A GUIDE TO ECONOMIC ASSESSMENT FOR DECISION MAKERS

An Outline of Economic Methods

and

A Response to the Land and Environment Court Issues with the Economic Assessments of the Warkworth Extension Project

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1 INTRODUCTION

Methods used by economists to evaluate projects can be confusing to decision-makers. Many guidelines and texts exist but they can be confusing for those without an economics background.

Environmental groups opposing developments are currently exploiting this fact in submissions, media campaigns and evidence to Planning and Assessment Commissions and the Land and Environment Court.

This document provides a simple dot point summary of some of the methods that are used by economists and where they fit within a decision-making framework. The focus is on:

- benefit cost analysis (BCA);
- choice modelling (CM); and
- regional economic assessment (input-output (IO) analysis and computable general equilibrium (CGE) modelling).

In context of the information provided on these methods, a detailed response is then provided to the main economic findings provided in the Land and Environment Court Judgement on the Warkworth Extension Project.

2 ECONOMIC METHODS

2.1 Benefit Cost Analysis

2.1.1 Introduction to Benefit Cost Analysis

1. BCA is the primary way that economists evaluate projects and policies and is the main method for addressing requirements in the Environmental Planning and Assessment Act 1979 for assessment of economic effects.

2. BCA evaluates whether the well-being (welfare) of the community is in aggregate improved by a project i.e. whether there is an increase in economic efficiency.

3. BCA is concerned with the single objective of economic efficiency. It does not address equity or other objectives of government. Decision-makers therefore need to consider the economic efficiency implications of a project, as indicated by BCA, alongside the performance of a project in meeting other, often conflicting, government goals and objectives.

4. BCA provides a comparison of the present value of aggregate benefits to the community, as a result of a project, with the present value of the aggregate costs.

5. If aggregate benefits are greater than aggregate costs then a project is welfare improving for the community and hence is desirable from an economic efficiency perspective.

6. Costs and benefits are defined and valued based on supply and demand – the aggregation of values held by individuals in the community. These values are revealed in markets or by nonmarket valuation methods such contingent valuation and choice modelling.

7. Values in BCA are anthropocentric i.e. things only have value to the extent that humans value them.

8. BCA is generally undertaken at the national level i.e. to examine the costs and benefits of a project to Australia. However, where major impacts spill over national borders e.g. greenhouse gas emissions, then BCA should be undertaken from a global as well as national perspective. BCA at a sub-national perspective e.g. NSW, is not recommended as it results in a range of costs and benefits from a project that accrue to Australia being excluded, making BCA a less valuable tool for decision-makers.

9. BCA does not include effects in secondary markets i.e. downstream users of a good or service or backward linkages i.e. suppliers of inputs to production.

2.1.2 Benefit Cost Analysis of Mining Projects

1. Mineral ores are intermediate goods i.e. they are an input to other production processes such as production of electricity and steel making. Only the costs and benefits of mining and delivery to port or domestic user are relevant to a BCA of a mining project.

2. BCA of mining proposals invariably involves a trade-off between:

   - the net production benefits of a project – comprised of royalties, company tax and net profits; and
   - the environmental, social and cultural impacts (most of which are costs of mining but some of which may be benefits).

3. Net production benefits can be estimated in monetary terms based on market data on the projected financial[1] value of coal less the capital and operating costs of projects, including opportunity costs of capital and land already in the ownership of mining companies. This is normally commercial-in-confidence data provided by the proponent.

4. The value of coal that is relevant for inclusion in the analysis is not the value of coal today but the projected value of coal over the life of the project. This requires projection of the value of the coal, which is normally estimated in United States Dollars, and projection of the Australian Dollar: United States Dollar exchange rate.

5. The consideration of environmental, social and cultural impacts in BCA relies on the assessment of other experts contributing information on the biophysical impacts. Only where biophysical impacts are identified by specialists can they be included in BCA.

6. The environmental impact assessment process results in detailed (non-monetary) consideration of the environmental, social and cultural impacts of a project and the proposed means of mitigating the impacts.

7. At its simplest level, BCA may summarise the consequences of the environmental, social and cultural impacts of a project (based on the assessments in the EIS/EA), for people's well-being. These qualitatively described impacts can then be considered alongside the monetised net production benefits, providing important information to the decision-maker about the economic efficiency trade-offs involved with a project.

8. At the next level of analysis, attempts may be made to value some of the environmental, social and cultural impacts. Valuation methods include using benefit transfer or, subject to available resources, primary non-market valuation methods.

9. Benefit transfer involves using information from the EA/EIS on the physical magnitude of impacts e.g. clearing of 2ha of native vegetation, and applying per unit value estimates e.g. $1000/ha, obtained from non-market valuation studies undertaken in other policy contexts.

