Assessing social and economic impacts associated with changes in the coal mining industry in the Bowen Basin, Queensland, Australia

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Abstract

Purpose – The coal mining industry makes a key contribution to the Queensland economy, and is the underlying driver of employment and economic conditions in many local and regional communities. This article aims to focus on how the social and economic impacts of mining should be assessed and negotiated with local and regional communities.

Design/methodology/approach – The following assessment tools were trialed to ascertain the impacts on communities of changes in the mining industry: extended stakeholder analysis of key community representatives; economic modeling of changes in the level of mining activity; a random survey of householders involving choice experiments to assess tradeoffs; and experimental workshops to assess how residents were prepared to prioritise different community development options.

Findings – The results showed that impact assessment should be addressed using different economic and social science tools to ensure regulatory approval as well as community acceptance.

Originality/value – This article suggests alternative social and economic impact assessment mechanisms that can be applied to any industry and any situation (e.g. growth, decline, new development, simultaneous changes).

Keywords Australia, Coal mining, Stakeholder analysis, Social audit, Input/output analysis, Modelling

Paper type Research paper

Introduction

The coal mining industry makes a key contribution to the Queensland and Australian economies, and is the underlying driver of employment and economic conditions in many local and regional communities. However, questions are sometimes raised about the limited economic impact on local areas where mining occurs, particularly when mines are serviced at a distance by fly-in/fly-out, or drive-in/drive-out operations. There is also debate about the potential social impacts that might be imposed on regional communities.

Currently, in Queensland the potential economic and social impacts are assessed for major projects prior to commencement through an Environmental Impact Assessment (EIS) process. This is focused on individual proposals, and typically involves economic

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impact assessment and social impact assessment components. While the EIS process remains important for the assessment of new projects, it does not cover all the economic and social impacts of mining on regional communities. Key deficiencies include:

- economic and social impacts are rarely assessed after the approvals stage;
- the impacts of changes in the scale of operations, such as those influenced by commodity cycles, are rarely assessed; and
- the impacts of multiple operations on communities are rarely assessed.

There is a number of reasons why economic and social impacts of mining should be assessed carefully through the life cycle of mining operations. First, an understanding of the positive impacts that exist can identify ways of enhancing these for local and regional communities. Second, there are many relationships that are symbiotic between mining operations and communities where improvements in economic and social relationships can make it easier for mining companies to source labour and access contract workers and professional services. Enhancement of these relationships can facilitate regional development.

The third broad reason is that the mining operations can sometimes be associated with negative consequences. Examples of these occur when there are impacts from new developments, flow-on effects from competition in factor markets (including labour), and the consequences of downsizing and/or mine closure. A better understanding of these impacts can help to avoid or mitigate the worst effects.

Existing literature on natural resource planning and management now takes it as given that broad consultation and participation reduces conflict and improves the quality of decision making. In relation to large resource development projects, public involvement is seen as something that should occur early in the life of a proposal in order to ensure that:

- impact assessment processes incorporate local knowledge about social conditions, processes and likely impacts;
- attitudes and perceptions towards proposed change can be identified;
- subjective and cultural impacts may be identified;
- appropriate mechanisms to involve different groups in the decision-making process may be identified;
- the views of the public may be incorporated at the stage of project design and used to maximise benefits rather than simply to compensate the losers following implementation;
- a range of alternative mitigation and development options may be identified and adequately assessed; and
- conflict over projects may be minimised by ensuring that as many interests as possible are considered in decisions and appropriate mitigation strategies are put in place (Lockie, 2001, p. 281).

It is not always clear, however, how communities of interest should best be involved. Current consultation strategies may often be little more than public relations exercises

that are conducted at the beginning of major projects. Ideally, consultation with communities affected by any aspect of mine development, operation or closure should begin as early in the life of a mining project as possible, and then be ongoing. Adequately resourced closure plans should be maintained throughout the life of mining projects to ensure that planned outcomes are achieved. Community acceptance of the plans will then facilitate the acceptance of tenure surrender at the end of mine life. Mine closure issues will vary from site to site, as will appropriate consultative processes.

There is growing interest in finding methods of engaging with communities that result in increasing benefits for both communities and coal mining companies. A recent study addressing complex risks associated with a smelter in South Australia (Proctor, 2005) indicated that there is also interest in community engagement methods in other industries, especially those concerning social and environmental issues.

The focus of this paper is to report some alternative mechanisms for the assessment of social and economic impacts in relation to a coal mining community in central Queensland. The alternative methods, choice modelling and experimental workshops, are compared to the traditional economic and social impact assessment procedures in the context of an established community undergoing some changes in the level of mining activities. Under the current regulatory framework, there is no requirement for industry or government to assess such impacts after initial approval for projects has been granted.

