Economic Modeling Paper

Murray and Mallee Local Government Association

March 2009

development
answers

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1. Introduction

The Murray and Mallee Local Government Association (MMLGA) has commissioned this Paper relating to the costs and benefits of economic modeling packages available for the use by Local Government in South Australia.

Background

The MMLGA in conjunction with the SA Centre for Economic Studies (SACES) and with support of the Local Government Research and Development Fund has initiated *the* **Ensuring Local Government Services Provision Project (ELGSPP)**.

In June 2008, in conjunction with a review of the MMLGA Strategic Plan and the formulation of an MMLGA/LGA SA Regional Sustainability Plan, Member Councils expressed concern about the effect that extraneous influences, outside the control of Council, may have on Council's revenues, the social, economic and environmental impact on the community, the continuation of community expected services and the expectation of increased services should events eventuate. Such events could include drought, fire, flood etc.

This review culminated in the following being included in the MMLGA Strategic Plan, insertion into the MMLGA/LGA SA Regional Sustainability Plan, and due to applicability to all SA regional Councils, subsequently mirrored in the current SAROC Annual Business Plan:

> *Make an application for funding from the LGR&D Scheme for preparation of a report by the SA Centre for Economic Studies (or other independent body) for the Murray Mallee Region on:*
> - *the economic impact of the drought on the provision of Local Government services to affected communities*
> - *rates and income modeling on all Councils in the region*
> - *options for a submission to the Grants Commission for additional support for affected Councils*
> - *other related issues as considered appropriate.*

A successful funding application was made to the LGR&D Fund for $70,000, to which the MMLGA contributed a further $5,000 to undertake the Project.

The MMLGA formed a Project Committee which met on the 11th July, 2008 when it was generally agreed that what Councils were seeking was a "plug in type template or tool kit that Councils and the community could use to identify local issues resulting from an external event, that provided information on Council's ability to provide services, the ability of the community to pay and then used to seek funding or to provide a foundation for decision making".

As a result of discussions between the CEO of the MMLGA, SACES and the SAROC representative, Diana Laube, EPLGA, it was considered that the REMPLAN program, compiled and written under the auspices of LaTrobe University, <u>could</u> be an appropriate avenue to investigate, with an emphasis on its applicability to Local Government Services Provision under changing economic circumstances and the general acceptability of Program outputs to all levels of Government.

At this point SACES retired from the Project as they perceived that their work to be undertaken was in potential judgement of like colleagues.

Following the presentation of REMPLAN, the Committee generally agreed that the program was applicable to the aims of the ELGSP Project. The ELGSPP Committee decided that it should consider other possible options via the preparation of this independent Paper on REMPLAN compared to similar programs that may be available.

2. Economic modeling

2.1 What is Economic Modeling[1]

> *"A theoretical system of relationships which tries to capture the essential elements in a real-world situation. Any real world problem will, in general, consist of a large number of variables, and a large number of quite complex relationships between them. If any headway is to be made in the analysis of such situations it is necessary to try to isolate the most important elements and to disregard the rest. Although this may mean that a model is 'unrealistic' in the sense that it does not completely describe the real world situation, it may still give us far more insight into a problem, and far greater predictive ability, than would a less abstract approach which tried to take everything into account."*

2.2 Uses, Benefits and Risks

Economic Modeling tools are relevant to the functions of Local Government (statutory functions and non-statutory functions).

Table 1 outlines the areas of use to Councils. Benefits and threats are also outlined.

Table 1- Uses, Benefits and Threats

Area of Use	Statutory requirement	Benefit	Threat
1. Strategic Management Plan	Yes – s122 LG Act	Assist with ranking of priorities from an economic point of view. Social, environmental and political aspects to be considered separately.	Nil*
2. Asset and Infrastructure Plan (AIP)	Yes – s122 LG Act	Limited assistance in ranking priorities of a general nature, but relevant to higher order infrastructure that underpins economic and community activity (see Case Studies on Monarto Freeway Interchange, and T and R)	Nil*
3. 10 Year long term financial plan	Yes – s122 LG Act	As per Strategic Management Plan (SMP), as the 10 year long term financial plan forms part of the SMP above	Nil*
4. Financial Sustainability Inquiry	Yes – Chapter 8-11 of LG Act	See SMP and AIP above	Nil*

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[1] Economics Dictionary definition