10. Primary non-market valuation methods include choice modelling and the contingent valuation method where a sample of the community is surveyed to ascertain their willingness to pay to avoid a unit change in the level of a biophysical attribute. Other methods include the property valuation approach where changes in environmental quality may result in changes in property value.

11. To avoid double counting of impacts, only residual impacts, after mitigation, offset and compensation, require additional consideration.

12. In attempting to value the impacts of a project on the well-being of people there is also the practical principle of materiality. Only those impacts which are likely to have a material bearing on the decision need to be considered in BCA.

13. Even where no attempt is made at valuing environmental, social and cultural impacts or there are debates about the level of impacts, BCA lays out the economic efficiency trade-off. The monetised estimate of net production benefit provides a threshold value that non-monetised impacts must exceed for the project not to be desirable from an economic efficiency perspective.

[1] In limited cases the financial value may not reflect the economic value and therefore it is necessary to determine a shadow price for the coal.

2.2 Introduction to Choice Modelling

1. The benefit/value of an environmental good to a person is measured by their willingness to pay for it.

2. The benefit/value of an environmental good to the community is the sum of the willingness to pay of all individuals in the community.

3. Choice Modelling (CM) is a non-market valuation survey method used to estimate respondents' preferences/values for environmental, social and cultural changes.

4. The values estimated in CM applications are consistent with the principles of BCA and can be incorporated into BCA studies.

5. The CM questionnaire describes within choice sets, the base case and alternative impact scenarios of a project in terms of different levels of environmental, social and cultural attributes, including a payment/cost attribute.

6. CM does not ask a direct willingness to pay question.

7. By observing people's choices between alternatives with differing levels of each attribute it is possible to determine the trade-offs respondents are willing to make between these attributes. Because one of the attributes is monetary it is possible to estimate respondent willingness to pay (WTP) for changes in the levels of the environmental, social and cultural attributes.

8. While the attributes included in CM studies must be relevant to policy makers they fundamentally must represent changes in outcomes that respondents value (are demand relevant). Respondents are therefore primarily responsible for determining what environmental attributes to include in CM studies.

9. There is a limit to the number of environmental attributes included in CM studies due to cognitive burden. In environmental policy applications of CM, attributes numbers tend to be limited to around five or six.

10. Attribute level ranges for environmental, social and cultural attributes should be sufficient to capture the range of impacts that may occur because of a project. The upper level of attributes must be higher than the highest impact that is possible from project options.

11. The upper level of the cost attribute that is included in choice sets reflects a level of disposable income that few people are willing to give-up.

12. The population sampled depends on the significance level of the issue and aims to capture a sample of the main population that would hold values for the impact. The literature has found a distance decay relationship where values held by respondents decline with distance from the site of interest. Therefore unless an impact is of national significance some subset of the population is sampled.

2.3 Assessment of Regional Economic Impacts

2.3.1 Input-Output Analysis

1. IO analysis is a cost effective and simple method for estimating the market economic activity i.e. financial transactions and employment, in a specified region that is associated with a project.

2. IO analysis was developed by Wassily Leontief for which he received the Nobel Prize in Economics.

3. IO analysis is a static analysis that looks at impacts in a particular year e.g. a typical year of a projects operation.

4. IO analysis has historically been applied at the regional level to assess the impacts of individual projects.

5. IO analysis involves the development of an input-output table representing the buying and selling of goods and services in the economy. These fixed average ratios are used to estimate the direct and indirect impacts of a change in expenditure in a region.

6. IO analysis identifies the direct and indirect additional (positive) regional economic activity associated with a project in terms of a number of indicators of economic activity – output, income, value-added[2] and employment.

7. Economic activity measures used in IO are not measures of benefits and costs relevant to a BCA.

8. IO analysis does not attempt to examine nonmarket environmental, social or cultural impacts.

9. The estimation of impacts in IO analysis are based on a number of simplifying assumptions – most notable is that the regional economy has access to sufficient labour and capital resources (from both inside and outside the region) so that an individual project does not result in any regional price changes e.g. wages in other industries or house rentals, which would lead to contractions ("crowding out") of economic activity in other sectors in the region.

10. For the assessment of the impacts of individual projects on small open regional economies e.g. the Hunter Valley, this is a reasonable assumption.

11. Nevertheless, the results of IO modelling can be seen as representing an upper bound for the net economic activity associated with a project.

2.3.2 Computable General Equilibrium Modelling

1. CGE modelling is an alternative more expensive, complicated but theoretically more sophisticated method for estimating the economic activity associated with a project.