The rest of the paper is structured as follows. An overview of approaches to assess social and economic impacts is provided in section two, while the coal mining industry in the Bowen Basin of central Queensland is described in section three. The results of traditional assessment methodologies for the case study follows: social impact assessment in section four, and economic impact assessment in section five. Results of the two alternative mechanisms then follow: choice modelling in section six and experimental workshops in section seven. Final conclusions are drawn in section eight.

Approaches to the assessment of social and economic impacts

Economic and social sciences offer a range of tools to assess economic and social impacts (Rolfe *et al.*, 2005a). Traditional economic impact assessment (EcIA) generates an estimate of the economic consequences of a particular project on the designated region, e.g. the local economy or larger area. The emphasis is typically on tracing the flow of spending associated with a project to identify changes in sales, income and employment. The focus is on understanding the likely order of magnitude of impacts rather than specific amounts. There are range of tools that can be used for the EcIA such as the use of simple spending multipliers, input output modelling, or general equilibrium modelling (Jensen and West, 2002; Rolfe *et al.*, 2005a). Many of the EISs in Australia involve the use of input-output modelling as the core of the EcIA stage.

Input output (IO) modelling provides a mechanism to estimate how economic impacts can "ripple" through an economy. It is typically performed by building a model of a regional economy where the transactions between each industry sectors, the household sectors, and the economy outside of the region are summarised in a matrix. While a model can be developed from primary data, most IO models are based on national or state-level accounts provided by the Australian Bureau of Statistics.

An economic assessment process can also include cost-benefit analysis (CBA). This provides some evaluation of the net welfare impacts as distinct from the normal focus of an EcIA on the identification of income, spending and employment impacts. A cost-benefit analysis involves the assessment of the net benefits of a project to society as a whole, and should include the costs and benefits of social and environmental impacts alongside of financial, infrastructure and other consequences. It is often difficult to include all of these impacts in a cost-benefit framework, which may explain why these are rarely included. However, the cost-benefit analysis framework is the most rigorous assessment process, while the EcIA approach simply identifies the impacts without any evaluation of whether they provide net benefits to society. Social impact assessment (SIA) is understood in different ways. However there is some agreement that all issues that affect people, directly or indirectly, as a result of a project or policy are pertinent to SIA (Burdge *et al.* 1995). According to Vanclay (2003, p. 6):

> Social Impact Assessment includes the process of analysing, monitoring, and managing the intended and unintended social consequences, both positive and negative, of planned interventions (policies, programs, plans, projects) and any social change processes invoked by those interventions. Its primary purpose is to being about a more sustainable and equitable biophysical and human environment.

SIA involves the consideration of changes in one or more of the following aspects:

- people's way of life, how they live, work, play and interact with one another on a day-to-day basis;
- their culture – shared beliefs, customs and values; and
- their community – its cohesion, stability, character, services and facility; and
- their environment, the quality of air and water people use, the availability and quality of the food they eat, the level of dust and noise they are exposed to, the adequacy of sanitation, their safety and fears about their security and their access to and control over resources (Burdge *et al.*, 1995 and Cox and Miers, 1995 cited in Petts, 1999, p. 304).

The broad ambit of SIA, along with the wide variety of quantitative and qualitative techniques available to SIA practitioners, allows SIA studies to focus on those changes that are most important within a community rather than on those that are easiest to measure or with which researchers are familiar (Burdge *et al.*, 1995; Lockie, 2001). While there is some debate among SIA practitioners over the extent to which SIA should provide a forum for negotiation over the management of interventions, as opposed to the extent to which it should focus strictly on predicting the outcomes of those interventions (Craig, 1990; Dale and Lane, 1994; Dale and Lane, 1995), it is widely accepted that the conduct of SIA should be closely linked to processes of public participation. Unfortunately, there are many examples of EIA studies in which this is not the case, and where a narrow focus on technical issues has lead to inadequate consideration of social impacts, ineffective public participation, and lost opportunities to avoid negative social and economic consequences (Dale *et al.*, 1997; Formby, 1990).

Apart from some common reliance on demographic data to describe community of interest, there is little integration or overlap of social and economic impact assessment techniques in Australia. This lack of integration and overlap may limit the usefulness

of their application (Ivanova *et al.*, 2005). Economic impact assessment may be too divorced from the communities of interest, with little direct input from the stakeholders of interest. Social impact assessment may identify many of the issues important to communities, but without any real assessment of how realistic tradeoffs should be made.

