Appendix

Q

Economic Assessment

Continuation of Boggabri Coal Mine Economic Assessment

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EXECUTIVE SUMMARY

Boggabri Coal Pty Limited (Boggabri Coal) is applying for a Project Approval under Part 3A of the *Environmental Planning and Assessment Act 1979* (EP&A Act) to gain a single, contemporary planning approval for the continuation of its mining operations within its current mining tenements for a further 21 years (the Project). The Project involves production of up to 7 Mtpa product coal per year.

The Project requires the preparation of an Environmental Assessment (EA) in accordance with the requirements of the EP&A Act. An economic assessment is required as part of the EA.

From an economic perspective there are two important aspects of the Project that have been considered:

- The economic efficiency of the Project (i.e. consideration of economic costs and benefits) which can be evaluated using benefit cost analysis; and
- The economic impacts of the Project (i.e. the economic stimulus that the Project would provide to the regional or State economy) which can be evaluated using regional economic impact assessment.

A Benefit Cost Analysis of the Project identified a range of potential economic costs and benefits of the Project. Values were placed on production costs and benefits as well as most external costs. The net production benefits of the Project were estimated at $1,266M. The main external costs from the Project relate to greenhouse gas generation, air quality, noise and vibration, ecology and transport. Greenhouse gas costs have been estimated at $138M. Air quality, noise and vibration have already been incorporated into the estimation of net production benefits via acquisition costs for nearby affected properties. Transport costs have also been included in the estimation of net production costs via incorporation of the costs of upgrading Harparary Road and the costs of continuing to maintain the existing road network on route to Boggabri Coal Mine. There would also be externality costs associated with the clearing of native vegetation. However, these would be counterbalanced by the offset actions proposed by Boggabri Coal. External benefits associated with employment provided by the Project have been estimated at $234M.

Overall the Project is estimated to have net benefits of $1,362M and hence is desirable and justified from an economic efficiency perspective.

A regional economic impact analysis, using input-output analysis, estimated that in total, the Project will contribute up to the following to the regional economy:

- $819M in annual direct and indirect regional output or business turnover;
- $360M in annual direct and indirect regional value added;
- $120M in annual household income; and
- 1,171 direct and indirect jobs.

At the State level the Project will make up to the following contribution to the economy:

- $1,527M in annual direct and indirect output or business turnover;
- $689M in annual direct and indirect value added;
- $315M in annual household income; and
- 3,675 direct and indirect jobs.

This stimulus would be felt across a range of sectors in the economy including the coal mining sector, agricultural and mining machinery manufacturing sector, wholesale trade sector, retail trade sector,

mining services sector, technical services sector, road transport sector and the hotels, cafes and restaurants sector.

Approval is being sought for the Project for 21 years, although it is recognised that there are further open cut and underground minable coal resources within Boggabri Coal's mining tenements beyond this period. On cessation of mining the economic stimulus provided by the Project will largely cease. The significance of these Project cessation impacts will depend on:

- The degree to which any displaced workers and their families remain within the region;
- The economic structure and trends in the regional economy at the time.
- Whether other mining developments or other opportunities in the region arise that allow employment of displaced workers.

Nevertheless, given the uncertainties about the circumstances within which Project cessation will occur, it is important for regional authorities and leaders to take every advantage from the stimulation to regional economic activity and skills and expertise that the Project brings to the region, to strengthen and broaden the region's economic base.

1 INTRODUCTION

Boggabri Coal Pty Limited (Boggabri Coal), a wholly owned subsidiary of Idemitsu Australia Resources Pty Ltd (IAR), operates the Boggabri Coal Mine. Boggabri Coal Mine is located approximately 15 km north east of Boggabri in the Narrabri Shire Council (NSC) Local Government Area (LGA) in the central north of NSW, see Figure 1.1.

Boggabri Coal Pty Limited (Boggabri Coal) is applying for a Project Approval under Part 3A of the *Environmental Planning and Assessment Act 1979* (EP&A Act) to gain a single, contemporary planning approval for the continuation of its mining operations within its current mining tenements for a further 21 years (the Project).

1.1 THE PROJECT

Boggabri Coal is seeking approval to continue its open cut coal mining and associated activities largely consistent with the existing operation for a further 21 years from 2011. In seeking a Project Approval, Boggabri Coal also seeks to maximise operational flexibilities through staged additions and upgrades to infrastructure and an increase in approved coal production to enable it to be in a position to take advantage of any favourable market opportunities going forward.

Specifically, the Project involves the following:

- Continuation of mining operations via open cut methods up to 7 Million tonnes per annum (Mtpa) product coal to the Merriown seam with an overburden emplacement height of approximately RL 395;
- Open cut mining fleet including excavators and fleet of haul trucks, dozers, graders, water carts and other equipment with the flexibility to introduce a dragline as required utilising up to 500 employees;
- Modifications to existing and continuation of approved (but not yet constructed) infrastructure including:
    - Coal Handling and Preparation Plant (CHPP);
    - Modifications to existing site infrastructure capacities including: Run of Mine (ROM) coal hopper, second crusher, stockpile area, coal loading facilities, water management and irrigation system;
    - Rail loop and 17 km rail line across the Namoi River and floodplain including overpasses across the Kamilaroi Highway, Therribri Road and Namoi River;
    - Minor widening of the existing coal haul road;
    - Upgrading and relocating site facilities including offices, car parking and maintenance sheds as and when required;
- Closing a section of Leard State Forest Road; and
- Upgrading the power supply capacity to 132 kilovolt (kV) high voltage lines suitable for dragline operations.

The above described production increase and related infrastructure upgrades to that currently in place will occur in a staged approach as can be justified by economic drivers.

1.2 ECONOMICS

An Environmental Assessment (EA) for the Project is required in accordance with the provisions of the EP&A Act. The NSW Department of Planning (DoP) Director-Generals Requirements for the Project

indicate that an economic assessment is needed as part of the EA. The Director-Generals Requirements identify the need for:

- A detailed assessment of the costs and benefits of the Project as a whole, and whether it would result in a net benefit to the community.

From an economic perspective there are two important aspects of the Project that can be considered:

- The economic efficiency of the Project (i.e. consideration of economic costs and benefits); and
- The economic impacts of the Project (i.e. the economic stimulus that the Project will provide to the regional or State economy).

Planning NSW (James and Gillespie, 2002) *Guideline for Economic Effects and Evaluation in EIA* identifies economic efficiency as the key consideration of economic analysis. Benefit Cost Analysis (BCA) is the method used to consider the economic efficiency of proposals. The draft guideline identifies BCA as essential to undertaking a proper economic evaluation of proposed developments that are likely to have significant environmental impacts.

The above draft guideline indicates that economic impact assessment may provide additional information as an adjunct to the economic efficiency analysis. Economic stimulus to the regional and State economy can be estimated using input-output modelling.

This study relates to the preparation of each of the following types of analyses:

- A BCA of the Project; and
- An economic impact assessment of the Project.

2 BENEFIT COST ANALYSIS

2.1 INTRODUCTION

For the Project to be economically desirable from a community perspective, it must be economically efficient. Technically, a development is economically efficient and desirable on economic grounds if the benefits to society exceed the costs (James and Gillespie, 2002). For mining developments, the main economic benefit is the producer surplus generated by the mine and the employment benefits it provides, while the main economic costs relate to environmental and cultural costs. The main technique that is used to weigh up these benefits and costs is BCA.

BCA involves the following key steps:

- identification of the base case or "without" project case;
- identification of the "with" project scenario;
- physical quantification and valuation of the projects incremental benefits and costs;
- consolidation of values using discounting to account for the different timing of costs and benefits;
- application of decision criteria;
- sensitivity testing;
- consideration of non-quantified benefits and costs, where applicable.

The sub-sections below provide a BCA of the Project based on financial, technical and environmental advice provided by Boggabri Coal and its specialist consultants.

2.2 IDENTIFICATION OF THE BASE CASE AND PROJECT

Identification of the "base case" or "without" Project scenario is required in order to facilitate the identification and measurement of the incremental economic benefits and costs of the Project.

Under the base case, the current operations of up to 5 Million tonnes per annum (Mtpa) of product coal would cease on 14 November 2011. In contrast, the Project involves the continuation of mining up to 7 Mtpa of product coal for a further 21 years.

Boggabri Coal's alternatives for the mining of coal are essentially limited to different scales, designs, technologies, processes, modes of transport, timing, impact mitigation measures etc. However, these alternatives could be considered to be variants of the preferred proposal rather than distinct alternatives. Consequently, this BCA focuses on the Project as described in Section 1 compared to the base case identified above.

2.3 IDENTIFICATION OF BENEFITS AND COSTS

Relative to the base case or "without" scenario of mining cessation, the Project may have the potential incremental economic benefits and costs shown in Table 2.1.

Table 2.1
Incremental Economic Benefits and Costs of the Project

Category	Costs	Benefits
Production	Opportunity cost of State Forests land Opportunity cost of existing land owned by Boggabri Coal Opportunity cost of capital Capital costs associated with coal production and ancillary works Operating costs, including administration, mining, processing, transportation and rehabilitation (ex royalties) Decommissioning costs	Avoided decommissioning costs in 2011 Sale value of coal Residual value of capital and land at the cessation of the Project
Potential Externalities	Air quality impacts Greenhouse gas impacts Noise and vibration impacts Ecology impacts (including opportunity cost of production from agricultural land acquired by Boggabri Coal and set aside as ecological offsets) Groundwater impacts Traffic and transport impacts Aboriginal archaeology and cultural heritage impacts Non-Aboriginal heritage impacts Visual impacts Surface water impacts and sediment/erosion control	Economic and social benefits of employment provided by the Project

It should be noted that the potential external costs, listed in Table 2.1, are only economic costs to the extent that they affect individual and community well-being through direct use of resources by individuals or non-use. If the potential impacts are mitigated to the extent where community wellbeing is insignificantly affected, then no external economic costs arise.