5. Development Plan Reviews	Yes – s30 Development Act	Infrastructure planning, economic, social and environmental assessments are a critical part of a S30 process. Economic Modeling can be a vital tool to estimate the positive and negative impacts of planning decisions, before a decision is actually made. (see Case Studies on Murray Bridge Urban Growth Management Plan)	Nil*
6. Development Plan Amendments	Yes – s25 Development Act	As per Section 30 Review.	Nil*
7. Business attraction	Yes – via Resource Agreements, S-122, and good business practice	Major assistance for Council business and economic development portfolios – to attract and promote investment opportunities. Eg demographics, gaps in market etc	Nil*
8. Budget priorities	Yes – various provisions	Similar to comments on SMPs	Nil*
9. Influence, alter or shape current government policy	Yes – various. Local Government Act, Development Act and other Acts	Very relevant - see Shared Services Review case study	Nil*
10. To influence the creation of new government policy	Yes – as above	Very relevant. Enables Councils to be proactive.	Nil*
11. Grant submissions	Yes – various financial sustainability and budget provisions – Objects of Local Government Act	Very relevant – can proactively target major grants – increases likelihood of success via use of meaningful and credible forecast/impact scenarios.	Nil*
12. Federal Economic Stimulus Package	Yes – at Local State and Federal levels	Major assistance in helping to promote and market results to community and government. Help to position councils for future grants in this area.	Nil*
13. Media and promotions	Best practice	To sell outcome of Council decisions on benefits of major events, investment attraction, credible data in media releases, high impact press articles.	Nil*
14. Marketing of council services and decisions	Yes – various Acts community consultation/ engagement	Lifting the profile and image of Local Government, linked to 13 above	Nil*

	provisions. Also best practice.		

* Threats – 1. Investing in the product and not using it; 2. Time investment for staff training – but benefits far outweigh these, and 3. "garbage in" "garbage out" – the data being entered for each economic scenario must be factual, for example, the number of jobs and/or impact on investment must be reasonably accurate for the output to be credible.

Note:- Financial risks associated with the purchase of Economic Modeling software can be managed by use of Annual Licenses only, and/or a fee for service scenario. – that is, under either option the client is not locked into 'long term' contracts.

3.0 Case Studies

3.1 Monarto Freeway Interchange[2]

In 2002 the Rural City of Murray Bridge and the Murraylands Regional Development Board undertook economic modeling to support a grant application to the State Government for infrastructure funding for the new freeway ramps.

The freeway ramps where a integral part of the Monarto Commercial Zone and the catalyst for economic development at the newly created Commercial Zone.

Economic data collected – $87 - $138 million investment into the Commercial Zone.

Outcome/influence – The economic data and multiplier effect on predicted economic investment provided credible data - assisted with the grant being approved.

3.2 Shared services initiative – SA Government

The State Government as part of it's Shared Services initiative planned to shed (or make redundant) 54 public services jobs in the Murraylands.

The MMLGA lobbied the SA Government against this initiative on the grounds of negative economic and social impact on the region. The MMLGA used the REMPLAN economic modeling package to provide datasets to the SA Government on this issue.

Economic data collected – Negative impact of $18 million on total regional output, $8.5 million on value added spending, $6 million multiplier effect (negative) on regional income and overall impact on regional jobs of 111 jobs.

Outcome/influence - It had a direct result in influencing policy on this matter.

3.3 Impact of water restrictions - River Murray

PIRSA conducted an economic impact assessment on the impact of SA Government policy on water restrictions. The study was titled, Lower Murray Drought Impact Study, EconSearch, 2007.

Economic data collected – Modeled impact of 20% and 0% water allocations in Murraylands. 20% allocation =loss of upto 1,131 jobs and loss of $167.7 million

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[2] Monarto Freeway Interchange, Submission to the Regional Infrastructure Development Fund, Rural City of Murray Bridge and the Murraylands Regional Development Board, 2002.

GDP; 0% allocation = loss of upto 1,457 jobs and loss of upto $203.3 million GDP.

Outcome/influence – Credible data leading to better understanding of impacts at State Government level.

3.4 T and R Pastoral[3]

The Murraylands Regional Development Board analysed the impact of T and R Pastoral (Murray Bridge's largest employer – over 1,000 jobs) on the economy of Murray Bridge.

Economic data collected – the 1,000 jobs equated to $751 million to the local economy. Total direct multiplier effect on employment = 30-40% of all jobs in the Murray Bridge economy directly or indirectly influenced by T and R.

Outcome/influence – Assisted the Board, Council and T and R Pastoral in lobbying and influencing Government policy and decision making. Marketing and promotional benefits, highlighting the importance of the business to the State.

3.5 Murraylands Regional Development Board – jobs and investment forecast 2009-2011

Commissioned by the Murraylands Regional Development Board. Development of multi- scenario forecasts, based on survey work and data analysis.

Forecasts were based on the capital investment expectations of the Region's business owners and managers. The surveys also investigated threats to growth and strategies to remove them.

A sample of 269 organisations was gathered, including all industry sectors throughout the Region. Respondents were asked to state their growth expectations for average, good and bad years, and their capital investment expectations, rated as very likely, quite likely, or just possible.

Economic data collected –Murraylands businesses expected an increase of 2,831 new positions (of which 1,776 will be full time) by the end of 2011. If three bad years are experienced, the full number will be 971, but it could be as high as 3,953 if the years are good.

In the most likely scenario, capital investment in the order of $1,132,102,500 is anticipated by the end of 2011. The sum could be as high as $1,509,872,500 if

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[3] Murraylands Regional Development Board.

all the projects being planned in fact eventuate, but it could be as low as $829,947,500 if only those rated as most likely succeed.