2. The CGE modelling can be dynamic or comparative static[3] and has historically been applied at the State and National level for major policies and developments.

3. CGE modelling estimates the additional net (positive and negative) regional economic activity associated with a project in terms of a number of economic indicators – including value-added and employment – but also real income, government tax revenue and components of value-added.

[2] Value-added is the difference between the gross value of business turnover and the costs of the inputs of raw materials, components and services bought in to produce the gross regional output.

[3] Comparative static models compare one equilibrium point with another but do not trace the impact path along the way. Dynamic models give year by year impacts of a shock.

4. Economic activity measures used in CGE modelling are not generally measures of benefits and costs relevant to a BCA.

5. CGE modelling does not attempt to examine nonmarket environmental, social or cultural impacts.

6. CGE modelling is underpinned by an IO database as well as a system of interdependent behaviour and accounting equations which are based on economic theory (but mostly without econometric backing at the regional level).

7. The equations in CGE models ensure that any change in demand in a region, no matter how small, translates into some change in prices and hence there is always some 'crowding out' of other economic activity in the region.

8. CGE results can be very sensitive to changes in these behavioural assumptions.

9. 'Crowding out' of other economic activities estimated via CGE modelling does not reflect losses of jobs but the shifting of labour resources to higher valued economic activities.

2.3.3 Comparison of IO Analysis and CGE Modelling

1. Both IO analysis and CGE modelling are identified in the Department of Planning and Infrastructure's draft *Guideline for Economic Effects and Evaluation in EIA* (James and Gillespie 2002) as appropriate methods for examining regional economic impacts i.e. impacts on economic activity – the size and structure of an economy.

2. Which modelling approach best represents the true situation depends on whether and to what extent price changes occur at a regional level as a result of individual projects. This is an empirical issue and would depend on the migration of labour into the region, commuting of labour and timely management of land releases by Councils. Few studies exist that examine this issue.

3. Regional economic activity is just one piece of information that decision-makers may take into account in considering a project.

4. The main concern that economists e.g. the Productivity Commission, have with both IO and CGE is using the results to justify a project when the appropriate economic justification for a project is its economic efficiency – as indicated by BCA.

3 RESPONSE TO THE LAND AND ENVIRONMENT COURT ISSUES

3.1 Response to BCA Issues

3.1.1 The BCA Does Not Include All the Things a Decision Maker Must Consider

The Judgement identifies the BCA and the CM on which the BCA depends as deficient as *"it does not consider all the relevant matters that need to be considered by an approval authority in determining a project"* (452).

This is an inappropriate criticism since BCA does not purport to address all the relevant matters that need to be considered by a decision-maker. BCA is only concerned with a single objective of the EP&A Act and governments i.e. economic efficiency. Even in context of economic efficiency, it is impractical and unnecessary to value all the impacts of a project. The focus of BCA is to identify the economic efficiency trade-off framework and where possible value the main economic costs and benefits.

BCA does not address other objectives of the EP&A Act and governments. Decision-makers therefore need to consider the economic efficiency implications of a project alongside the performance of a project in meeting other conflicting goals and objectives of the EP&A Act and government.

3.1.2 The BCA is Trying to Supplant the Decision-Making Role of the Court

The Judgement considers that the BCA *"seeks to supplant the Court's essential task, …, of applying the appropriate weight to the relevant matters"* (para 484).

This is incorrect. BCA provides information relating to a single objective of the EP&A Act and Governments. Decision-makers therefore need to weigh up the economic efficiency implications of a project with the implications of a project for other conflicting goals and objectives of the EP&A Act and government.

Within the BCA framework, it is the community's weights and values for impacts that are important, with this information obtained from market transactions and nonmarket valuation studies.

3.1.3 The BCA Does Not Value all the Non-market Impacts Identified in the EIS

The Judgement considers that there "*are non-market values that have either not been, or have been inadequately been, taken into consideration in the BCA, including impacts of noise and dust, impacts on amenity values and ecosystem services. The omission of these non-market values is a deficiency of the BCA" (para 482).*

BCA is a way of logically and rationally organising information on the economic efficiency benefits and costs of a project. Standard guidelines on BCA identify that rarely can all benefits and costs of a project be valued, and rarely can the most important items be valued with certainty (Sinden and Thampapillai 1995). The level to which costs and benefits are valued is therefore not prescribed in any guidelines. Valuation of all the potential impacts of a project is idealistic and unrealistic.

Where nonmarket valuation is included in a BCA, it generally focuses on the main potential impacts of a project or policy. This is what the BCA and CM of the Warkworth Extension Project focused on – the major categories of potential impact of the Project.