2.4 QUANTIFICATION/VALUATION OF BENEFITS AND COSTS

In accordance with NSW *Treasury Guidelines for Economic Appraisal* (NSW Treasury, 2002), where competitive market prices are available, they have generally been used as an indicator of economic values.

2.4.1 *Production Costs and Benefits*

Production Costs

Opportunity Cost of Land

There is an opportunity cost associated with continuing to use land already owned by Boggabri Coal for coal production instead of its next best use i.e. rural production. An indication of the opportunity cost of the land can be gained from its market value, estimated at $6.1 Million (M).

Much of the mining activity will occur over land owned by State Forest NSW and has previously been used for hardwood timber production. While the land would not have valuable timber for 20 to 30 years

it contributes to sustainable yield forecasts for the region and hence there is an opportunity cost to society from using this land for open cut coal mining rather than timber production. This can be estimated from its contribution to sustainable yield and associated producer surplus value from timber production. Data was not readily available to estimate this value and so a rural land value of $1,000/ha was assumed. This gives an opportunity cost of $2M.

Opportunity Cost of Capital

Boggabri Coal has invested in $40M of capital equipment over the last 3 years. There is an opportunity cost associated with using this capital in the Project rather than realising its market value through sale. This opportunity cost is estimated at $8M.

Capital Cost of the Project

Capital costs over the life of the Project are estimated at $1.2B including major mining equipment, mobile mining equipment, coal handling and processing plant, site infrastructure, offsite infrastructure and services, land purchases, project management costs, sustaining capital and contingency costs. These costs are included in the economic analysis in the years that they are expected to occur.

Annual Operating Costs of the Project

The operating costs of the Project include those associated with overburden stripping, mining, processing, rail and port charges, selling costs, rehabilitation, marketing and general administration. Average annual operating costs of the mine are estimated at $370M.

While royalties are a cost to Boggabri Coal they are part of the overall producer surplus benefit of the mining and processing activity that is redistributed by government. Royalties are therefore not included in the calculation of the resource costs of operating the Project. Nevertheless, it should be noted that the Project will generate total royalties in the order of $950M (undiscounted).

Decommissioning Costs

At the cessation of the Project the mine site will be decommissioned at an estimated cost of $52.5M.

Production Benefits

Avoided Decommissioning Costs

Under the base case the site would be decommissioned in 2011. With the Project these costs are avoided (but incurred at the end of the Project life). This avoided decommissioning cost in 2011 is a benefit of the Project.

Sale Value of Coal

Open cut mining is assumed to ramp up to 7 Mtpa of product coal by Year 5 and remain at this level until Year 21. Both demand and supply for coal influences current and projected prices.

Demand for thermal coal is derived demand, i.e. dependent on demand for the end products within which the coal resource is used (i.e. electricity). Demand for thermal coal therefore fluctuates considerably based on numerous market factors including the demand for goods and services requiring electricity as an input to production, the price of coal fired electricity, the price of alternative sources of energy, income of consumers, population growth etc.

World supply of thermal coal also fluctuates depending on price of electricity, prices of factors of production, prices of related goods, expected future prices, the number of suppliers, technology, greenhouse gas emission policy, etc.

Projected prices for the Project product coal were provided by Boggabri Coal and averaged AUD$94/tonne (t).

There is obviously considerable uncertainty around future coal prices and hence assumed coal prices have been subjected to sensitivity testing (see Section 2.6).

Residual Value at End of the Evaluation Period

At the end of the Project, rehabilitated land and purchased capital equipment may have some residual value that could be realised by sale. The final rehabilitated landform is likely to be mainly native hardwood timber for conservation purposes and hence is assumed to have no residual value. Capital equipment purchased as part of the Project would have some positive residual value at the cessation of mining which is estimated at $37.5M.

2.4.2 ***External Costs and Benefits***

Noise and Blasting - noise and blasting onsite has the potential to impact on sensitive receptors such as nearby residences and buildings. These impacts can potentially be valued using the property value method, where the change in property value as a result of the noise is estimated. 28 properties owned by 14 individual landholders were identified as likely to experience noise impacts above the relevant criteria. It is expected that the owners of those properties impacted above DECC guidelines will be granted options to sell their properties to Boggabri Coal. Instead of incorporating the partial property value impact on these 28 properties, conservatively, the full cost of acquiring these 28 properties has been incorporated into the analysis. Further to this, 58 properties are predicted to receive minor to moderate noise impacts of the noise level. However, it is assumed that these impacts are likely to have a negligible effect on amenity and hence property values.

Air quality – air quality impacts that reduce the enjoyment associated with a property can potentially also be valued using the property valuation method. Two properties have been identified as being adversely affected by dust. These properties are also adversely affected by noise and hence the full cost of acquiring the properties has already been incorporated into the analysis.

Greenhouse gases – the Project is predicted to generate in the order of 10.8 Million tonnes of scope 1, scope 2 and scope 3 greenhouse gas emissions associated with mining and transport of product coal by rail to the port[1]. To place an economic value on carbon dioxide equivalent (CO_2-e) emissions, a shadow price of carbon is required that reflects its social costs. The social cost of carbon is the present value of additional economic damages now and in the future caused by an additional tonne of carbon emissions. There is great uncertainty around the social cost of carbon with a wide range of estimated damage costs reported in the literature. An alternative method to trying to estimate the damage costs of carbon dioxide is to examine the price of carbon credits. Again, however, there is a wide range of permit prices. For this analysis, a shadow price of carbon of AUS$30/t CO_2-e was used, with sensitivity testing from AUS$8/t CO_2-e to AUS$40/t CO_2-e (refer to Appendix 1).

Ecology – Approximately 1,503 ha of forest and woodland (including 82 ha of Federally listed Box Gum Woodland) are proposed to be cleared as a result of the Project. This will remove habitat for a range of threatened fauna species. These areas may have non-use values to the community that could potentially be estimated using non-market valuation methods such as choice modelling or contingent valuation.

[1] It should be noted that greenhouse gas generation associated with sea transport and usage of the product coal is considered to be outside of the scope of the BCA of the Project.

The flora and fauna impacts will be internalised by Boggabri Coal's proposal to manage adjacent and nearby land for conservation as an offset for the ecological impacts of the Project. These lands contain a number of threatened flora and fauna species, endangered ecological communities and endangered populations. With the implementation of the above ecological offset proposal it is considered that the potential impacts of the Project on terrestrial fauna and flora would largely be offset and hence no significant economic cost would arise that would warrant inclusion in the BCA. The capital and operating cost of this offset have also been incorporated into the capital and operating costs of the Project. The capital cost of acquiring land for the offset reflects, among other things, the foregone agricultural production to society.

Aboriginal heritage – A total of 104 Aboriginal archaeological sites are known to occur within and adjacent to the Project boundary. While the sites are considered to be important to the Aboriginal community there are no sites that are considered to be of high archaeological significance, apart from at a local scale.

Any impacts on Aboriginal heritage sites may impact the well-being of the Aboriginal community. However, monetisation of these impacts is problematic and so these impacts are best left to consideration as part of the preparation of the Aboriginal Heritage Management Plan. It should be noted that the Brigalow and Nandewar Conservation agreement set aside significant areas of land for use by Aboriginal people and the protection of Aboriginal archaeology, essentially as an offset for areas such as Leard State Forest that would be disturbed by forestry and mining.

Impacts on highly significant Aboriginal heritage sites have also been shown to affect the well-being of the broader community (Gillespie Economic 2009). However, as no sites of high archaeological significance are reported as being affected (except for at a local level) no values have been included in the BCA

Groundwater – The Project will result in a reduction in water levels in the alluvial aquifer of less than 1m, which will be undetectable from seasonal cycles in aquifer water levels and hence no significant impacts on river flows is anticipated. However, depressurisation and leakage of the coal seam aquifer as a result of the Project will cause a reduction in water levels in existing bores in the zone of influence, 3 km to 3.5 km beyond the open cut pit at the end of mining in year 21. Most bores within this zone are owned by mining companies and used for groundwater monitoring or no longer remain in use. No registered irrigation bores constructed in the alluvial sediments are present within the zone of influence. Consequently, no ground water impacts are included in the BCA.

Traffic and transport – A traffic impact assessment of the Project did not identify any significant traffic impact from the projected increase in mine operations, the number of construction staff or the proposed closure of a section of Leard Forest Road. However, so as to provide an alternative route during wet weather for the small number of users of Leard Forest Road, Boggabri Coal has agreed to pay for the upgrade of Harparary Road between Leard Forest Road and Kamilaroi Highway, including the construction of a bridge over the Namoi River. The cost of this upgrade has been included in the capital costs of the Project. The costs of continuing to maintain the existing road network on route to Boggabri Coal Mine has been included as part of the operating costs of the mine. A Train Operations Traffic Impact Study concluded that the increased length and number of coal trains as a result of the Project would not make any significant impact on the at-grade railway crossings in Boggabri, Gunnedah and Curlewis.