Outcome/influence – Major assistance to the region in marketing, business attraction, lobbying, influencing and shaping government and council policy.

3.6 International Pedal Prix[4]

The Rural City of Murray Bridge engaged Dynamic Project delivery to undertake an economic benefit analysis of the Murray Bridge Pedal Prix.

Council invests $70,000 into the event on an annual basis and the event attracts over 20,000 visitors to Murray Bridge.

The on ground survey work was supplemented by a REPLAN analysis, highlighting the flow on benefits of the event.

Economic data collected – an economic flow on effect of $3.7992 million dollars to the Murray Bridge community.

Outcome/influence – Marketing, future business decisions of Council regarding sponsorship, use by Pedal Prix to attract sponsors. To influence business houses to consider extended trading.

3.7 Mobilong Prison expansion[5]

Social and economic analysis of the positive and negative impacts of the Mobilong Prison expansion.

Commissioned by the Rural City of Murray Bridge and the SA Government.

Economic data collected – REMPLAN predicted the project would have a $52.5 million direct impact on the towns economy, leading to 295 construction jobs, and 1217 jobs flowing from the project (495 of these jobs at the new Prison).

Outcome/influence – Provided Council and all relevant service agencies with credible data to assist with future service and infrastructure planning.

3.8 Murray Bridge Urban Growth Management[6]

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[4] Rural City of Murray Bridge and Dynamic Project Delivery, 2007
[5] Urban Growth Management Plan, Rural City of Murray Bridge and Murraylands Regional Development Board, 2007
[6] Ibid

Research, investigations and analysis into the urban growth scenarios and recommendations for the future management of Murray Bridge from an urban development perspective.

Research and planning analysis included, demographics, traffic and transport, infrastructure, social, economic and environmental.

A major part of the work included an economic analysis (undertaken by Econ Search) and development of predicted growth models. A population policy was developed based on this research, in association with the planning and infrastructure considerations.

Economic data collected – *population forecast of 30,000 people in Murray Bridge by 2025 (a doubling of the population).*

Outcome/influence – *Marketing, business attraction, infrastructure planning, staged zoning plan, assist with grant submissions. Essential document for the planning of any community. Winner of Planning Institute of Australia award.*

4. Options for consideration[7]

The MMLGA has requested that the Regional Economic Modeling Plan (REMPLAN) produced by LaTrobe University be assessed, in relation to its suitability for use by Regional Councils for economic research, analysis and modeling.

In order to assess and analyse the pros and cons of REMPLAN it has been considered appropriate to benchmark REMPLAN against other economic modeling opportunities.

4.1 REMPLAN

Product:-   The REMPLAN economic modeling and analysis system is used by State and Federal Government agencies, economic development boards, local governments, universities and consultants across Australia. These organisations value the provision of area-specific industrial economic data (output, employment, wages & salaries, regional exports, regional imports, and gross regional product) combined with a dynamic economic impact modelling capability. REMPLAN is essentially made up of 2 base components; REMPLAN software and REMPLAN data files, (REMFiles) REMFiles incorporate region specific data compiled using an input-output methodology and REMPLAN is navigational software that allows the client to extract useful information and modeling from the REMFiles.

REMPLAN is innovative in that it takes a complex methodology and provides an interface that makes data contained in the REMFiles accessible to economic and business development practitioners both with, and without, a formal background in economics. With its automated features, information pane and comprehensive help files, REMPLAN makes the economic data easy to use and understand. Compelling Economics also provides on-site training and ongoing support to all REMPLAN clients to ensure they get the most from their subscription.

Further details regarding REMPLAN are attached – see *Appendix A*.

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[7] Information supplied to Development Answers Pty Ltd by MMLGA and relevant Agencies as part of a desk-top analysis. All contacts advised at the time that REMPLAN was being considered as a possible option and that the MMLGA wished to consider other potential options – data has been obtained from an understanding of the products available, and has not included a full open tender style assessment of the market place.

Fee:-   Outlined in Appendix A - will vary depending on whether the total package is sold to one central point – this creates economies of scale with the per annum fee, per Council, being $1,235 to $1,854, depending on the A to AAA annual service scenarios purchased (see Appendix A).

Alternatively, as outlined in Appendix A, the REMPLAN package could be sold to individual Councils direct, for a per annum fee of $4,496.25.to $7,496.25 depending on the A to AAA annual service scenarios purchased (see Appendix A).

Data:-   By individual Council area. DTED (see 4.2) Input/output data sets proposed to be imported as part of the fee (source – MMLGA).

4.2 RISE Model – Department of Trade and Economic Development (DTED)

Product:-   DTED are in the process of developing an Input/Output Economic Modeling tool for South Australia which includes data for the regional development board boundaries. It is tilted the Regional Industry Structure and Employment (RISE) Impact Model, and will be available with a number of weeks.

The RISE Impact Model was originally developed 3-4 years ago via EconSearch, engaged by the DTED. RISE is a Microsoft Excel spreadsheet model designed to assist a regional analyst understand the structure of a regional economy and estimate the economic impact of change in the region.