Contrary to the statements in the Judgement, nonmarket valuation methods were used to value all of the following main environmental, cultural and social impacts of the Project, based on the assessment of impacts in the EA:

- Greenhouse gas emissions – valued using an estimate of the global and Australian damage cost of carbon
- Noise and dust impacts – valued by incorporating the full cost of property acquisition rather than the partial property devaluation for properties significantly impacted by the Project.
- Groundwater and surface water impacts – valued by inclusion of an allowance in the capital and operating costs for the acquisition of Water Access Licences and lowering of private bores if impacted;
- Visual amenity impacts – valued by including the capital and operating costs of mitigation measures in the production costs of the mine;
- Aboriginal heritage impacts – valued using the results of the Project CM study;
- Clearing of Endangered Ecological Communities (EEC) – valued using the results of the Project CM study;
- Provision of EEC offsets – valued using the results of the Project CM study;
- Non-market employment impacts – valued using the results of the Project CM study;
- Traffic and transport impacts – valued using estimates of increased vehicle operating costs and vehicle accident costs from increased kilometres travelled because of the closure of Wallaby Scrub Road.

The BCA was one of the few in NSW, for public or private sector projects, that has included primary nonmarket valuation.

One of matters identified in the Judgement as being omitted was ecosystem services (para 482). This is despite the Judgement identifying that the economists agreed that *" it is difficult to say whether there would be any impact on environmental services values as a result of the Project" (para 482).* If biophysical impacts of a project are not identified by environmental specialists then they cannot be incorporated into the analysis, even in a qualitative manner.

Also, as identified by the NSW Government guidelines, there is also the practical principle of materiality. Only those impacts which are likely to have a material bearing on the decision need to be considered in BCA (NSW Government, 2012). For example, if the net present value of a project is $20 million, costs or benefits valued at less than $1 million are unlikely to be material (NSW Government, 2012).

3.1.4 The BCA Does Not Value the New Impacts Identified in the Judgement

One of the deficiencies of the BCA raised in the Judgement, relates to the fact that the BCA did not include "*the relevant matters at the level of particularity required, or in accordance with the factual findings and inferences I have made in relation to the relevant matters" (para 452).* This partly relates to the fact that the Judgement is in disagreement with the proponent's environmental specialists about the noise, dust and ecological impacts of the Project. However, it is circular argument to suggest that the BCA should somehow have foreseen this disagreement

Even this disagreement about the level of impacts does not negate the value of the BCA to the decision-maker. Based on the assessments undertaken in the EA, and the valuation undertaken of those assessments, the Project was identified as having net social benefits to Australia of $1.253B.

While the major environmental, cultural and social impacts (as assessed in the EA) were quantified and included in the Project BCA, any other residual environmental, cultural or social impacts that remain unquantified would need to be valued at greater than $1,253M for the approval of the Project to be questionable from an Australian economic welfare perspective. In other words, the additional (economic welfare) impacts that are identified in the Judgement, that were not identified in the EA would need to be valued at greater than $1,253M, to reject the project on economic efficiency grounds.

Put another way there is an opportunity cost to Australia of $1,253M, including $252M in royalties to NSW and $515M in company taxes, from rejecting the proposal because of the additional environmental impacts identified in the Judgement.

3.1.5 The BCA does Not Incorporate Equity Considerations

The Judgement is critical of the economic analysis because it has not addressed intra and intergenerational equity. The Judgement considers that "*These failures to consider adequately intergenerational and intra-generation equity limit the utility of the BCA and CM to the Court for the purposes of evaluating, weighting and balancing the relevant matters to be considered in determining the Project" (Para 495)*

However, this is an inappropriate criticism of BCA since BCA is only concerned with a single objective of the EP&A Act and governments i.e. economic efficiency. That is, whether the aggregate benefits of the Project exceed the aggregate costs. Welfare economics and BCA are explicitly neutral on the distribution of costs and benefits. There are no welfare criteria for determining what is a fair, an equitable or a preferable distribution of costs and benefits. As identified by Sinden and Thampapilla (1995, p. 210) "the method can hardly be criticised for something it does not pretend to do". "Matters relating to distributional effects are usually left to the political process" (James and Gillespie 2002).

The fact that BCA does not consider equity (and other) issues should not limit the utility of it to the Court as its goal is to examine one, and only one, of many conflicting goals and objectives of relevance to the decision-maker. Decision-makers should have regard to the economic efficiency implications of the Project alongside the performance of the Project in meeting other conflicting goals and objectives of the EPA Act and government.

3.1.6 The BCA Did Not Consider the Distributional Justice for the Components of Biodiversity

A particular entity that the Judgement identifies the BCA failed to consider in regards to distributive justice was the *"components of biological diversity, such as the EECs and threatened fauna within the disturbance areas, which would also suffer the burdens of the Project"* (para 490).