Two alternative assessment techniques have been identified that provide some potential integration of economic and social assessment techniques. Both involve community members in the assessment of potential impacts of new or changed developments, akin to traditional social impact assessment procedures. However, the outcomes of the assessments are quantitative, and involve some assessment in monetary tradeoffs, akin to traditional economic impact assessment. Here the two techniques are outlined in more detail.

The choice modelling technique

Choice modelling is a stated preference technique that has been adapted from conjoint analysis roots in transport and marketing fields to estimate values in economic research. There have been a number of applications to recreation and environmental issues in recent years (e.g. Adamowicz *et al.*, 1998; Blamey *et al.*, 2000; Rolfe *et al.*, 2000; Morrison and Bennett, 2000; Bennett and Blamey, 2001). There has also been growing interest in using the technique to analyse the choices people make in production enterprises (Lusk and Hudson, 2004; Windle and Rolfe, 2005).

Of particular interest are efforts to adapt the technique to analysis of social issues. There have been some developing applications in this area. Rolfe and Windle (2003) used choice modelling to identify how both indigenous and non-indigenous groups valued the protection of Aboriginal cultural heritage sites in central Queensland, Australia. Bennett *et al.* (2004) used the technique to assess community preferences for the preservation of country communities in Australia. Rolfe *et al.* (2005b) report the use of choice modelling to analyze the potential factors that influence relocation choices to regional areas.

Choice modelling involves asking respondents to a survey to make a series of choices about alternative scenarios. Each choice set involves a number of profiles describing the alternatives on offer. One of the profiles describes a current or future status quo option, and remains constant between the choice sets. This effectively gives respondents a default option where they can choose continuation of the current situation. The other alternatives typically offer some improvements on the current situation, but with some monetary cost implications. These alternatives are described by a set of attributes, where variations in the levels of each create differences in the choice sets on offer.

While the choice modelling technique has traditionally been employed to analyse tradeoffs in transport and environmental fields, there is also potential for it to be employed to analyse tradeoffs with social issues. Key advantages of the use of the technique for this purpose are that it involves assessment of the preferences of the community of interest, it focuses attention on the key issues or attributes of importance, and it provides some quantitative feedback about the relative importance of those issues and attributes.

Experimental workshops

Experimental workshops are an application of experimental economics procedures in an applied workshop setting. Many experimental economics processes were developed by Vernon Smith, joint winner of the 2002 Nobel prize for economics. He developed procedures to test in laboratory settings how people responded to economic incentives. Participants would normally be asked to undertake voluntary trades where the incentives are set by the underlying trading and institutional rules. By comparing trading results under different institutional settings, researchers can identify how human behaviour and preferences are influenced by the environmental setting.

Experimental economics can be adapted to test different market mechanisms and resource allocation procedures, so that the most efficient process can be selected before its application in a "real" setting. Although it is more common to conduct experiments in a laboratory environment, a workshop setting can be more appropriate when the participation of case study stakeholders is being sought (Rolfe *et al.*, 2004). An experimental workshop is a form of synthesis between experimental economics and a field pilot without being easily classified into either group. It is like experimental economics in that it utilizes a simulated environment to test how people would form preferences, but is not as tightly controlled as a normal experimental procedure. It is also like a field pilot in that it is focused on a real world application with actual stakeholders, but does not go beyond hypothetical scenarios in a half-day workshop.

The use of experimental workshops has been reported by Rolfe and Windle (2006). The reported workshops involved landholders, where they were given "dummy" farms similar to their own, but with only the most important attributes identified. Workshop participants were then asked to indicate the types of conservation activities that they would be prepared to engage in, and the level of incentives they would require. The workshop format allowed information to be collected about both the potential supply of activities and likely levels of engagement.

This is a potential for the same type of workshop to be applied to community development options where members of the community can "trade" in different options to identify which are generate the most support.

The case study of interest

The Bowen Basin is a large coal mining region in central Queensland, Australia. The basin produced $2.76 billion of coal in 1999/2000 or 34 per cent of Queensland's total mineral production (Department of Local Government and Planning, 2002). Coal mining firms directly employed approximately 16,400 people, and paid them almost $1,000 million in salaries in 1999/2000 (ACIL Consulting, 2002a). A further 15-20 per cent of jobs and salary payments would have been sourced through payments to contractors, and a further $2,200 million was paid to firms that provided goods and services to the mining industry (ACIL Consulting, 2002a). It is estimated that there are up to 60,000 full-time and part-time jobs involved in the provision of goods and services to the mining industry.