Non - Aboriginal cultural heritage – the Project will not impact on any significant non-Aboriginal Cultural Heritage sites and hence no externality costs have been included in the BCA.

Visual impacts – the visual impact assessment focused on the impact of the continuation of Boggabri Coal Mine compared to existing operations and concluded that the Project will have minimal visual impacts on the surrounding receptors. Due to the location of the existing mining operation, vegetation and topography, views of the existing surface infrastructure and mine are significantly restricted to the

immediate area. Consequently, continuation of mining will not significantly impact on the visual amenity of the surrounding area and hence no impacts were included in the BCA.

Surface water impacts – the Project may potentially have a range of impacts in relation to surface water including:

- Changes to catchment yields;
- Restricted flow of natural drainage lines; and
- Dirty water contamination.

However, these impacts are assumed to have negligible environmental effects as additional water requirements will be met through the purchase of additional water entitlements if necessary, changes in flow to local drainage lines will be very localised with negligible impacts on the Namoi River, export of contaminants will be prevented through a network of sediment and runoff control mechanisms and surplus water will be used for irrigation purposes for agriculture and potential forestry plantations.

Social and economic value of employment –the Project would generate up to 500 direct jobs (450 on average) for a period of 21 years. Historically employment benefits of projects has tended to be omitted from benefit cost analysis on the implicit assumption that labour resources used in a project would otherwise be employed elsewhere. Where this is not the case and labour resources would otherwise be unemployed for some period of time, Streeting and Hamilton (1991) and Bennett (1996) outline that otherwise unemployed labour resources utilised in a project should be valued in a BCA at their opportunity cost (wages less social security payments and income tax) rather than the wage rate which has the effect of increasing the net production benefits of the project. In addition, there may be social costs of unemployment that require the estimation of people's willingness to pay to avoid the trauma created by unemployment. These are non-market values.

More recently, it has been recognised that the broader community may hold non-environmental, non-market values (Portney 1994) for social outcomes such as employment (Johnson and Desvouges 1997) and the viability of rural communities (Bennett et al 2004). Gillespie Economics (2008) estimated the value the community hold for the 23 years that the Metropolitan Colliery provides 320 jobs, at $756M (present value). Gillespie Economics (2009) estimated the value the community hold for the 30 years that the Bulli Seam Operations provides 1,170 jobs, at $870M (present value).

The Project will provide an average of 450 direct jobs for a period of 21 years. Using the more conservative Bulli Seam Operation employment value gives an estimated $234M for the employment benefits of the Project. This value has been included in the BCA.

2.5 CONSOLIDATION OF VALUE ESTIMATES

The present value of costs and benefits, using a 7% discount rate are provided in Table 2.2.

Table 2.2
Benefit Cost Analysis Results of the Project (Present Values @7% discount rate)

COSTS ($M)		BENEFITS ($M)	
Production			
Opportunity cost of SF land	$2	Avoided decommissioning costs	$46
Opportunity cost of mine land	$5	Revenue	$5,343
Opportunity cost of capital	$7	Residual value of land	$0
Capital costs, including land acquisition	$778	Residual value of capital	$8
Operating costs	$3,328		
Decommissioning costs	$11		
Total Production Costs	**$4,130**	**Total Production Benefits**	**$5,397**
		Net Production Benefits	**$1,266**
Potential Externalities			
Air quality	Acquisition costs included in capital costs	Social and economic values of employment	$234
Greenhouse gases	$138		
Noise and vibration	Acquisition costs included in capital costs		
Ecology	Some loss of values but offset. Cost of offset included in capital costs and operating costs		
Groundwater	Negligible impacts		
Traffic and transport	Negligible impacts. Costs of Harparary Rd upgrade included in capital costs. Costs of road maintenance included in operating costs.		
Aboriginal heritage	Negligible impacts. Area set aside as part of BNC Agreement.		
Non-Aboriginal heritage	Negligible impacts		
Visual impacts	Negligible impacts		
Surface water	Negligible impacts		
TOTAL QUANTIFIED	**$4,269**	**TOTAL QUANTIFIED**	**$5,631**
NET QUANTIFIED BENEFITS		**$1,362**	

The main decision criterion for assessing the economic desirability of a project to society is its net present value (NPV). NPV is the present value of benefits less the present value of costs. A positive NPV indicates that it would be desirable from an economic perspective for society to allocate resources to the Project, because the community as a whole would obtain net benefits from the Project. Table 2.3 indicates that the Project will have net production benefits of $1,266M.

The net production benefit shown in Table 2.3 is distributed amongst a range of stakeholders including:

- The local community in the form of donations and community support programs;
- Boggabri Coal and its shareholders;
- The NSW Government via royalties; and
- The Commonwealth Government in the form of Company tax.

The NSW Government receives additional benefits in the form of payroll tax and local councils also benefit through rates and development contributions.

The main external costs from the Project relate to greenhouse gas generation, air quality, noise and vibration, ecology and transport. Greenhouse gas costs have been estimated at $138M. Air quality, noise and vibration have already been incorporated into the estimation of net production benefits via acquisition costs for nearby affected properties. Transport costs have also been included in the estimation of net production costs via incorporation of the costs of upgrading Harparary Road and the costs of continuing to maintain the existing road network on route to Boggabri Coal Mine. There would also be externality costs associated with the clearing of native vegetation. However, these would be counterbalanced by the offset actions proposed by Boggabri Coal. External benefits associated with employment provided by the Project have been estimated at $234M.

Overall the Project is estimated to have net benefits of $1,362M and hence is desirable and justified from an economic efficiency perspective.

2.6 SENSITIVITY ANALYSIS

This NPV presented in Table 2.3 is based on a range of assumptions around which there is some level of uncertainty. Uncertainty in a BCA can be dealt with through changing the values of critical variables in the analysis (James and Gillespie, 2002) to determine the effect on the NPV.

In this analysis, the BCA result was tested for 20% changes to the following variables at a 4%, 7% and 10% discount rate:

- Opportunity cost of State Forest land;
- Opportunity cost of Boggabri Coal land;
- Opportunity cost of capital;
- Capital costs;
- Operating costs;
- Decommissioning costs;
- Revenues;
- Residual value of capital and land;
- Greenhouse costs; and
- Employment benefits.

What this analysis indicated (refer to Appendix 2) is that the results of the BCA are not sensitive to reasonable changes in assumptions regarding any of these variables. In particular, significant increases in the values used for external impacts such as greenhouse gas costs had little impact on the economic desirability of the Project.

The results were most sensitive to increases in capital and operating costs and decreases in the sale value of coal.

3 ECONOMIC IMPACT ASSESSMENT

3.1 INPUT-OUTPUT TABLE AND ECONOMIC STRUCTURE OF THE REGION

Economic impact assessment is primarily concerned with the effect of an impacting agent on an economy in terms of a number of specific indicators, such as gross regional output, value-added, income and employment.

These indicators can be defined as follows:

- ***Gross regional output*** – the gross value of business turnover;
- ***Value-added*** – the difference between the gross regional output and the costs of the inputs of raw materials, components and services bought in to produce the gross regional output;
- ***Income*** – the wages paid to employees including imputed wages for self employed and business owners; and
- ***Employment*** – the number of people employed (including full-time and part-time).

An impacting agent may be an existing activity within an economy or may be a change to a local economy (Powell *et al.,* 1985; Jensen and West, 1986). This assessment is concerned with the impact of 7 Mtpa of product coal production at Boggabri.

The economy on which the impact is measured can range from a township to the entire nation (Powell *et al.,* 1985). In selecting the appropriate economy, regard needs to be had to capturing the local expenditure and employment associated with the Boggabri Project, but not making the economy so large that the impact of the Project becomes trivial (Powell and Chalmers, 1995). Advice is that the workforce is likely to predominantly reside in Gunnedah, Narrabri and Boggabri townships. Consequently, for this study, the economic impacts of the Project have been estimated for the Australian Bureau of Statistics (ABS) Statistical Local Areas (SLA) of Narrabri and Gunnedah.

A range of methods can be used to examine the economic impacts of an activity on an economy including economic base theory, Keynesian multipliers, econometric models, mathematical programming models and input-output models (Powell *et al.,* 1985). This study uses input-output analysis.

Input-output analysis essentially involves two steps:

- Construction of an appropriate input-output table (regional transaction table) that can be used to identify the economic structure of the region and multipliers for each sector of the economy; and
- Identification of the initial impact or stimulus of the Project (construction and/or operation) in a form that is compatible with the input-output equations so that the input-output multipliers and flow-on effects can then be estimated (West, 1993).

A 2005-06 input-output table of the regional economy (Narrabri SLA and Gunnedah SLA,) was developed using the Generation of Input-Output Tables (GRIT) procedure (Appendix 3) with a 2005-06 input-output table of the NSW economy (developed by Monash University) as the parent table. The 109 sector input-output table of the regional economy was aggregated to 30 sectors and 6 sectors for the purpose of describing the economies.

A highly aggregated 2005-06 input-output table for the regional economy is provided in Table 3.1. The rows of the table indicate how the gross regional output of an industry is allocated as sales to other industries, to households, to exports and other final demands (OFD - which includes stock changes, capital expenditure and government expenditure). The corresponding column shows the sources of inputs to produce that gross regional output. These include purchases of intermediate inputs from

other industries, the use of labour (household income), the returns to capital or other value-added (OVA - which includes gross operating surplus and depreciation and net indirect taxes and subsidies) and goods and services imported from outside the region. The number of people employed in each industry is also indicated in the final row.