However, BCA is not concerned with distributional considerations. It leaves judgements about distribution to the political process. BCA is also not concerned with ethical issues about the rights or feelings of plants and animals. It is therefore inappropriate to criticise and discount the BCA for something it does not pretend to do (Sinden and Thampapillai 1995).

Like the EP&A Act which is concerned with *"all aspects of the surroundings of* ***humans****, whether affecting any human as an individual or in his or her social groupings",* BCA is anthropocentric. The environment has values for consideration in BCA to the extent that humans value it.

3.1.7 The BCA Did Not Consider Appropriately the Principle of Ecologically Sustainable Development

The Judgement also criticises the economic assessment because "*With respect to intergenerational equity, the BCA and CM did not consider adequately, or accord sufficient weight to, this principle of ESD"* (para 493).

However, BCA is only concerned with a single objective of the EP&A Act and governments i.e. economic efficiency. BCA does not explicitly address other objectives of the EP&A Act and governments such as ESD. It is therefore inappropriate to criticise and discount the BCA for something it does not pretend to do (Sinden and Thampapillai 1995). ESD considerations are therefore generally addressed in other sections of EISs.

Nevertheless, BCA and nonmarket valuation are not inconsistent with the principles of ESD. Nonmarket valuation directly addresses the principle of improved valuation of environmental impacts. This valuation is

based on the values held by individuals in the society i.e. current generations. There is no way to measure the value that future generations hold for impacts of current day projects as they are not here to express it. Nevertheless, as identified by Boardman *et al.* (2001) this is not considered a serious problem for BCA because:

- few policies involve impacts that only appear in the far future. Consequently, the willingness to pay of people alive today can be used to predict how future generations will value them;
- most people alive today care about the well-being of their children, grandchildren, and great grandchildren, whether or not they have yet been born. They are therefore likely to include the interests of these generations to some extent in their own valuations of impacts. Because people cannot predict with certainty the place that their future offspring will hold in society, they are likely to take a very broad view of future impacts; and
- discounting used in BCA also reduces the influence of costs and benefits that occur a long way into the future.

Furthermore, increased wealth (e.g. royalties and taxes) generated by projects that have a net benefit to the community can be used to improve the services (e.g. health, school and community services) and environment (e.g. protected areas) that are passed on to future generations.

3.2 Response to Choice Modelling Issues

3.2.1 The Australian Population Should Have Been Sampled

The Judgement considers that *"the distribution of the surveys to NSW was too limited and that the broader Australian community could well place values on the ecological and Aboriginal cultural heritage impacts of the Project*. *The national-wide concern and campaigns to protect natural areas in Tasmania (such as Franklin-Gordon, Lemonthyme and Southern Forests, and more recently, the Tarkine) and in Queensland (Daintree and the Wet Tropics) are illustrations" (para 470).*

CM practitioners have to determine the population that may hold values for the attributes under consideration. Recognising the distance decay function for values reported in the literature (Rolfe and Windle 2012), the geographical extent to which a project impacts people is a key consideration: Is the project of local, state or national concern. For example, in Australia the National Land and Water Audit CM study (van Bueren and Bennett 2000) investigated the costs of land and water degradation across Australia and hence the sampling strategy for that study involved the Australian population. In contrast, a study commissioned by the NSW EPA on water reforms and environmental flows in major rivers in NSW (Morrison and Bennett 2004), sampled NSW households as well as households living in the catchments of the major rivers.

The Warkworth Extension Project and its non-market value impacts were not considered of national significance and hence sampling was undertaken of NSW households. The view expressed in the Judgement, that the environmental issues in this Project can be likened to the Franklin-Gordon, Daintree and Wet Tropics, and hence can be considered of National significance, is highly questionable.

Even if it is considered that a broader population should have been sampled, the implication of this for the BCA would be that the negative nonmarket impacts (clearing of EEC, Aboriginal heritage impacts) and positive nonmarket impacts (EEC offsets and employment) of the project have been understated. The economic efficiency trade-off question then becomes whether the additional net impacts are valued at greater than $1,253M.

3.2.2 Deficiencies in Information Provided in the CM Questionnaire

Introduction

The Judgement considers that the *"information provided to survey respondents was not, ….., sufficiently accurate to enable them to make informed and meaningful choices"* (paragraphs 471).

Using ecological impacts as an example the Judgement considers that the information provided regarding Endangered Ecological Communities (EECs) was "*inaccurate, indiscriminate and uninformative*" (para 471).

Inaccurate Information on EECs

The Judgement elaborates that the information was *"inaccurate as there are four, not three, EECs affected by clearing"* (para 472).