The model has three functions:
- describe industry structure;
- measure economic impact; and
- provide an input-output table and multipliers for the region.

The model can be used to estimate the impact on the regional economy of a change in the final demand for the output of one or many sectors. It can also be used to illustrate the impact of establishing a new industry/business in the region. Impacts are measured in terms of gross regional product, employment, household income and value of output.1

The aim of the analytical component of this model is to provide a statement of regional economic impact as a result of a particular event or new industry. The results of the analysis do not indicate whether the costs to the regions outweigh the benefits.

Peer review by Adelaide University.

Further information:- **Refer Appendix B**

Fee:-   RISE will be provided at **no cost** Regional Development Boards and Agencies.

It does not cover Council areas, but could be modified, for a fee, for individual Councils on a fee for service basis.

RISE has similar capabilities to the REMPLAN, but is restricted to regional impacts, not individual Council or small groups of Councils level.

Data:-   *12* Regions only, inclusive of the 4 metropolitan areas.

Shift share analysis also available - uses the input and output data and also takes a snap shot 5 years into the future – analyses results and trends.

4.3 Metropolitan and Regional Indicators project - Sustainable Mapping Project[8]

Product:-   The Economic, Social and Environmental Sustainability Mapping project will develop a web presence to be used by developers, investors and others seeking information and data on possible economic and other opportunities in South Australia.

It will provide information at Council, regional and State levels that is helpful to economic decision makers. The web site will also be helpful to Council Members and officers considering reports on economic development, strategic planning and analysis and other Council requirements.

The South Australian Department for Trade and Economic Development (DTED) has funding to develop a website that has a strong correlation between the information it wishes to map spatially and the outcomes the LGA is seeking through the Economic, Social and Environmental Sustainability Mapping project.

In addition, the Australian Bureau of Statistics (ABS) has provided resources to the project, including a statistician to work on the project during its development phase and a range of statistical information.

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[8] LGA of SA

The LGA took up an offer to 'piggy back' on the DTED project and obtain a higher quality package from data, design and operability viewpoints, than it would be able to develop through its own resources.

The project has a mid-June 2009 deadline for it to be 'live' on the web. To achieve this deadline, the project is moving quickly and has already determined data requirements, indicators to be included, mapping and reporting requirements, the 'look and feel' of the website, hosting and maintenance arrangements and other matters.

At this time the LGA Secretariat is seeking the agreement of Councils to access some Local Government Grants Commission information for the website and some text that provides an Overview of the Council in terms of location and main features and the current and future Economic Development situation of that Council. In addition Councils will have the opportunity to have their logo and an image that represents their Council's area on the website alongside the text. With the Council logo and an image representative of the Council area alongside this text, the opportunity has been created for a 'snapshot' of the Council to be created for local, interstate and overseas visitors to the website.

Fee:-   *No charge to Councils, and developed with assistance from the LGA Research and Development Fund.*

It is not an economic modeling tool.

Data:-   *Council areas, but no Economic modeling. Can work along side RISE model.*

4.4 Regional Development Boards

Regional Development Board, by their very nature (as Economic Development Agencies) should have access to economic modeling tools.

Boards use economic modeling tools from time to time, but according to Compelling Economics there is only one Board in SA that has acquired REMPLAN, being the Murraylands Regional Development Board. Information obtained from the Murraylands Regional Development Board (some of which is referenced in the Case Studies) highlights that economic modeling is an essential and vital tool – without this tool the Board could not undertake it's role with the same degree of success.

In the future Boards will have the benefit of the RISE model (see above) accessed via the Department for Trade and Economic Development.

4.5 Councils

Various Councils across South Australia have already invested in Economic Modeling software. Some of these Councils include:-

- Adelaide City Council
- Onkaparinga Council
- Marion Council
- Rural City of Murray Bridge
- Coorong Council
- Karoonda East Murray Council

4.6 Consultancy services

A an number of consultancy firms specialise in Economic Modeling. The services provided are all credible and highly recommended.

Such services are generally provided for a fee for service based on an hourly rate and/or project scenario. It would be inappropriate to estimate a fee range on behalf of third party consultancy firms. However, based on work completed for the Rural City of Murray Bridge, it is understood that fees were in the range of $1,500 to $3,000 for small to medium type 'one-off' economic modeling scenarios. REMPLAN and RISE annual packages will do 'unlimited' scenarios.

5. Conclusion

Economic Modeling has a very important role to play for Councils, Regional Development Boards and government agencies. Economic Modeling provides:-

- Credible forecast data
- An increased chance of success with grant applications by using credible data
- A stronger influence for lobbying and submissions to government on current government policy, Parliamentary Bills and decision making
- A stronger influence on future government policy needed to address a particular issue.
- Economic data and forecasts for business planning and investment attraction
- Opportunities to better market council services, regional or business opportunities
- An improved process for forward strategic planning, as a result of forecasts from an economic model

In simple terms, the relevant agencies with a responsibility for *Forward Planning* must have access to *economic analysis* tools to be able to plan and shape their communities with some degree of accuracy.