Table 3.1
Aggregated Transactions Table: Regional Economy 2005-06 ($'000)

	Ag, forestry, fishing	Mining	Manuf.	Utilities	Building	Services	TOTAL	Household Expenditure	OFD	Exports	Total
Ag, forestry, fishing	35,880	6	22,442	1	48	1,440	59,818	2,239	75,566	273,793	411,416
Mining	0	1,366	408	4,542	80	75	6,472	9	414	39,497	46,391
Manuf.	18,864	521	33,443	358	7,526	19,964	80,677	13,561	14,582	252,514	361,334
Utilities	2,466	233	4,773	35,397	447	7,841	51,156	5,122	474	24,237	80,988
Building	1,176	219	599	919	18,524	6,158	27,596	0	63,881	17,943	109,419
Services	35,693	2,975	45,703	2,314	9,353	138,231	234,269	144,288	216,795	340,979	936,331
TOTAL	94,079	5,321	107,369	43,531	35,979	173,709	459,987	165,218	371,711	948,963	1,945,879
Household wages	87,711	6,599	48,813	5,236	25,714	294,091	468,164	0	0	0	468,164
OVA	110,176	27,920	47,614	17,119	12,784	193,010	408,623	25,985	13,143	1,706	449,457
Imports	119,450	6,551	157,538	15,103	34,943	275,521	609,105	279,748	70,615	67,275	1,026,744
TOTAL	411,416	46,391	361,334	80,988	109,419	936,331	1,945,879	470,952	455,469	1,017,944	3,890,243
Employment	2,288	105	728	88	440	5,868	9,517				

Note: Totals may have minor discrepancies due to rounding.

Gross regional product (GRP) for the regional economy is estimated at $917M, comprising $468 to households as wages and salaries (including payments to self employed persons and employers) and $449M in OVA.

9,517 people were working in the region.

The economic structure of the regional economy can be compared with that for NSW through a comparison of results from the respective input-output models (Figures 3-1 and 3-2). This reveals that the agriculture sector is of greater relative importance than it is to the NSW economy, while the services sectors and building sectors are of less relative importance than they are to the NSW economy. Mining, manufacturing and utilities sectors in the region are of similar relative importance as they are to NSW.

Figure 3.1
Summary of Aggregated Sectors: Regional Economy (2005-06)

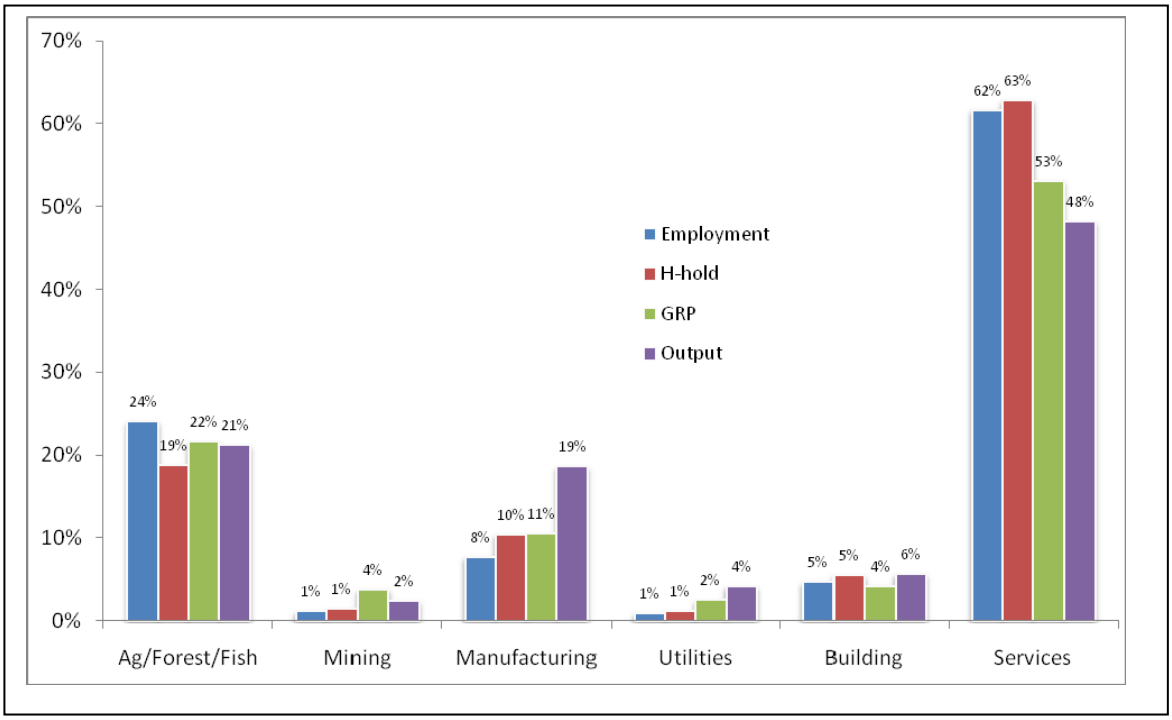
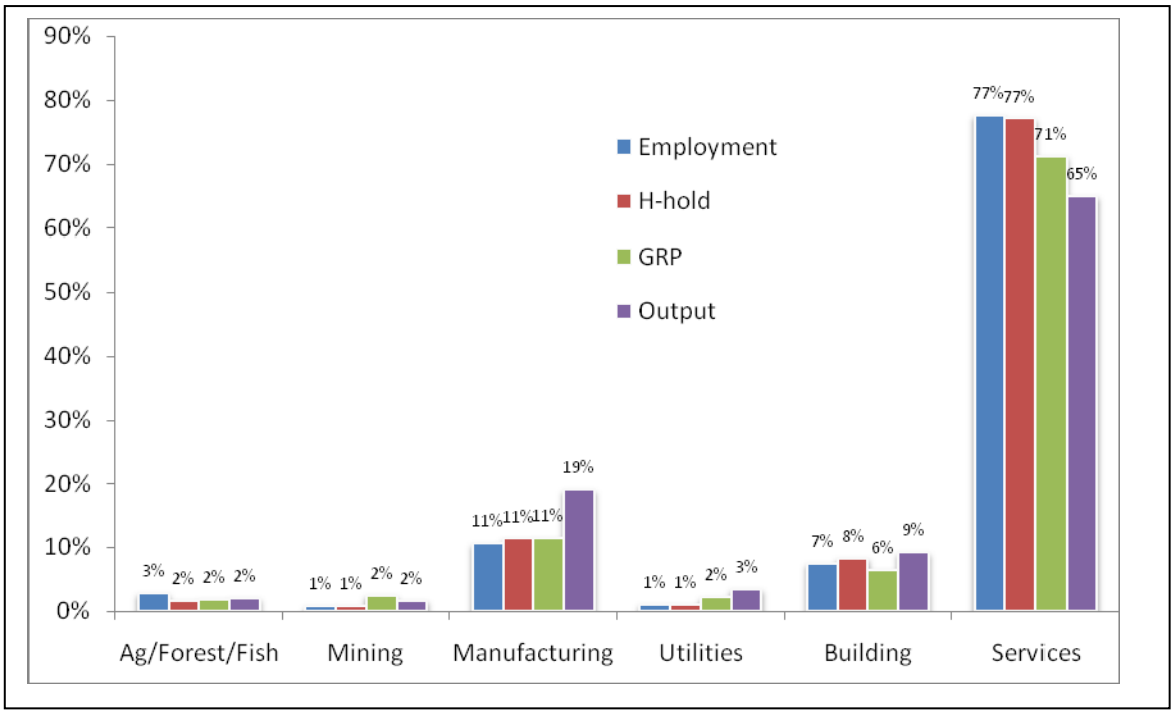