However, the main EECs impacted by the Project are Warkworth Sands Woodland, Central Hunter Box Ironbark and Hunter Lowland Redgum Forest. While there is a minor occurrence of a fourth EEC, called Central Hunter Spotted Gum Ironbark Forest, it is extremely similar to the Central Hunter Box Ironbark. So much so that Cumberland Ecology amalgamated it with Central Hunter Box Ironbark for the purposes of offsetting. Consequently, for the purpose of the CM, which examined the value of the community for the clearing of EEC and the offsetting of EEC, it was also amalgamated with Central Hunter Ironbark. The questionnaire therefore referred to three EECs being impacted by the Project. However, the ultimate focus of the CM was on the total area of EECs cleared not the level of each EEC cleared.

Other information inaccuracies referred to in the Judgement included that "*the total area to be cleared (under the existing consent and the Project approval) is less than stated (around 765ha instead of 900ha)"* (para 472).

However, this criticism misunderstands the nature of CM. Because CM studies are undertaken before the precise impact of a policy has been determined, the range in impact levels for each environmental attribute must represent an upper and lower bound of potential impacts. The upper bound of potential impacts of the Project was estimated prior to completion of the EIS as 900 ha. The upper bound is **not** meant to represent the actual level of impact as suggested in the Judgement. The fact that the upper bound level of impact is higher than the actual level of impact is also not a cause for concern. This is common to every application of CM.

From the choices that respondents to the CM questionnaire make, it is possible to estimate how much respondents are willing to pay to avoid an additional hectare of EEC being cleared. It is this unit value or implicit price that is then applied to the actual area cleared as a result of a project to estimate the economic welfare impact.

Indiscriminate Information on EECs

The Judgement considers that the information provided to respondents is indiscriminate *"in that it groups the four disparate and heterogeneous EESs to be cleared by the Project…..into one homogenous category of EECs"* (paragraph 472).

In CM the policy situation and environmental and non-environmental values being estimated need to be summarised into a representative set of attributes (Rolfe and Wang 2008). These attributes should represent the most important characteristics and trade-offs of the policy choice (Rolfe *et al.* 2008). However, the number of attributes should not be so large as to create a cognitive burden for respondents (Mogas *et al*. 2002). There is therefore discretion about attributes to include (Rolfe and Wang 2008) and there is a trade-off between choice complexity and information elicitation (Rolfe *et al.* 2008).

In environmental policy applications of CM, attributes numbers tend to be limited to around five or six. In the Warkworth CM application six attributes that were selected to represent the major potential non-market environmental, cultural and social impacts of the Project were:

- clearing of EEC;
- offsetting of the clearing of EEC through:
  - planting of EEC in the region; and
  -protecting existing EEC in the region.
- impact on highly significant Aboriginal sites;
- impact on rural families in the small rural community;
- years that the mine provides 975 jobs.

EEC was treated as a single amalgamated attribute. While at a micro-level EECs are clearly heterogeneous, in the context of the broader level of assessment that is provided by CM, they can and should be treated as a single attribute. There are no CM studies in the world where vegetation attributes of the same level of significance are disaggregated into individual communities. Indeed most studies where vegetation is cleared utilise a single vegetation attribute.

While the attributes must be relevant to policy makers they fundamentally must represent changes in outcomes that respondents value (are demand relevant) (Bennett, 1999; Blamey *et al.* 2000; Blamey *et al.* 1998). The attributes that matter are those that are relevant to individuals in the community (Hensher *et al.* 2005, p. 72). The relevant attributes for inclusion in CM are determined through qualitative research methods such as interviews, focus groups and literature reviews (Adamowicz *et al.* 2008; *Hensher et al.* 2005). For the Warkworth CM study, attributes and there descriptors were developed and tested in a series of four focus groups. These focus groups confirmed the relevance of these attributes to them. Not a single focus group participant considered that there should be an attribute for each of the EECs.

Uninformative Information about EECs

The Judgement identifies that the CM questionnaire "*is uninformative not only in failing to inform respondents of these matters but also of other information relevant to valuing the EECs to be cleared, including at a general level, what are the endangered ecological communities, why their conservation is important, and what are the threats to their long term survival, and more particularly, what are the relative condition and quality of the EECs to be cleared compared to equivalent EECs in the Hunter Valley, what are the relative condition and quality of the EECs to be cleared compared with those which would remain, and what are the threats to these EECs and whether and to what extent the Project exacerbates, abates or otherwise affects the EECs and their ongoing survival"* (para 473).