The risks to Councils and agencies are small. Risks include:-

- Investing in the product and not using it - a wasted investment if the agency is not committed to using it.
- Time investment for staff training – but benefits far outweigh this.
- "Garbage in" "garbage out" – the data being entered for each economic scenario must be factual, for example, the number of jobs and/or impact on investment must be reasonably accurate for the output to be credible.

Given the various products available at present, there is some confusion and duplicated effort. Councils need to make their own educated assessment, and this Paper should assist in that decision making process.

It is considered however, that Councils should be utilising Economic Modeling tools as part of their day to day core business, for the reasons outlined above.

6. Recommendation

1. That Councils and relevant agencies **seriously consider investing in Economic Modeling tools** for the day to day function of their business units.

2. That for **Council wide data**, the REMPLAN offer provides excellent value for money to Councils, with a **strong return on investment.** Noting that REMPLAN is currently only available from the Murraylands Regional Development Board (regional data only) and 5 of the 8 MMLGA member Councils. Should this approach be supported:-

   a. Individual REMPLAN models be held by each Council for their own input/output use, and
   b. Regional LGA's auspice all Council models for their region, providing
      i) A single source of data input by a trained operator
      ii) The ability to model on a regional, part regional, Council group(s) as well as on an individual basis.
      iii) The ability for a Regional LGA to bring to the attention of their Association the resultant impacts modeled by one Council on other adjoining Councils.

3. That for Councils and Agencies only wishing to utilise broader based **regional data only** – the existing RISE model offers the best return for money as it is provided via DTED **at no cost**. However, should a Council wish to obtain RISE data on a Council area basis for a specific Council based scenario, the cost will be based on a 'fee for service'.

4. That for those Councils not wishing to access the REMPLAN or RISE (DTED) options, various fee for service options are available via Economic Consultancies based on an hourly rate and/or project scenario. This option is likely to be more expensive than option 2 and 3, given it is often 'project based' and is an hourly rate scenario, depending on the complexity of the project and the frequency of use of such a service.

5. That the MMLGA and DTED undertake further 'testing' of common economic modeling scenarios via the REMPLAN and RISE models to ensure consistency, and to avert the risk of two similar products having inconsistent results within the Local Government and agency network.

Appendix A

REMPLAN product

Appendix B

DTED RISE model
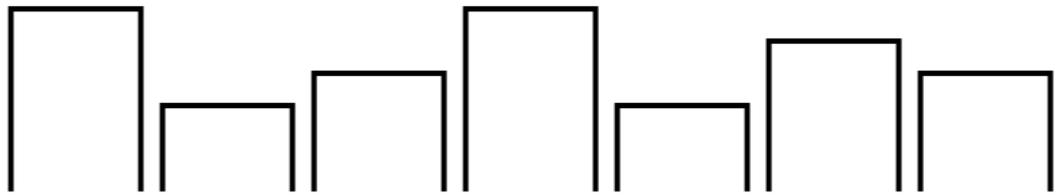
Compelling Economics

Proposal:

Provision of:

REMPLAN™ Software and economic data

To:

M&MLGA
Murray and Mallee Local Government Association

Proposal

To: **Murray and Mallee Local Government Association**

By: **Compelling Economics**

CONTENTS

Proposal

To: **Murray and Mallee Local Government Association**

By: **Compelling Economics**

Introduction

Intent of proposal:

The intent of this proposal is to provide Murray and Mallee Local Government Association (M&MLGA) with options to consider regarding accessing REMPLAN™ economic modelling and analysis software and data for each Local Government Area (LGA) in South Australia and each of the State Government defined regions.

Content of proposal:

This brief presents a background to REMPLAN and how REMPLAN is currently packaged and priced. A number of options are outlined and include pricing and delivery schedules.

REMPLAN background:

The REMPLAN™ economic modelling and analysis system is used by State and Federal Government agencies, economic development boards, local governments, universities and consultants across Australia. These organisations value the provision of area-specific industrial economic data (output, employment, wages & salaries, regional exports, regional imports, and gross regional product) combined with a dynamic economic impact modelling capability.

REMPLAN is essentially made up of 2 base components; REMPLAN software and REMPLAN data files, (REMFiles) REMFiles incorporate region specific data compiled using an input-output methodology and REMPLAN is navigational software that allows the client to extract useful information and modelling from the REMFiles.

REMPLAN is innovative in that it takes a complex methodology and provides an interface that makes data contained in the REMFiles accessible to economic and business development practitioners both with, and without, a formal background in economics. With its automated features, information pane and comprehensive help files, REMPLAN makes the economic data easy to use and understand. Compelling Economics also provides on-site training and ongoing support to all REMPLAN clients to ensure they get the most from their subscription.

Further details regarding REMPLAN can be found on our website at www.remplan.com.au and detail on the different packages can be found in the appendices of this document.