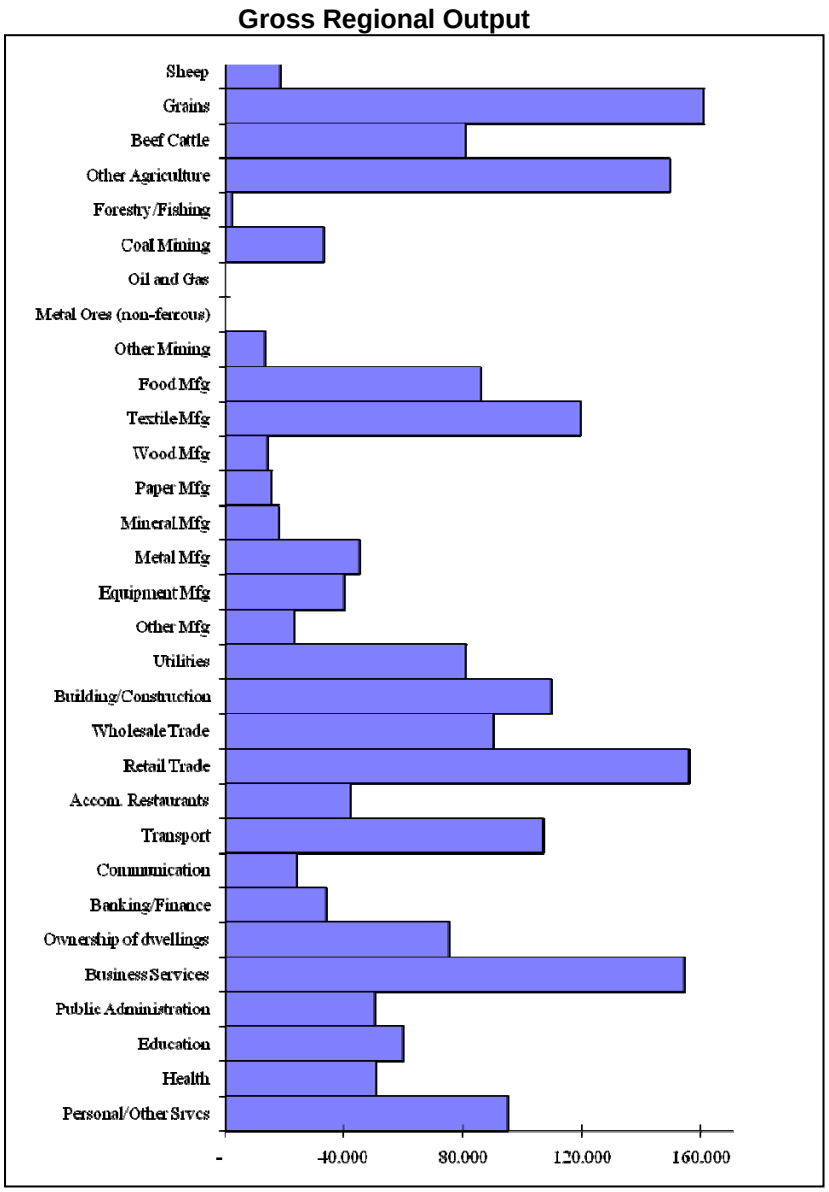
Figure 3.2
Summary of Aggregated Sectors: NSW Economy (2005-06)



Figures 3.3 to 3.5 provide a more expansive sectoral distribution of gross regional output, employment, household income, value-added, exports and imports, and can be used to provide some more detail in the description of the economic structure of the economy.

From these figures it is evident that in terms of gross regional output and value-added grains and other agriculture sector, business services and retail trade are the most significant sectors. The retail trade sector is the most significant sector in terms of regional employment while the retail trade sector and business services sector are the most significant sectors in terms of income. Imports and exports are spread across many sectors with major contributors being the grains and other agriculture sectors, food and textile manufacturing, retail trade and business services.

Figure 3.3 Sectoral Distribution of Gross Regional Output and Value-Added ($'000)



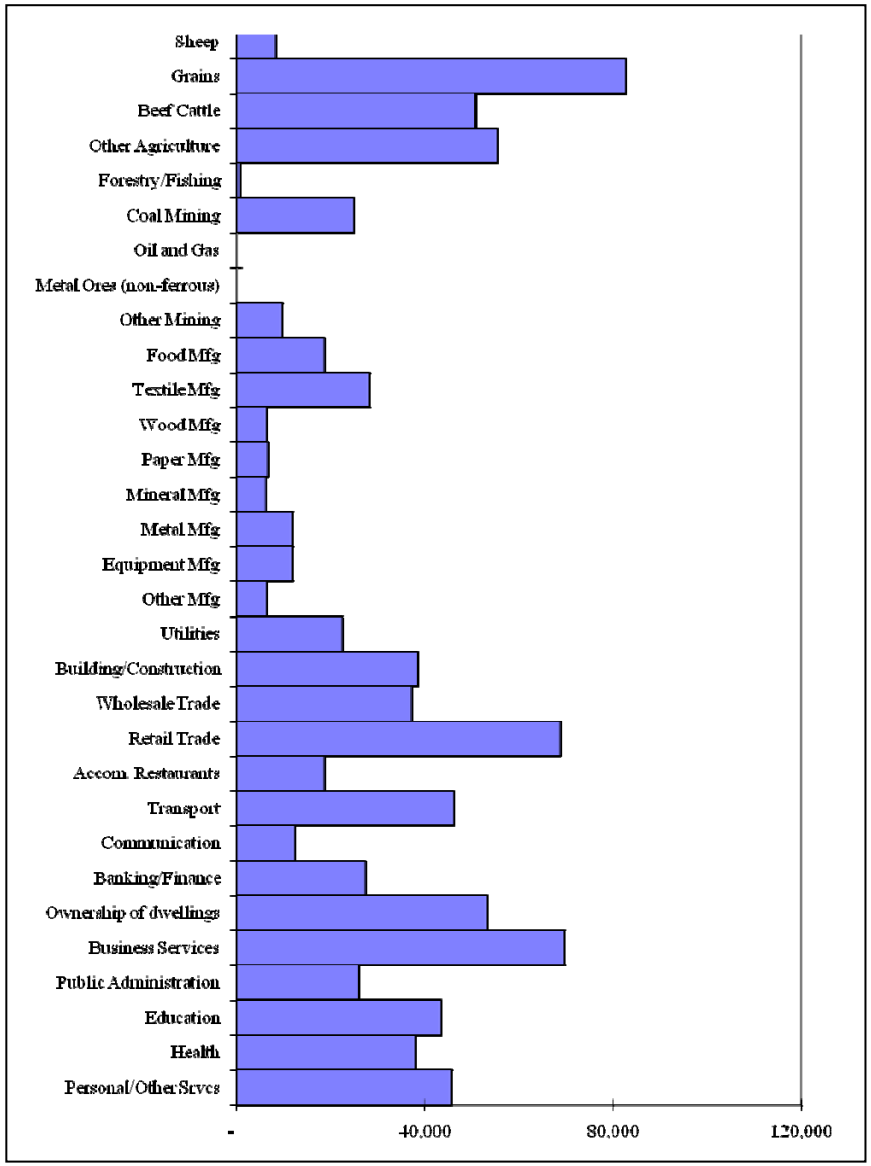
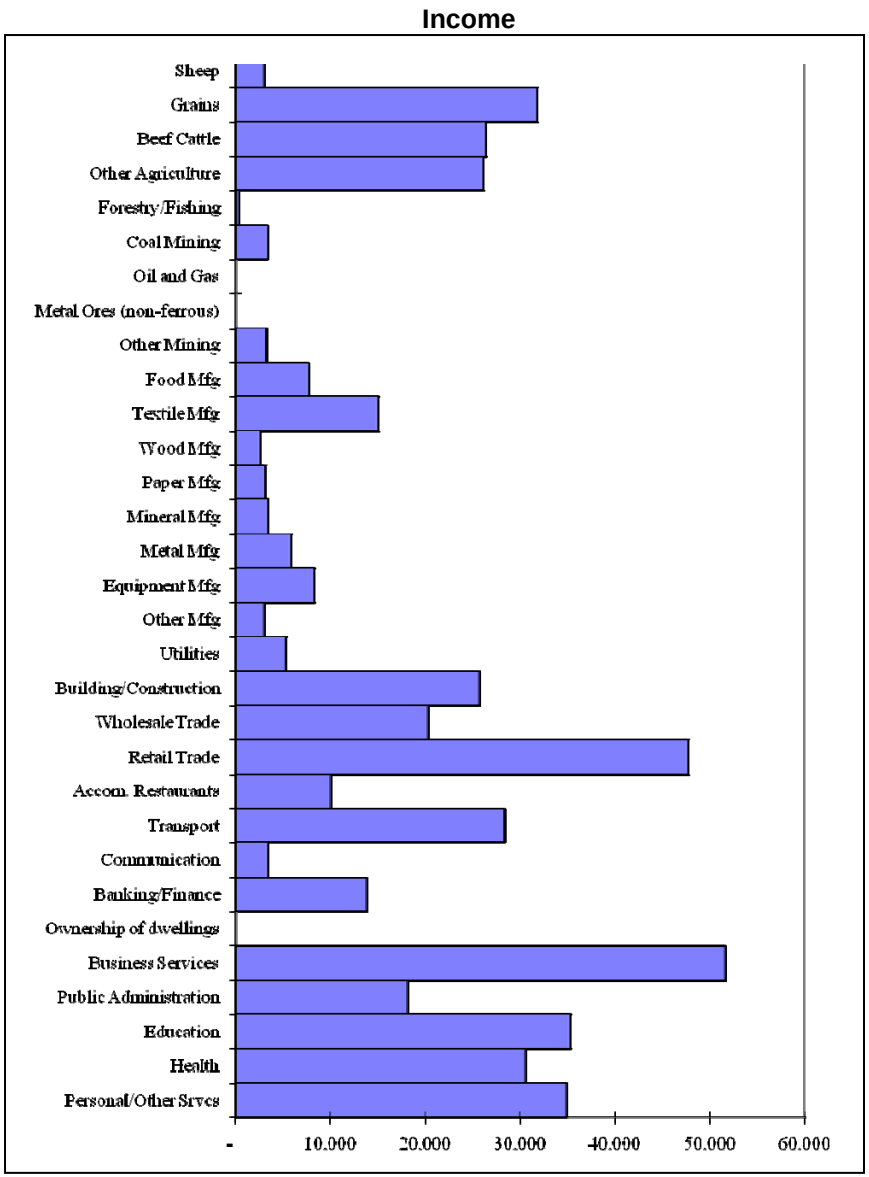


Figure 3.4 Sectoral Distribution of Gross Regional Income ($'000) and Employment (No.)