The aim in CM is to identify, capture and use as much as possible of the information that an individual takes on board when they process a situation leading to a choice (Hensher *et al.* 2005, p. 72.). However, balance is required to ensure that not too much or too little information is provided and that the respondents understand the information provided to them.

The information provided in the CM questionnaire was developed in consultation with the proponent and its consultants and fine-tuned in a series of four focus groups. The questionnaire that was implemented contained a number of follow-up questions to ascertain the respondents' views about the information that was provided. Refer to Table 1. Contrary to the views expressed in the Judgement, the majority of respondents did not consider that they required more information than provided. The vast majority of respondents also reported that they understood the information provided (refer to Table 1).

Table 1 – Information in CM Questionnaire

	Strongly Disagree (Score 1)	Disagree (Score 2)	Neither Agree or Disagree (Score 3)	Agree (Score 4)	Strongly Agree (Score 5)	Average Likert Score
I understood all the information provided	2%	5%	18%	56%	18%	3.8
I needed more information than was provided	7%	31%	39%	19%	3%	2.8
I found answering Q1-6 confusing	14%	41%	31%	12%	2%	2.5

The Judgement also states *"that the survey respondents were not provided with factual findings and inferences of the kind made in Part 3 of the Judgement as to the value of and impacts on the EECs to be cleared by the Project"* (para 473).

This is not surprising since the CM study was based on the information and assessment of impacts available from experts at the time that the CM was undertaken. However, given the fact that CM deals with the policy trade-offs at a broader level than the consideration of EEC impacts in the Judgement, it is questionable whether the considerations in the Judgement would result in any substantive changes.

3.2.3 The CM Study Did Not Ask Respondents What They Would Be Prepared to Pay

The Judgement is critical of the CM study because it *"did not ask respondents what they were prepared to pay"* (para 479).

Dating back to the US National Oceanic and Atmospheric Administration panel findings in 1993 (Arrow *et al.* 1993), best practice non-market valuation does not directly ask people their willingness to pay for an environmental outcome. This is to overcome strategic bias[4]. Instead, alternative approaches to eliciting the willingness to pay (WTP) of respondents have been developed. The state of the art method is CM, the method used for the Warkworth study. CM does not directly ask people their WTP. Instead, through the use of sophisticated econometric techniques the choices made by respondents can be modelled and the WTP of the respondent for unit changes in the levels of environmental attributes can be estimated.

3.2.4 Cost Values Included in the CM Study

The Judgement is critical of the upper level of cost ($625) included in the CM choice sets. "*The Choice Modelling survey attributed values to each of the choices, range in from zero up to $625, ….." "I agree with Mr Campbell that modelling a situation based on a willingness to pay of survey respondents presented with a range of (cost) levels that has nothing to do with costs, is of limited assistance in the situation confronting a decision maker"* (para 479).

The cost levels used in CM should not be determined with reference to any other costs or benefits of the Project. The cost variable reflects an amount of money (disposable income) that respondents might be willing to give up for changes in the levels of different environmental attributes. The upper level of the cost attribute that is included in choice sets reflects a level of disposable income that few people are willing to give-up. In this way, the modelling captures those that are willing to give up a lot of disposable income and those that are willing to give up very little. The upper bound is determined based on reference to the upper level found in other studies and on evidence from focus groups. This involves getting focus group attendees to answer the questionnaire and examining the proportion of responses where they were willing to give up a high amount and also directly asking them about the cost levels included in the questionnaire and what would be their maximum level they would be willing to give up.

[4] When the respondent does not provide a true answer, in order to influence the outcome.

The assertion in the Judgement that because the value included in the choice sets has nothing to do with costs it is of little value, is fundamentally methodologically incorrect.

3.2.5 CM Study Published in International Peer Reviewed Journal

The CM study undertaken for Warkworth has been published in the Journal of Environmental Economics and Policy (Gillespie and Bennett 2012) and as such has been the subject of rigorous independent (double-blind) peer review by economic experts in the field.

3.3. Response to Input-Output Analysis Issues

3.3.1 CGE Analysis Would Be Superior to IO Analysis

Having regard to the assumptions underlying the Hunter Valley Research Foundation (HVRF) IO analysis the Judge identified that he is *"not persuaded that it is appropriate to accept the conclusion drawn in the IO analysis* (Para 459). It is implied by the Judgement that CGE would have been superior.

IO analysis is consistent with the DP&I guidelines (James and Gillespie 2002). While more complex models such as CGE models can conceptually deal with the positive economic activity impacts of a project and any offsetting negative economic activity impacts, for small regional economies, it is unlikely that these more complex models will surpass the simpler input-output model. Firstly, the small open economy condition minimises the need to address offsetting impacts (see explanation below). Secondly, given the considerable difficulties associated with estimating a large number of coefficients and parameters required for CGE models when there is virtually no local data available, many exogenous assumptions are required to be made by the modeller (e.g. impact of in-migration on house prices and rentals) and so the increased 'fuzziness' is likely to more than offset the increase in model sophistication. Consequently, CGE models are mostly used at the State and National level for significant policy issues.