To: **Murray and Mallee Local Government Association**

By: **Compelling Economics**

Options for consideration:

The details outlined below provide the M&MLGA with options to consider in regards to accessing REMPLAN software and data.

Option 1

Provision of REMPLAN to one client only

Provide a REMPLAN annual service package* to the technical specialist or team for use in their offices and for servicing the member councils. This package would include REMPLAN data, (REMFiles) for each of the 68 LGAs and (if required) data for each of the State Government regions.
REMPLAN annual service packages are available in 'A', 'AA' and 'AAA' levels.

All REMPLAN packages come with the following features

- 12 month licence to REMPLAN software
- REMFile (economic data file) for 1 defined region
- Economic profile data for 17 an 35 industry sectors
  ('AA' and 'AAA' models also have data at 109 industry sectors)
- Economic impact modelling for 17 industry sectors
  ('AA' packages have modelling at 17 and 35 industry sectors and 'AAA' packages have modelling at 17, 35 and 109 industry sectors)
- Onsite training session
- Comprehensive ongoing service and support via email and phone

As REMPLAN comes in two (2) components it is possible for the team at Compelling Economics to use Input-Output data compiled by secondary sources, such as the State Government, to be compatible with the REMPLAN software. This allows clients to navigate through their own data and undertake impact modelling scenarios in the same way they do with other REMFiles.

Option 1: Fees

OPTION 1 Fees (Inc GST)	'A' Package	'AA' Package	'AAA' Package
REMPLAN Annual Service Package:	$ 5,995.00	$ 7,495.00	$ 9,995.00
67 Additional REMFiles:	$ 71,926.80	$ 89,278.60	$ 110,016.10
Sub-Total	**$ 77,921.80**	**$ 96,773.60**	**$ 120,011.10**
Build template for converting Client I/O Tables	$6,050.00	$6,050.00	$6,050.00
Total	**$ 83,971.80**	**$102,823.60**	**$ 126,061.10**

To: **Murray and Mallee Local Government Association**

By: **Compelling Economics**

Option 2

Provision of REMPLAN to Each of the 68 LGAs

Provide a REMPLAN annual service package* to each of the South Australian LGAs for use in their respective offices. Each of the LGAs would receive a REMFile for their individual region plus the broader region.
* REMPLAN annual service packages are available in 'A', 'AA' and 'AAA' levels.

All REMPLAN packages come with the following features

- 12 month licence to REMPLAN software for each LGA
- REMFile (economic data file) for 1 defined region
- Economic profile data for 17 an 35 industry sectors
  ('AA' and 'AAA' models also have data at 109 industry sectors)
- Economic impact modelling for 17 industry sectors
  ('AA' packages have modelling at 17 and 35 industry sectors and 'AAA' packages have modelling at 17, 35 and 109 industry sectors)
- Onsite training session
- Comprehensive ongoing service and support via email and phone

As in Option 1 because REMPLAN comes in two (2) components it is possible for the team at Compelling Economics to use Input-Output data compiled by secondary sources, such as the State Government, to be compatible with the REMPLAN software. This allows clients to navigate through the data and undertake impact modelling scenarios in the same way they do with other REMFiles. If required this can be done and provided to each LGA as required.

Option 2 Per Client Fees

OPTION 2 Fees (Inc GST) per LGA	'A' Package	'AA' Package	'AAA' Package
REMPLAN Annual Service Package:	$ 5,995.00	$ 7,495.00	$ 9,995.00
Additional REMFile using client I/O tables*	No charge*	No charge*	No charge*
Discount for group purchase, (25%)	- $1,498.75	- $ 1,873.75	- $2,498.75
	$ 4,496.25	**$ 5,621.25**	**$ 7,496.25**
*As a part of option 2, no fee will be charged for the construction of a template			

To: **Murray and Mallee Local Government Association**

By: **Compelling Economics**

Delivery Schedule:

Upon receiving written instructions from Murray and Mallee Local Government Association to proceed, Compelling Economics will;

- send a REMPLAN licence agreement/s that will need to be signed,
- REMPLAN software and economic data for the local government areas within a maximum of 48 days,
- Construct a template for client supplied I/O tables to be used in REMPLAN and,
- make arrangements for training session/s.

To proceed with this proposal, or if you have any questions or queries, please contact:

Tony Moore
Compelling Economics Pty Ltd
Ph. 03 5444 4788 or 0429 351 429
Email: tony@compellingeconomics.com.au

To: **Murray and Mallee Local Government Association**

By: **Compelling Economics**

Appendices

REMPLAN™ Annual Service Packages

'A' Service Package

Includes:

- REMPLAN 12 month licence
- 1 x 'A' REMFile (defined by any single LGA, or combination of LGAs)
- Training conducted by Compelling Economics staff
  (location at client's discretion)

Details:

The 'A' Service Package allows users to perform regional economic modelling tasks at a 17 industry sector 'breakdown'. The data that is generated by modelling provides detailed information across industry sectors, on direct and 'flow-on' impacts, in terms of output, wages and salaries, employment and Gross Regional Product (GRP), of an economic change in the region. Clients also have access to a 35 industry sector transaction table. This table contains valuable information on supply chain interactions between industry sectors within the regional economy.

