteria.

Within the economic group of criteria there were seven that related to cost and one that related to development benefits (*Measure of Attractiveness*). Hence there was an implicit weighting towards least cost options rather than those that would provided the greatest net benefits.

Because of the double counting issue referred to above some other aspects of the analysis also received greater relative weight. For example, there were three criteria related to public transport issues (i.e. distance to public transport node, public transport ability, frequency of public transport), five criteria related to access to facilities (i.e. accessibility to local shops, accessibility to subregional centre, accessibility to regional and sporting facilities, accessibility to health services, accessibility of subregional shops) and three related to habitat clearance (impact on flora and fauna, impact on areas of conservation significance, extent of habitat fragmentation).

Sometimes analysts explicitly give weightings to different criteria to address subjectively the problems associated with each criteria being given the same weighting in the analysis. In MCA of HUGS there was no explicit weighting of criteria and hence each criteria was given the same weight. For instance, the full discounted cost of infrastructure (water and sewerage) which for Option 2 was valued at \$94,268 was given the same weight as the full discounted capital cost of roads which for Option 2 was valued at \$10,151. For any particular option the costs of discounted capital costs of roads were between 0% and 34% of the discounted capital and operating costs of water and sewerage.

Using an ordinal ranking system the difference between Option 1 and Option 2 for the criteria of *full discounted cost of roads* was 1. Similarly the difference between Option 2 and Option 3 was also 1. However, when the real differences in dollar figures are examined the difference between option 1 and option 2 was \$10,151 whereas the difference between Option 2 and Option 3 was \$5,709. The ordinal ranking approach was not able to capture these scale differences between options.

To determine the overall desirability of options to accommodate growth in the Hastings LGA, the MCA summed the rankings for each option (implicitly giving each criteria equal weighting and not capturing scale differences in the performance of options against different criteria). The option with the lowest summed ranking was the preferred option i.e. Option 1 followed by Option 2 etc. The problem with this approach can be readily illustrated with the following simple example. Suppose there were only two Options (Option 1 and Option 2) and two criteria (cost of infrastructure and revenue generated), and the two criteria also happened to be the only economic costs and benefits of relevance. Now assume the options performance against each of the criteria is as represented in the following table.

Table 4 – Illustration of How Totalling of Rankings May Not Be the Same as the Option with the Highest Net Benefits

Criteria	Option 1	Rank	Option 2	Rank
Criteria 1 - Cost of infrastructure (PV)	-\$10M	2	-\$5M	1
Criteria 2 - Revenue Generated (PV)	\$100,000	1	\$50,000	2
Net Benefits/Total Ranking	-\$9.9M	3	-\$4.95M	3

Under the MCA approach, because the ranking against the cost of infrastructure criteria is given the same weight as the ranking against the revenue criteria, regardless of the magnitude of the differences in actual values, both options are considered equal overall. However, on a simple calculation of the net benefits of the 2 options it can be seen that Option 2 has greater net benefits by \$4.05M (i.e.  $-\$4.95 - (-\$9.9M) = \$4.05M$ ).

#### MCA as Substitute for Appropriate Rigorous Analysis

While economic criteria were deemed to be important enough to be included in the HUGS MCA, the main economic criteria recognised by economists for evaluating the desirability of different resource allocations and recognised as an integral component of

any consideration of Ecologically Sustainable Development i.e. economic efficiency (Young 1992) was not.

## 6. Conclusion

While MCA often includes economic, financial, social and environmental criteria these criteria and the measurement of the performance of alternatives against these criteria is often a substitute for rigorous economic, social or environmental analysis.

If decision makers are genuinely interested in how alternative resource allocation options compare against economic, financial, environmental and social criteria, then there is no substitute for undertaking separate specific detailed evaluations such as benefit cost analysis, financial analysis, environmental impact assessment and social impact assessment. Attempts to integrate the results of these assessments using the subjective and arbitrary procedures of MCA only serve to obscure the results of individual analyses and the tradeoffs involved between objectives.

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