3.3.2 IO Assumes there is a Ghost Pool of Highly Skilled Yet Unemployed People in the Hunter Region

The Judgement (para 460) mistakenly identifies that *"the IO analysis assumes that there are unemployed resources available* ***within the Hunter region*** *to meet any increase in workforce demand" (para 460).* The Judgement accepts Dr Denniss' evidence that, *"the assumption of the IO model that there is a ghost pool of highly skilled yet unemployed people* ***in the Hunter region****, from which labour for the extension of the existing mine would be drawn, is unrealistic"* (para 460).

However, IO analysis does not make this assumption. Most of the direct labour resources for the Warkworth Extension would come from the existing employees at the mine. No ghost pool of highly skilled yet unemployed labour is required. The additional direct employment may come from employed or unemployed labour resources that already reside in the region, migrate into the region or reside outside the region and commute.

Where the regional labour market is tight a large proportion of the additional labour resources required will not come from the region at all but will migrate into the region or commute into the region. There is evidence that of considerable proportion of new mining jobs are being filled by an in-migrating or commuting workforce. For example, there was an increase in the population of the Hunter Region by 2,088 between 2006 and 2011 with the number of residents of the Hunter Region employed in the mining sector increasing by 1,502 during this period (ABS 2006; ABS 2011). In 2011, 3,678 people who were employed in the mining sector in the Hunter Valley resided outside the region (ABS 2011b).

3.3.3 The Singleton Economy is Near Full Employment

The Judgement (para 460) identifies that *"employment generated from the extension of the Warkworth mine would involve currently employed skilled workers transferring from other industries, but the vacancy thereby create in the other industries may not necessary be filled*" (para 460).

This is a static view that ignores the dynamics of the labour market and ignores the regional focus of IO analysis and the mobility of the labour force. It also ignores the fact that the majority of direct labour required for the Project will come from the existing Warkworth Mine workforce. Additional labour requirements will come from either the local labour force, in-migration or a commuting labour force.

Even where a mining project utilises already employed labour resources from inside the region, there is a filter effect where these jobs are filled by other employed or unemployed labour resources[5], which creates vacancies that are then filled by other employed or unemployed labour resources[5] etc, with these employed and unemployed labour resources[5] coming from both inside or outside the region. The potential labour force to meet demand in the region is considerably greater than just the labour force in the region.

Offsetting impacts (crowding out of economic activity) are likely to be small because the Australian economy is not at full-employment and the regional economy is not a closed economy as assumed in the Judgement. While unemployment rates in Singleton LGA and Upper Hunter at the time were relatively low (2.7%) the unemployment rate for Muswellbrook LGA was 4.7%, the unemployment rate for Newcastle was 5.0% and the unemployment rate for NSW was 5.2% (Department of Education, Employment and Workplace Relations 2013). In December 2013, the unemployed labour force levels were 983 in the Hunter Valley, 84,000 in Newcastle, 192,600 in NSW and 635,300 in Australia. Unemployment levels for the Hunter Valley and Newcastle have been rising since March 2012 (Department of Education, Employment and Workplace Relations 2013).

It is also not true that the Hunter Valley economy is a closed economy. There are interactions between economic agents within the regional economy and those outside the regional economy. Because labour is a mobile resource, particularly in the medium to long run, projects within the region utilise employed and unemployed labour resources[5] from both inside and outside the economy.

These labour resources can migrate into the region or reside outside the region and commute. Consequently, the reference in the judgement to unemployment levels in the region is irrelevant.

3.3.4 The IO Analysis Does Not Look at Environmental or Social Impacts

A more fundamental issue raised in the Judgement with respect to the IO analysis is that *"it only looks to economic impacts, not environmental or social impacts, and then only to economic impacts measured with references to goods and services with a market value, not those without a market value*" (para 463). *"It does not assist in weighting the economic factors relative to the various environment and social factors, or in balancing the economic social and environmental factors"* (para 451).

However, IO analysis is not meant to and does not purport to examine anything apart from the economic activity in the region associated with a project. Just as ecological analysis only looks at one piece of information relevant to decision-making and the noise impact analysis only looks at one piece of information relevant to decision making, IO analysis only looks at one piece of information relevant to decision-making. It is not appropriate to criticise it for something it is not meant to do.

[5] Including the continual addition to the labour force from school leavers and TAFE and University graduates

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