'AA' Service Package

Includes:

- REMPLAN 3 12 month licence
- 1 x 'AA' REMFile (defined by any single LGA, or combination of LGAs)
- Training conducted by Compelling Economics staff
  (location at client's discretion)

Details:

The 'AA' Service Package has all the features of the 'A' Service Package, with the additional capacity to 'drill-down' from the 35 industry sector transaction table to a 109 industry sector transaction table.

The 'AA' Service Package also allows the client to model economic impact scenario's at both 17 and 35 industry sector breakdowns.

At 109 industry sectors clients have access to extremely detailed information on the type of industries operating in their region and on how these industries interact (i.e. buy from, and sell to each other) in the regional economy. The tables also display how much each industry sector imports from the rest of Australia, and from overseas, into the region. This data is essential for identifying possible opportunities to add-value to the output of the region and to replace regional imports. Detailed, timely, region-specific data is the starting point for a strategic approach to economic development.

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'AAA' Service Package

Includes:

- REMPLAN 12 month licence
- 1 x 'AAA' REMFile (defined by any single LGA, or combination of LGAs)
- Advanced Training conducted by Compelling Economics staff
  (location at client's discretion)

Details:

The 'AAA' Service Package has all the features of the 'AA' Service Package, with the additional capacity to model different impact scenarios at 17, 35 and 109 industry sector breakdowns.

Industry sector data and an economic modelling capability, both at a 109 industry sector breakdown, provide the user with an impressive data resource for informational and reporting purposes, as well as more strategic applications involving development planning and opportunity scoping.

'AAA' Service Packages are applied by Compelling Economics to its own contract research and consulting tasks, and it is the experience gained through these activities which has shaped the Advanced REMPLAN Training program which is provided with this package.

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User Notes for the
RISE Impact Model

A report prepared for

Regional Communities Consultative Council

Local Government Association of SA

Regional Development SA

Prepared by

econsearch

29 July 2005

Contents

Abbreviations

CPI	Consumer Price Index
FTE	Full Time Equivalent
GRP	Gross Regional Product
GSP	Gross State Product

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1. Introduction

1.1   RISE Impact Model Overview

The RISE Impact Model is a *Microsoft Excel* ® spreadsheet model designed to assist a regional analyst understand the structure of a regional economy and estimate the economic impact of change in the region.

The model has three functions:

- describe industry structure;

- measure economic impact; and

- provide an input-output table and multipliers for the region.

The model can be used to estimate the impact on the regional economy of a change in the final demand for the output of one or many sectors. It can also be used to illustrate the impact of establishing a new industry/business in the region. Impacts are measured in terms of gross regional product, employment, household income and value of output.[1]

The aim of the analytical component of this model is to provide a statement of regional economic impact as a result of a particular event or new industry. The results of the analysis do not indicate whether the costs to the regions outweigh the benefits.

1.2   When to use the RISE Impact Model

An overview of the RISE Impact Model is shown on the diagram on the following page. The main menu has three choices that are consistent with the model's three main functions listed above:

- Prepare Industry Structure Report;

- Conduct Impact Analysis; and

- View Input-Output and Multiplier Tables.

The RISE Impact Model has input-output analysis as its core. Input-output models, such as RISE, provide a detailed picture of the structure of an economy at a particular point in time. The model provides a basis for analysis of inter-sectoral relationships within the economy. Accordingly, this makes the input-output model ideal for regional impact analysis.

Based on the assumption that no single firm, industry or sector exists in isolation, input-output analysis provides an analysis of the dependencies that exist between firms. Each firm, industry or sector depends to some extent on others as sources of inputs or as markets for outputs. An understanding of these dependencies is essential in measuring the impact of a change in a particular sector.

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[1] See Appendix 1 for a glossary of input-output terminology.

MAIN MENU

PREPARE INDUSTRY STRUCTURE REPORT

CONDUCT IMPACT ANALYSIS

VIEW INPUT-OUTPUT AND MULTIPLIER TABLES

Profile GRP & Output

Profile Jobs, Income & H/H Expenditure

Profile Imports & Exports

Output Chart

GRP Chart

Employment Chart

Household Income Chart

Input Data for Final Demand

Input Data for New Industry Impact

Output Impact

GRP Impact

Employment Impact

Household Income Impact

Input-Output Transactions

Direct Coefficients Table

Output Multipliers

GRP Multipliers

Employment Multipliers

Household Income Multipliers

The user of the model should understand the distinction between economic impact analysis and economic evaluation. Economic impact analysis is concerned with measuring the impact or effect of a given stimulus on the economy in economic terms.

Economic impact statements should not be used as a justification for a particular course of action. They do not provide evaluative direction in terms of cost versus benefit, rather they should be used as an input in an evaluation study. Techniques such as the cost benefit analysis, which express the relationship between the benefits to society and the costs incurred as a result of the action, are more appropriate for providing information about return on investment and project viability.