Mining activities tend to be carried out by larger scale firms. There were 45 coal mines operating in Queensland during 2003-2004. Of these, 34 were open-cut mines and 11 were underground (NRM, 2005a). Since that period, a sharp increase in coal prices and international demands has stimulated substantial development in the basin. This

includes the development of new mines as well as increases in production from many existing ones.

The mining industry in the region is serviced by a number of smaller towns close to the mine sites, and some regional cities along the coastline. Blackwater is a mining service town of approximately 7,000 people that hosts a number of permanent mine workers as well as temporary workers and contractors. The town is approximately 200 kilometers inland from Rockhampton, a regional city located close to the coast, while Emerald, a regional hub of about 13,000 people, is located 80 kilometers to the west. While Blackwater does service some agricultural and transport industry, the dominant economic driver is servicing several coal mines in close proximity.

As a mining town, the development of Blackwater has been dependent on mine developments over the past 30 years. New mines have brought more people to the town, while mine closures have meant population declines. Changes in employment relations, restructuring of shift patterns and greater use of contractors saw a contraction of the town population and economy from 1999 to 2003. This was reversed in 2004 and 2005, when increases in production and several construction projects saw sharp increases in population, the number of contractors, and a booming housing market.

In this case study, the economic and social impacts on Blackwater of this upswing in the coal industry has been assessed with four different techniques. The traditional SIA and EcIA tools of stakeholder analysis and input-output analysis have been used to used to assess the likely impacts of the additional mining activity on the community. Targeted interviews and desktop assessment were the data collection methods employed for these techniques. As well, a choice modelling study has been performed, with the collection of data from a random sample of households, and experimental workshops with groups of community members were also held. A broad overview of the research plan is provided in Figure 1.

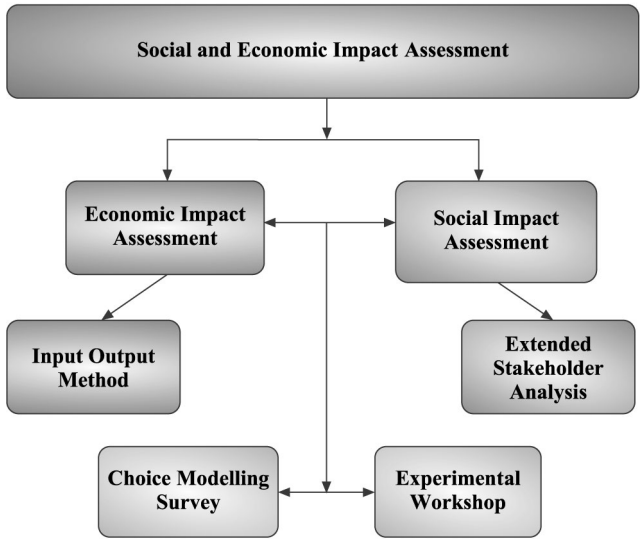

Figure 1.
Research flow chart

Input-output modelling

Input-output modelling was used to predict the impacts of the increased mining activities at the local and regional level. This involved the construction of a representative model for each of the economies of interest, where the interrelationships between each business sector, households and the external world (i.e. outside of the region of interest) is summarised by a series of multipliers. Changes in activity in the coal sector can then be fed into the model as an input, and the consequential (multiplied) changes in each of the other sectors can then be read from the model as an output, usually in terms of changes in employment, expenditure and incomes.

While the results of input-output models are very useful, it is often very difficult to estimate them with great levels of accuracy, for a number of reasons (Ivanova and Rolfe, 2005; Jensen and West, 1986; West, 2004). In many cases, input-output models are estimated by adjusting national or state models to regional or local circumstances. The source models are often several years old and the relationships between sectors may not translate well across time and to regional or local situations. The models are based on ex poste data, which may not be strong predictions of future activity.

Although the input output technique can be used to model economic activity in a region of any size, accurate results will depend on a high quality data about the level of economic activity and interrelationships between economic sectors. However, the smaller the region, the fewer official statistics are available. The best approximation is normally to use the Australian Bureau of Statistics (ABS) data on employment and adjust the input output table for a region according to local employment figures.

The sub-regional model that was developed for this case study predicted that an increase in $1 of output of the coal mining sector in the Central Highlands would increase household income in the coal mining sector within the region by $0.141. The direct and indirect impacts of this increase in output will result in a $0.210 income effect on coal mining and all other supporting industries in the Central Highlands. This dollar of additional output from coal mining in the Central Highlands will also have a consumption induced effect of $0.022.

A 25 per cent ($209m) expansion in coal mining development in the regional (Central Highlands) area was modeled to provide indicative analysis of impacts on the community of interest. Under the 25 per cent expansion scenario, the total (direct, indirect and induced) impacts of expansion of mining industry in the Central Highlands region on industry output, household income and employment in an average year is expected to be $180m, $37m and about 806 jobs respectively. The expected impacts on the town of Blackwater will be a subset of the predicted effects.