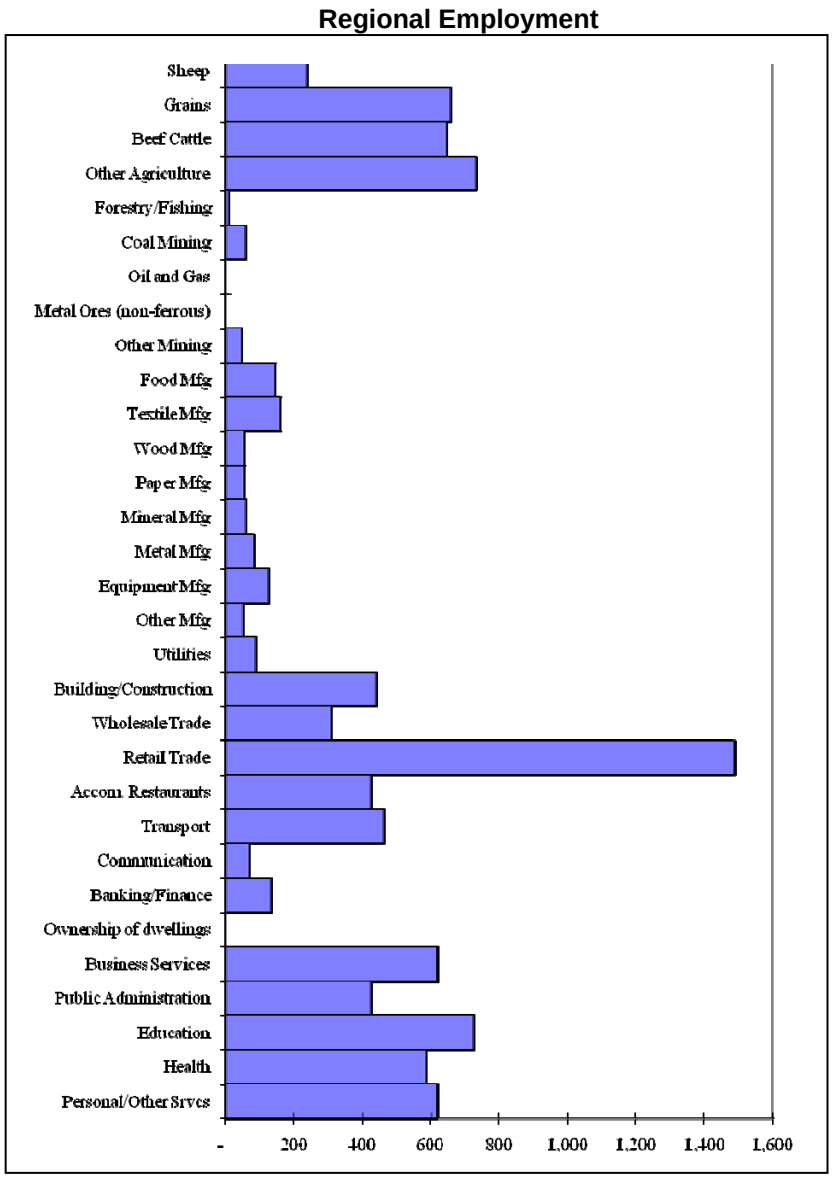
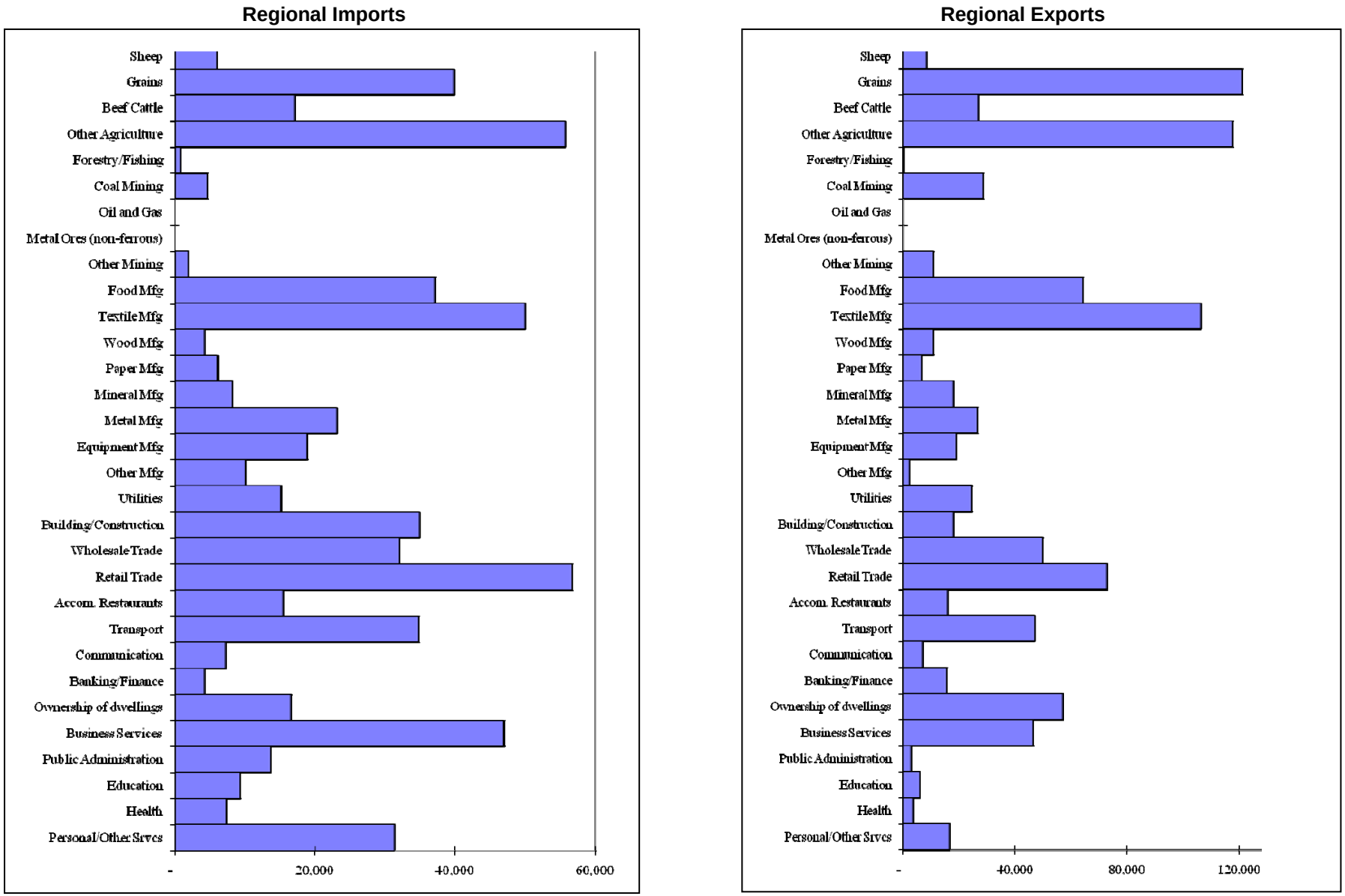


Figure 3.5 Sectoral Distribution of Imports and Exports ($'000)



3.2 REGIONAL ECONOMIC IMPACT OF THE PROJECT

3.2.1 *Introduction*

For the analysis of the continuation of mining at Boggabri Coal Mine, a new Boggabri Coal Mine sector was inserted into the regional input-output table reflecting peak production levels of 7 Mtpa of coal for the Project and peak employment levels. The revenue, expenditure and employment data for this new sector was obtained from financial information provided by Boggabri Coal. For this new sector:

- the estimated gross annual revenue was allocated to the *Output* row;
- the estimated wage bill of the direct employment residing in the region (100%) was allocated to the *household wages* row;
- non-wage expenditure was initially allocated across the relevant *intermediate sectors* in the economy, *imports* and *other value-added*;
- allocation was then made between *intermediate sectors* in the local economy and *imports* based on regional location quotients;
- purchase prices for expenditure in each sector in the region were adjusted to basic values and margins and taxes and allocated to appropriate sectors using relationships in the latest (2001-02) National Input-Output Tables;
- the difference between total revenue and total costs was allocated to the *other value-added* row*;* and
- employment that resides in the region was allocated to the *employment* row.

3.2.2 *Impacts of the Project on the Regional Economy*

The total and disaggregated annual impacts of the Project on the regional economy in terms of output, value-added, income and employment (in 2009 dollars) are shown in Table 3.2.

Table 3.2
Annual Regional Economic Impacts of the Project

	Direct Effect	Production Induced	Consump. Induced	Total Flow-on	TOTAL EFFECT
OUTPUT ($'000)	663,494	102,292	53,419	155,711	819,205
Type 11A Ratio	*1.00*	*0.15*	*0.08*	*0.24*	*1.24*
VALUE ADDED ($'000)	293,441	41,108	25,671	66,779	360,220
Type 11A Ratio	*1.00*	*0.14*	*0.09*	*0.23*	*1.23*
INCOME ($'000)	78,649	24,512	16,932	41,445	120,094
Type 11A Ratio	*1.00*	*0.31*	*0.22*	*0.53*	*1.53*
EMPL. (No.)	500	338	333	671	1,171
Type 11A Ratio	*1.00*	*0.68*	*0.67*	*1.34*	*2.34*

In total, the Project is estimated to make up to the following contribution to the regional economy:

- $819M in annual direct and indirect regional output or business turnover;
- $360M in annual direct and indirect regional value added;
- $120M in annual household income; and
- 1,171 direct and indirect jobs.