In a summary it can be said that the IO results provide some guide as to the size of distribution of impacts from the current coal mining expansion and the potential impacts at the local level. However, the IO analysis performed was a desktop study that involved limited adjustment to the local economy. While more detailed models can be built with better information about local business spending, the preliminary modelling performed in this case study was typical of the economic impact assessment reported in EIS studies.

Stakeholder analysis

The stakeholder analysis involved a number of semi-structured interviews with community leaders and other residents of the local community. Over a period of nine days in October 2005, the researchers talked to 15 key informants in face-to-face interviews lasting between half an hour and two hours at the home or workplace of the participants. In order to ensure that a good understanding was generated of the spread of community perceptions, the researchers developed an interview schedule based on open-ended questions, and approached as diverse a range of potential respondents as possible. The selected participants were drawn from areas such as health care, religious organisations, local businesses, education and local government. Six of the informants had a close association with the mining industry; employed in the mines (1), had a partner employed in the mines (2) or had previously worked in the mines (3).

The results showed that stakeholders held strong views about the negative and positive impacts of mining on their community. Some of the negative impacts identified were physical ones, such as vibrations from detonations, coal dust, and noise from the trains. There are also indirect negative impacts of the mines on local businesses. Businesses are currently struggling for staff because most people work or want to work in the mines (because of higher wages) Another impact is that there is an extreme shortage of housing, which is also very expensive.

There were a number of concerns regarding shiftworkers, and contractors with several work camps in Blackwater. Shift workers/contractors were seen to make noise, upset the police and make residents afraid for the safety of their daughters. Stakeholders also noted that shift work is unhealthy for shift workers themselves: shifts involve only work and sleep, and no recreation. A strong concern was that miners work in Blackwater but many live elsewhere: during their days off they leave Blackwater. They reside their family on the coast, live in camp for work periods and commute home on days off. There were also concerned about more traffic accidents because workers want to go home straight after their shift finishes when they may be fatigued. While all respondents agreed with the statement that Blackwater should try to attract more mining families to live in the town, most thought it unlikely that this would happen.

Many stakeholders expressed fears that the residents of Blackwater could lose their sense of community, making it harder to run sporting clubs and other voluntary events. Potential population losses would have a negative effect on the number of schools, ambulances and police. Another result of miners not living in Blackwater is that they don't spend their money in Blackwater, except for essential shopping; small/indirect businesses have shut down or are struggling for patronage.

The positive impacts are also similar to other mining towns: the mines are the main source of income in Blackwater. There are a lot of direct work opportunities in coal mines and there are indirect work opportunities. Local businesses have gained the opportunity to grow and there is potential for developing new businesses. Stakeholders suggested that there is a need for diversification in Blackwater, and supply of more industry/services for the growing population. More than 70 per cent of the respondents agreed with the statement that mining in the shire creates a good environment to invest in other businesses.

The extended stakeholder analysis helped to identify some major issues and values of the Blackwater community. While this approach is valuable in identifying major issues in communities, it does not provide decision makers with an idea of the community ranking of these issues in terms of importance. While social sciences have a range of techniques to evaluate importance of issues and estimate tradeoffs, the stakeholder analysis technique does not estimate the communities' preferred development options for the local region. The results of the extended stakeholder analysis therefore can be limited. Alternative mechanisms for reporting and assessing community views are reported in the following sections.

The choice modeling survey

The application of the choice modeling technique is described in more detail by Rolfe *et al.* (2000), Bennett and Blamey (2001), Louviere *et al.* (2000) and Hensher *et al.* (2005). Here, a brief summary is provided of the design, application and analysis stages employed in this project.

Key tasks in the design stage are to identify the relevant attributes of interest and the way of framing the tradeoffs in a choice experiment. The consultation stage was used to design both the choice modelling survey and the experimental workshop sessions. Focus groups were held in the Blackwater community to explore the issues of interest to the community. A desktop study also reviewed the conduct of a choice modelling experiment in the same community about location choices (Rolfe *et al.*, 2005b). As well, discussions were held with the local shire council and representatives of local mining companies to identify their perceptions about the key issues for community development.

From the design stage, six key attributes were identified as being indicative of some of the tradeoffs that influenced community development. These are described in Table I. To frame the choice task, it was decided to offer respondents alternatives where improvements in the attributes were balanced against costs to them, expressed as decreases in their disposable income. For two of the attributes where it was unclear if people wanted increases or declines ("Population change", and "Shopping in nearby centres"), there were both increases and decreases offered in the choice sets.