3.2.3 *Multipliers*

The adjusted Type 11A ratio multipliers for the Project range from 1.23 for value-added up to 2.34 for employment.

Capital intensive industries tend to have a high level of linkage with other sectors in an economy thus contributing substantial flow-on employment while at the same time only having a lower level of direct employment (relative to output levels). This tends to lead to a relatively high ratio multiplier for employment. A lower ratio multiplier for income (compared to employment) also generally occur as a result of comparatively higher wage levels in the mining sectors compared to incomes in the sectors that would experience flow-on effects from the Project. Capital intensive mining projects also typically have a relatively low ratio multiplier for value-added reflecting the relatively high direct value-added for the Project compared to that in flow-on sectors. The low output ratio multiplier largely reflects the high direct output value of the Project compared to those sectors that experience flow-on effects from the Project.

3.2.4 *Main Sectors Affected*

Flow-on impacts from the Project are likely to affect a number of different sectors of the regional economy. The sectors most impacted by output, value-added and income flow-ons are likely to be the:

- Agricultural and mining machinery manufacturing sector;
- Wholesale trade sector;
- Retail trade sector;
- Mining services sector;
- Technical services sector.
- Road transport sector; and
- Hotels, cafes and restaurants sector.

Examination of the estimated direct and flow-on employment impacts gives an indication of the sectors in which employment opportunities will be generated (Table 3.3).

Table 3.3
Sectoral Distribution of Total Regional Employment Impacts

Sector	Average Direct Effects	Production induced	Consumption-induced	Total
Primary	0	9	6	15
Mining	500	33	0	533
Manufacturing	0	107	12	119
Utilities	0	7	4	11
Wholesale/Retail	0	83	84	167
Accommodation, cafes, restaurants	0	3	49	52
Building/Construction	0	7	2	9
Transport	0	32	13	45
Services	0	56	164	221
Total	**500**	**338**	**333**	**1,171**

Note: Totals may have minor discrepancies due to rounding.

Table 3.3 indicates that direct, production-induced and consumption-induced employment impacts of the Project on the regional economy are likely to have different distributions across sectors. Production-induced flow-on employment will occur mainly in mining, manufacturing, wholesale/retail, transport and services sectors while consumption induced flow-on employment will be mainly in wholesale/retail, accommodation/cafes/restaurants and services sectors.

Businesses that can provide the inputs to the production process required by Boggabri Coal and/or the products and services required by employees will directly benefit from the Project by way of an increase in economic activity. However, because of the inter-linkages between sectors, many indirect businesses also benefit.

3.3 STATE ECONOMIC IMPACTS OF THE PROJECT

3.3.1 *Introduction*

The State economic impacts of the Project were assessed in the same manner as for estimation of the regional impacts. A new Boggabri Coal sector was inserted into a 2009 NSW input-output table in the same manner described in Section 3.2.1. The primary difference from the sector identified for the regional economy was that a greater level of expenditure was captured by NSW economy compared to the regional economy.

3.3.2 *Impacts of the Project on NSW*

The total and disaggregated annual impacts of the Project on the NSW economy in terms of output, value-added, income and employment (in 2009 dollars) are shown in Table 3.4.

Table 3.4
Annual State Economic Impacts of the Project

	Direct Effect	Production Induced	Consump. Induced	Total Flow-on	TOTAL EFFECT
OUTPUT ($'000)	663,494	498,403	365,554	863,957	1,527,451
Type 11A Ratio	*1.00*	*0.75*	*0.55*	*1.30*	*2.30*
VALUE ADDED ($'000)	293,441	209,736	186,197	395,933	689,374
Type 11A Ratio	*1.00*	*0.72*	*0.64*	*1.35*	*2.35*
INCOME ($'000)	78,649	129,983	106,555	236,538	315,187
Type 11A Ratio	*1.00*	*1.65*	*1.36*	*3.01*	*4.01*
EMPL. (No.)	500	1,653	1,523	3,175	3,675
Type 11A Ratio	*1.00*	*3.31*	*3.05*	*6.35*	*7.35*

In total, the Project is estimated to make the following contribution to the NSW economy:

- $1,527M in annual direct and indirect output or business turnover;
- $689M in annual direct and indirect value added;
- $315M in annual household income; and
- 3,675 direct and indirect jobs.

The impacts on the NSW economy are substantially greater than for the regional economy, as the NSW economy is able to capture more mine and household expenditure, and there is a greater level of intersectoral linkages in the larger NSW economy.

3.4 PROJECT CESSATION

The Project will stimulate demand in the regional and NSW economy leading to increased business turnover in a range of sectors and increased employment opportunities. Conversely, the cessation of the mining operations in the future would result in a contraction in regional economic activity.

The magnitude of the regional economic impacts of cessation of the Project would depend on a number of interrelated factors at the time, including:

- The movements of workers and their families;
- Alternative development opportunities; and
- Economic structure and trends in the regional economy at the time.

Ignoring all other influences, the impact of Project cessation would depend on whether the workers and their families affected would leave the region. If it is assumed that some or all of the workers remain in the region, then the impacts of Project cessation would not be as severe compared to a greater level leaving the region. This is because the consumption-induced flow-ons of the decline would be reduced through the continued consumption expenditure of those who stay (Economic and Planning Impact Consultants, 1989). Under this assumption, the regional economic impacts of Project cessation would approximate the direct and production-induced effects in Table 3.3. However, if

displaced workers and their families leave the region then impacts would be greater and begin to approximate the total effects in Table 3.3.

The decision by workers, on cessation of the Project, to move or stay would be affected by a number of factors including the prospects of gaining employment in the local region compared to other regions, the likely loss or gain from homeowners selling, and the extent of "attachment" to the local region (Economic and Planning Impact Consultants, 1989).

To the extent that alternative development opportunities arise in the regional economy, the regional economic impacts associated with mining closure that arise through reduced production and employment expenditure can be substantially ameliorated and absorbed by the growth of the region. One key factor in the growth potential of a region is its capacity to expand its factors of productions by attracting investment and labour from outside the region (BIE, 1994). This in turn can depend on a region's natural endowments. In this respect, the Gunnedah Basin is highly prospective with considerable coal resources (DPI, 2008).

It is therefore likely that over time, new mining developments will occur, offering potential to strengthen and broaden the economic base of the region and hence buffer against impacts of the cessation of individual activities. Conversely, if the Boggabri Coal Project is not approved, this may discourage other miners from investing in exploration in the region due to a perceived uncertainty as to whether they could be successful in gaining approvals to mine.

Ultimately, the significance of the economic impacts of cessation of the Project would depend on the economic structure and trends in the regional economy at the time. For example, if Project cessation takes place in a declining economy, the impacts might be significant.

Alternatively, if Project cessation takes place in a growing diversified economy where there are other development opportunities, the ultimate cessation of the Project may not be a cause for concern.

Nevertheless, given the uncertainty about the future complementary mining activity in the region it is not possible to foresee the likely circumstances within which Project cessation would occur. It is therefore important for regional authorities and leaders to take every advantage from the stimulation to regional economic activity and skills and expertise that the Project would maintain in the region.

4 CONCLUSION

A Benefit Cost Analysis of the Project identified a range of potential economic costs and benefits of the Project. Values were placed on production costs and benefits as well as most external costs. The net production benefits of the Project were estimated at $1,266M. The main external costs from the Project relate to greenhouse gas generation, air quality, noise and vibration, ecology and transport. Greenhouse gas costs have been estimated at $138M. Air quality, noise and vibration have already been incorporated into the estimation of net production benefits via acquisition costs for nearby affected properties. Transport costs have also been included in the estimation of net production costs via incorporation of the costs of upgrading Harparary Road and the costs of continuing to maintain the existing road network on route to Boggabri Coal Mine. There would also be externality costs associated with the clearing of native vegetation. However, these would be counterbalanced by the offset actions proposed by Boggabri Coal. External benefits associated with employment provided by the Project have been estimated at $234M.

Overall the Project is estimated to have net benefits of $1,362M and hence is desirable and justified from an economic efficiency perspective.

A regional economic impact analysis, using input-output analysis, estimated that in total, the Project will contribute up to the following to the regional economy:

- $819M in annual direct and indirect regional output or business turnover;
- $360M in annual direct and indirect regional value added;
- $120M in annual household income; and
- 1,171 direct and indirect jobs.

At the State level the Project will make up to the following contribution to the economy:

- $1,527M in annual direct and indirect output or business turnover;
- $689M in annual direct and indirect value added;
- $315M in annual household income; and
- 3,675 direct and indirect jobs.

This stimulus would be felt across a range of sectors in the economy including the coal mining sector, agricultural and mining machinery manufacturing sector, wholesale trade sector, retail trade sector, mining services sector, technical services sector, road transport sector and hotels, cafes and restaurants sector.

Approval is being sought for the Project for 21 years, although it is recognised that there are further open cut and underground minable coal resources within Boggabri Coal's mining tenements beyond this period. On cessation of mining the economic stimulus provided by the Project will largely cease. The significance of these Project cessation impacts will depend on:

- The degree to which any displaced workers and their families remain within the region;
- The economic structure and trends in the regional economy at the time.
- Whether other mining developments or other opportunities in the region arise that allow employment of displaced workers.