The choice sets were structured in terms of two alternative scenarios that depicted different development options for Blackwater. Respondents could choose a development option (which came at some cost to them), or choose a "status quo" or "unsure" option. An experimental design was used to allocate levels to choice sets and select a fractional factorial of 64 sets to be collected. As four choice sets were offered per survey to minimise fatigue issues, 16 different versions of the survey had to be collected.

The use of a payment vehicle to represent costs can help to ensure that the choice sets involve tradeoffs, and also allow the subsequent model outputs to be expressed in terms of monetary values. It was difficult in this case study to choose a specific payment vehicle that would apply to all potential respondents, so a more general form was adopted. The choice scenarios and the payment mechanism were framed in the survey in the following way:

> In the next four questions, we ask you about some options for the future development of Blackwater. In each question, we are going to give you two options for how the town could develop in the future, where each option is described in different, but similar ways.

Attribute	Levels
Change in population	+25% + 10% − 10% − 25%
Jobs for partners/children	Very rare Difficult to find Moderately available Easily available
Entertainment	Few restaurants or social events Good choice of restaurants, but few social events Few restaurants, but variety of social events available each weekend Good choice of restaurants and variety of social events available each weekend
Standard of medical facilities	Improves by 10% Improves by 20% Improves by 50% Improves by 100%
Shopping and services in Emerald and Rockhampton	−10%, −5%, +20%, +50%
% of jobs held by people who don't live in Blackwater	+10%, +20%, +50%, +100%
Reduction in disposable income	$20, $50, $100, $150, $250, $500, $1,000, $2,000

Table I.
Attributes and levels used in choice modelling experiment

> Each option involves a tradeoff, where we show that the positive development outcomes might involve some costs to Blackwater residents. We have summarised this as a reduction in your disposable income, which might occur because of a mixture of:
> extra support for local businesses and services although local prices are higher;
> increased charges by state and local government to provide better services;
> reduced wages from coal mining companies so they can put more money into communities.
>
> There are no current plans for any of these extra charges – first we are trying to find out if Blackwater residents think it is worth developing the town in specific ways.

The surveys were collected by a mixture of telephone and mailout, and drop-off and collect techniques in November, 2005. A total of 304 usable responses were collected, with an estimated response rate of 74 per cent. The questionnaire included a number of questions on background, demographic and context issues as well as the choice sets. Here, only the results from the choice set question are discussed. Respondents who indicated the "unsure" option in the choice sets were coded as preferring the "status quo" option. This represented the current situation for Blackwater (the base level for each attribute) without any payment requirements. The choice data was analysed with the LIMDEP software package.

A summary of the logistic regression models for the choice data is presented in Table II. The results show that the model was significant (chi-square test), and had acceptable explanatory power (Rho-square statistic). All of the attributes in the choice sets were highly significant, apart from the "Population change" variable. This suggests that the level of population was not important to most respondents. Only one

	Coefficient	Standard error	Part worth
Constant	−2.140***	0.257	−$7,212.07
Population change	0.002	0.004	Not signif.
Jobs for partners/children	0.278***	0.047	$938.37
Entertainment and social events	0.176***	0.047	$592.70
Standard of medical facilities	0.008***	0.001	$28.47
Shopping and services in nearby centres	0.005**	0.002	$17.57
Increase in proportion of jobs held by people who don't live in town	−0.012***	0.002	−$41.88
Reduction in disposable income	−0.000***	0.000	
Household income	0.000**	0.000	
No. of observations		1,166	
Log likelihood		−1089.04	
Adjusted Rho-square		0.14801	
Chi-square statistic (9 D. of F.)		169	

Table II.
Results from choice modelling application

Notes: *** = significant at the 1% level; ** = significant at the 5% level; * = significant at the 10% level

demographic variable was significant, being "Household income". The positive coefficient indicates that people with higher levels of income were more likely to choose the alternatives for town development rather than a "status quo" option.

The other attributes were signed as expected. The positive coefficients for "Jobs", "Entertainment", "Medical" and "Shopping" attributes indicates that respondents preferred choice sets with increasing levels of these attributes. The negative coefficients for "Outside jobs" and "Reduction in income" indicate that people wanted lower levels of these attributes. The significance of the constant value suggest there are other factors which drive choices, while the negative value may indicate some preference for the status quo situation.

The results can be identified more clearly with the estimation of part-worth values. This represents a negative of the ratio of each non-monetary attribute coefficient to the monetary coefficient. The part-worths indicate the value of a one unit change for each attribute. For example, an improvement in "Jobs for partners/children" is valued at $938, while an improvement in "Entertainment and social events" is worth $593. Each 1 per cent improvement in "Health services" is worth $28.47, while each 1 per cent improvement in "Shopping in nearby centres" is worth $17.57.

There was a strong value attached to having jobs filled by people who lived in the town. Each 1 per cent increase in the "Proportion of jobs held by people who don't live in the town" created a decrease in value of $41.88. This is likely to reflect an opinion that unless workers and families live in the town on a full-time basis, additional services and shopping are unlikely to develop. However, the results are a little inconsistent with the non-significance of the coefficient for the "Population" attribute.

The choice modelling survey identified the attributes that are significant and how trade off between those attributes can be evaluated. However, caution should be taken when interpreting the results. Since only several key attributes were included in the choice models, the results should be put in the context of the wider issues that arose

from the stakeholder analysis. These two techniques should be used in ways that compliment each other.

The experimental workshops

Three experimental workshops were conducted in Blackwater, involving a total of 23 participants from the community. The workshops were focused on the same key attributes used in the choice modelling study, and many of the preliminary design and focus group stages of the choice modelling survey also helped in the design of the experimental workshops.

A series of budget allocation exercises were used in the experimental workshops to identify the key priorities for government expenditure. Participants were initially asked to rank the six key attributes in order of importance. Then they were asked to apportion an identified budget amount between each of the six areas, assuming that an additional budget became available. The same budget level was used for each respondent. There were five rounds of the exercise, where the level of budget was changed in each round. There was a discussion section in the workshops where participants could review what they thought were the priorities. Finally, participants were asked to repeat the ranking of the six key attributes in order of importance to identify whether the participation in budget allocation exercise and in discussion changed their perceptions about the important of these attributes.

The results of the simple ranking exercise are shown in Figure 2, where "Medical" was viewed as most important, with an average ranking close to 1. "Shopping and services in nearby centres", and "Proportion of jobs" held by people who don't live in town" were the lowest ranked factors. After the budget allocation exercise and discussion, "Shopping" was seen as less important than before the workshop, but the "Proportion of'jobs held by people who don't live in town" became a more important issue.

The results of the budget ranking exercises are summarised in Table III and Figure 3. The results demonstrate the importance of "Health" to workshop participants, with approximately 40 per cent of any additional budget being allocated to this category. The allocation was higher for smaller budget levels, indicating the high marginal value that community members placed on improvements in this area.

While the general ranking exercise and the budget ranking exercises identified the same priority issues of "Health" and "Jobs for partners/children" as most important,

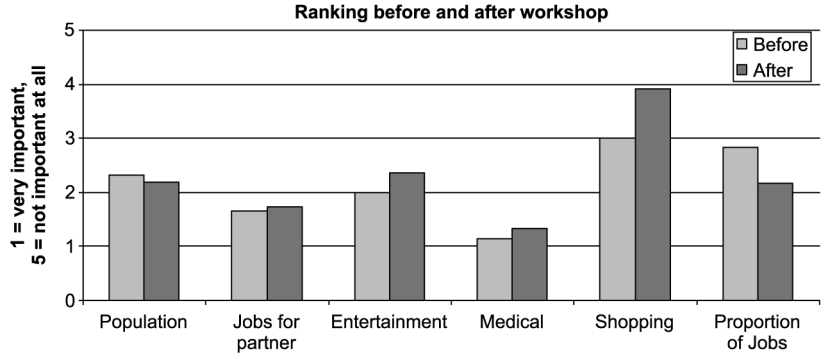

Figure 2.
Ranking of attributes prior to and after budget allocation exercises

and "Shopping" and "Services in other centres" as least important, other issues were not ranked consistently with both techniques, perhaps indicating a need for providing more information during the workshop regarding these attributes and their affects on the community.

The results showed the importance of deliberation of the issues with the community. Information provided at the workshops should be balanced in sense of covering positive and negative impacts and non-biased. Presenting the unbiased information from conventional economic assessment methods, such as IO analysis, followed by the discussion might assist with formulating the true community needs and demands.

Discussion and summary

The results showed that practitioners of impact assessment have a range of tools to choose from to make an assessment and negotiation process informative and acceptable for decision makers and communities.