Nevertheless, given the uncertainties about the circumstances within which Project cessation will occur, it is important for regional authorities and leaders to take every advantage from the stimulation to regional economic activity and skills and expertise that the Project brings to the region, to strengthen and broaden the region's economic base.

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Appendix 1 – Valuing Greenhouse Gas Emissions

To place an economic value on CO_2-e emissions a shadow price of carbon is required that reflects its social costs. The social cost of carbon is the present value of additional economic damages now and in the future caused by an additional tonne of carbon emissions.

A prerequisite to valuing this environmental damage is scientific dose-response functions identifying how incremental emissions of CO_2-e would impact climate change and subsequently impact human activities, health and the environment on a spatial basis. Only once these physical linkages are identified is it possible to begin to place economic values on the physical changes using a range of market and non market valuation methods. Neither the identification of the physical impacts of additional greenhouse gas nor valuation of these impacts is an easy task, although various attempts have been made using different climate and economic modelling tools. The result is a great range in the estimated damage costs of greenhouse gas.

The Stern Review: Economics of Climate Change (Stern 2006) acknowledged that the academic literature provides a wide range of estimates of the social cost of carbon. It adopted an estimate of US$85/t CO_2-e for the "business as usual" case, i.e. an environment in which there is an annually increasing concentration of greenhouse gas in the atmosphere.

Tol (2006) highlights some significant concerns with Stern's damage cost estimates including:

- that in estimating the damage of climate change Stern has consistently selected the most pessimistic study in the literature in relation to impacts;
- Stern's estimate of the social cost of carbon is based on a single integrated assessment model, PAGE2002, which assumes all climate change impacts are necessarily negative and that vulnerability to climate change is independent of development;
- Stern uses a near zero discount rate which contravenes economic theory and the approach recommended by Treasury's around the world

All these have the effect of magnifying the social cost of carbon estimate, providing what Tol (2006) considers to be an outlier in the marginal damage cost literature.

Tol (2005) in a review of 103 estimates of the social cost of carbon from 28 published studies found that the range of estimates was right-skewed: the mode was US$0.55/t CO_2-e (in 1995 US$), the median was US$3.82/t CO_2-e, the mean US$25.34/t CO_2-e and the 95th percentile US$95.37/t CO_2-e. He also found that studies that used a lower discount rate and those that used equity weighting across regions with different average incomes per head, generated higher estimates and larger uncertainties. The studies did not use a standard reference scenario, but in general considered 'business as usual' trajectories.

Tol (2005) concluded that "it is unlikely that the marginal damage costs of carbon dioxide emissions exceed US$14/t CO_2-e and are likely to be substantially smaller than that". Nordhaus's (2008) modelling using the DICE-2007 Model suggests a social cost of carbon with no emissions limitations of US$30 per tonne of carbon (/tC) (US$8/t CO_2-e).

An alternative method to trying to estimate the damage costs of carbon dioxide is to examine the price of carbon credits. This is relevant because emitters can essentially emit CO_2-e resulting in climate change damage costs or may purchase credits that offset their CO_2-e impacts, internalising the cost of the externality at the price of the carbon credit. The price of carbon credits therefore provides an alternative estimate of the economic cost of greenhouse gas. However, the price is ultimately a function of the characteristics of the scheme and the scarcity of permits etc and hence may or may not reflect the actual social cost of carbon.

The price of carbon credits under the European Union Emissions Trading Scheme are currently around €24/t CO_2-e, the equivalent of about US$38 t CO_2-e while spot prices in the Chicago Climate Exchange are in the order of US$3.95 t CO_2-e.

More recent information on the cost of carbon credits can be obtained from the carbon reduction schemes in Australia. As of July 2008 the spot price under the NSW Government Greenhouse Gas Reduction Scheme was AUS$7.25 t CO_2-e. Prices under the Commonwealth Governments Greenhouse Friendly Voluntary Scheme were AUS$8.30 t CO_2-e and Australian Emissions Trading Unit (in advance of the Australian Governments Emissions Trading Scheme) was priced at AUS$21 t CO_2-e (Next Generation Energy Solutions pers. comms. 24 July 2008).

A National Emissions Trading Scheme is foreshadowed in Australia by 2010. While the ultimate design and hence liabilities under the scheme are still a work in progress, the National Emissions Trading Taskforce cited a carbon permit price of around AUS$35 t CO_2-e.

The Carbon Pollution Reduction Scheme: Australia's Low Pollution Future White Paper (Australian Government,2008) cited a carbon permit price of AUS$23/t CO_2-e in 2010 and AUS$35/t CO_2-e in 2020 (in 2005) dollars for a 5% reduction in carbon pollution below 2000 levels by 2020.

Given the above information and the great uncertainty around damage cost estimates, a range for the social cost of greenhouse gas emissions from AUS$8/ t CO_2-e to AUS$40/ t CO_2-e was used in the sensitivity analysis in Section 2.6, with a conservatively high central value of AUS$30/ t CO_2-e.

Appendix 2 – Sensitivity Testing (NPV A$M)

INCREASE 20%	4%	7%	10%
Opportunity cost of SF land	$2,013	$1,362	$951
Opportunity cost of Boggabri Coal land	$2,013	$1,361	$950
Opportunity cost of capital	$2,012	$1,361	$950
Capital costs	$1,827	$1,207	$818
Operating costs	$1,078	$697	$461
Decommissioning costs	$2,019	$1,369	$958
Revenue	$3,524	$2,431	$1,732
Residual value of capital and land	$2,017	$1,364	$952
Greenhouse costs @$40/t	$1,949	$1,316	$917
Employment benefits	$2,062	$1,409	$996
DECREASE 20%			
Opportunity cost of SF land	$2,014	$1,363	$951
Opportunity cost of Boggabri Coal land	$2,015	$1,363	$952
Opportunity cost of capital	$2,015	$1,364	$952
Capital costs	$2,200	$1,518	$1,084
Operating costs	$2,950	$2,028	$1,440
Decommissioning costs	$2,008	$1,355	$943
Revenue	$504	$294	$169
Residual value of capital and land	$2,011	$1,361	$950
Greenhouse costs @ $8/t	$2,156	$1,464	$1,025
Employment benefits	$1,966	$1,315	$905

Appendix 3 – The GRIT System for Generating Input-Output Tables

"The Generation of Regional Input-Output Tables (GRIT) system was designed to:

- combine the benefits of survey based tables (accuracy and understanding of the economic structure) with those of non-survey tables (speed and low cost);
- enable the tables to be compiled from other recently compiled tables;
- allow tables to be constructed for any region for which certain minimum amounts of data were available;
- develop regional tables from national tables using available region-specific data;
- produce tables consistent with the national tables in terms of sector classification and accounting conventions;
- proceed in a number of clearly defined stages; and
- provide for the possibility of ready updates of the tables.

The resultant GRIT procedure has a number of well-defined steps. Of particular significance are those that involve the analyst incorporating region-specific data and information specific to the objectives of the study. The analyst has to be satisfied about the accuracy of the information used for the important sectors; in this case the non-ferrous metals and building and construction sectors. The method allows the analyst to allocate available research resources to improving the data for those sectors of the economy that are most important for the study. It also means that the method should be used by an analyst who is familiar with the economy being modelled, or at least someone with that familiarity should be consulted.

An important characteristic of GRIT-produced tables relates to their accuracy. In the past, survey-based tables involved gathering data for every cell in the table, thereby building up a table with considerable accuracy. A fundamental principle of the GRIT method is that not all cells in the table are equally important. Some are not important because they are of very small value and, therefore, have no possibility of having a significant effect on the estimates of multipliers and economic impacts. Others are not important because of the lack of linkages that relate to the particular sectors that are being studied. Therefore, the GRIT procedure involves determining those sectors and, in some cases, cells that are of particular significance for the analysis. These represent the main targets for the allocation of research resources in data gathering. For the remainder of the table, the aim is for it to be 'holistically' accurate (Jensen, 1980). That means a generally accurate representation of the economy is provided by the table, but does not guarantee the accuracy of any particular cell. A summary of the steps involved in the GRIT process is shown in Table A-1" (Powell and Chalmers, 1995).

Table A-1
The GRIT Method

Phase	Step	Action
PHASE 1		ADJUSTMENTS TO NATIONAL TABLE
	1	Selection of national input-output table (106-sector table with direct allocation of all imports, in basic values).
	2	Adjustment of national table for updating.
	3	Adjustment for international trade.
PHASE II		ADJUSTMENTS FOR REGIONAL IMPORTS
		(*Steps 4-14 apply to each region for which input-output tables are required*)
	4	Calculation of 'non-existent' sectors.
	5	Calculation of remaining imports.
PHASE III		DEFINITION OF REGIONAL SECTORS
	6	Insertion of disaggregated superior data.
	7	Aggregation of sectors.
	8	Insertion of aggregated superior data.
PHASE IV		DERIVATION OF PROTOTYPE TRANSACTIONS TABLES
	9	Derivation of transactions values.
	10	Adjustments to complete the prototype tables.
	11	Derivation of inverses and multipliers for prototype tables.
PHASE V		DERIVATION OF FINAL TRANSACTIONS TABLES
	12	Final superior data insertions and other adjustments.
	13	Derivation of final transactions tables.
	14	Derivation of inverses and multipliers for final tables.

Source: Bayne and West (1988)