Traditional tools of social impact assessment and economic impact assessment have many advantages but also some difficulties. Social impact assessment has strength in terms of being able to tap into different community groups and discover how they could be affected. Normally social impacts are assessed only during the assessment stage, without using the range of available techniques for mitigating negative impacts and negotiation trade-off with impacted communities. A deficiency is that it is hard to identify tradeoffs in quantitative manner in a social impact assessment. Economic impact assessment, on the other hand, has strengths in

	Budget $4m	Budget $6m	Budget $9m	Budget $12m	Budget $14m	All budgets, $m
Population	0.6891	1.1087	1.6141	2.038	2.2717	1.5443
Jobs	1.1848	1.5217	2.4174	3.1033	3.4293	2.3313
Entertainment	0.4565	0.625	0.8587	1.1359	1.2033	0.8559
Medical	1.8913	2.5272	3.6359	4.2989	5.1793	3.5065
Shopping	0.0761	0.1141	0.163	0.4239	0.3967	0.2348
New jobs	0.4348	0.6957	0.8478	1.1033	1.1685	0.85

Table III.
Means of budget allocation, $m

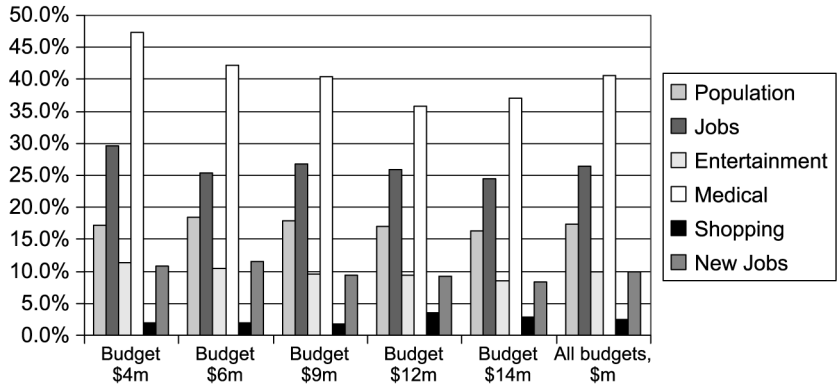

Figure 3.
Proportions of budgets allocated by area

identifying some quantitative impacts but often lacks richness of data or direct community input. It is also difficult to apply some of economic tools at a community level due to data limitations.

In this project, two alternative assessment mechanisms were tested, namely the choice modelling and experimental workshop techniques. To facilitate the comparison with more traditional approaches to impact assessment, input output modelling and stakeholder analysis has also been performed. The comparison of traditional impact assessment tools with these alternative approaches has generated a number of insights.

First, there is a great deal of consistency in the results from the different techniques. For example, the positive impacts of mining on employment and economic growth was consistently identified, as was the importance of health services in future community development. Some of the consistency may be attributable to the use of the stakeholder analysis as a prior design stage for the choice modelling and experimental workshop applications, and to the selection of a generic set of attributes for both of those latter techniques. However, the broad consistency of results is a general indicator of the acceptability of these different approaches.

Second, each of the tested techniques provided some different insights into the types of impacts on communities. These insights varied across techniques. As expected, stakeholder analysis provided a rich data set about the variety of impacts but little guidance about the priorities or strength of community preferences, while the economic modelling provided some understanding about the changes in economic activity without much understanding of community impacts. As well, there was a tendency with stakeholder analysis for negative impacts to be emphasised, while the economic modelling focused on net positive impacts. In contrast, the alternative assessment provided more guidance about prioritisation and how communities viewed tradeoffs for future development, but without the rich detail of the stakeholder analysis or the predictions of net economic impacts available from economic modelling. These alternative techniques are better viewed as complement rather than substitutes to the traditional impact assessment tools.

Third, the application of the choice modelling technique revealed some particular benefits not available with the other options. The use of a survey allowed data to be collected from a large (and random) sample of community members, gaining input from many more people. In many cases, the application of this technique was more inclusive. As well, it was possible in the survey format to collect data on a very wide range of issues in ways that allowed more quantitative analysis. This was particularly the case for the results of the choice modelling analysis, where the priority tradeoffs for key issues could be expressed in monetary terms.

Fourth, the experimental workshops had particular value in understanding how group feedback might change priority setting, and allowing participants to get feedback about how their preferences or allocations to future community development might contribute to a pool of community preferences. The combination of a group workshop setting with experimental feedback loops made this technique more appropriate to work through potential options for community development and understanding how individual preferences may change with information feedback.

These different assessment mechanisms do appear to offer key insights into community preferences about dealing with impacts that are not available from stakeholder analysis and economic modelling approaches.

There is a value in adding choice modelling and experimental workshops to the toolkit of economic and social impact assessment. While survey and workshop mechanisms give different insights into community preferences, they are better viewed as complements to rather than replacements for more traditional types of social and economic impact assessment. Further work to develop these tools and include them in impact assessment processes appears warranted.

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