2. Data and Outputs of the RISE Model

The model can be divided into three distinct segments:

- Input data – information provided by the model user (e.g. expected annual change in final demand, number of jobs, expected annual demand from local suppliers);

- Model data – information embodied in the model that has been drawn from other sources (e.g. input-output transactions tables, multipliers and direct coefficients tables);

- Impact results – measures of economic impact calculated by applying input data to model data.

All the cells in the RISE spreadsheet model are shaded either purple or green. Purple shaded cells indicate input data. Where no impact is being estimated the purple input data cells on the "Final Demand" and "New Industry" sheets are all empty. Green shaded cells represent text (e.g. sector labels), model data or final output. All output cells contain formulae.

2.1   Overview of Input Data

2.1.1   General input data

There is an option to change some default values and text in the RISE Impact Model on the "Base Data" worksheet. These include:

- region name;

- model reference year; and

- Consumer Price Index (CPI) or GDP deflator between model reference year and impact year.

2.1.2   Data for impact analysis

Data describing the nature of the impacting event is provided by the model user. Input data for the model can be entered on the "Final Demand" and "New Industry" worksheet, reached through the *Main Menu/Conduct Impact Analysis/Final Demand* and *Main Menu/Conduct Impact Analysis/New Industry*.

Input Data for Final Demand Impact

At the "Final Demand" screen either:

1. enter the expected annual change, whether growth or decline, in final demand by sector (a decline in final demand is represented as a negative value); or

2. when the change in final demand is unknown enter the change in the number of full time equivalent jobs expected from the growth/decline scenario and the model will calculate an estimate of final demand. These estimates need to be entered into the final demand estimator column.

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Input Data for New Industry Impact

At the "New Industry" screen:

1. enter the aggregate parameters for the new industry/business (e.g. sales, wages and salaries, employment); and

2. enter the expected annual demand from local suppliers, in basic values.[2]

2.2   Overview of Model Data

Input-Output Transaction Tables

An input-output transactions table illustrates and quantifies the value of purchases and sales of goods and services in an economy at a given point in time. It provides a numerical picture of the size and shape of the economy and its essential features. Each item is shown as a purchase by one sector and a sale by another, thus constructing two sides of a double accounting schedule.

The transactions table provides a detailed picture of the structure of the economy and a basis for the analysis of the relationships between sectors. The transactions table also provides the data to develop profiles of the regional economy. Indicators of regional economic activity include:

- value of output;

- gross regional product;

- employment and household income; and

- regional imports and exports.

Direct Coefficients Table

Direct coefficients calculated by dividing the cells in a column of a transactions table by the column total represent clearly the purchasing pattern of each sector. The direct coefficients for a sector of interest represent the direct requirements from the output of each sector of the economy following an increase in output by the sector of interest.

Multipliers

A multiplier is an index (ratio) indicating the overall change in the level of activity that results from an initial change in economic activity. Multipliers indicate the total change in all sectors that is required to satisfy a change in final demand and are an indication of the strength of the linkages between a particular sector and the rest of the regional economy. The RISE Impact Model includes output multipliers, gross regional product multipliers, employment multipliers and household income multipliers. A brief definition of multipliers can be found in the Glossary in Appendix 1 and an explanation of the mathematical structure of multipliers is provided in Appendix 2.

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[2]   *Basic value* is the price received for a good or service by the producer. It is also known as *producers' price*. It excludes indirect taxes and transport, trade and other margins.

2.3   Overview of Impact Results

The model generates several tables of economic impact. These tables are derived from input data and model data. The tables of economic impact are divided into three columns highlighting the initial effect of the change, the production induced effect and the consumption induced effect.[3] A fourth column indicates total impact. The tables of economic impact can be viewed from: *Main Menu/Conduct Impact Analysis*. The range of impact types is described below.

Output Impacts

Value of output is a measure of the gross revenue of goods and services produced by commercial organisations (e.g. farm-gate value of production) and gross expenditure by government agencies. Total output needs to be used with care as it includes elements of double counting (e.g. the value of winery output includes the farm-gate value of grapes) and therefore overstates the level of net economic activity.

Gross Regional Product Impacts

Gross Regional Product (GRP) is a measure of the net contribution of an activity to the state or regional economy. Contribution to gross state/regional product is measured as value of output less the cost of goods and services (including imports) used in producing the output. GRP can be measured as household income plus other value added (gross operating surplus and all taxes, less subsidies). It represents payments to the primary inputs of production (labour, capital and land). Using contribution to Gross State Product (GSP) or GRP as a measure of economic impact avoids the problem of double counting that may arise from using value of output for this purpose.

Employment Impacts

Employment is a measure of the number of working proprietors, managers, directors and other employees. Employment can be expressed as either the number of full-time equivalents (fte) or total jobs. Employment in the RISE Impact Model is measured by place of remuneration rather than place of residence. This has a significant impact on employment numbers in some regions, particularly the Outer Adelaide and Barossa regions, where a large number of residents are employed outside the region (i.e. mostly in Adelaide).
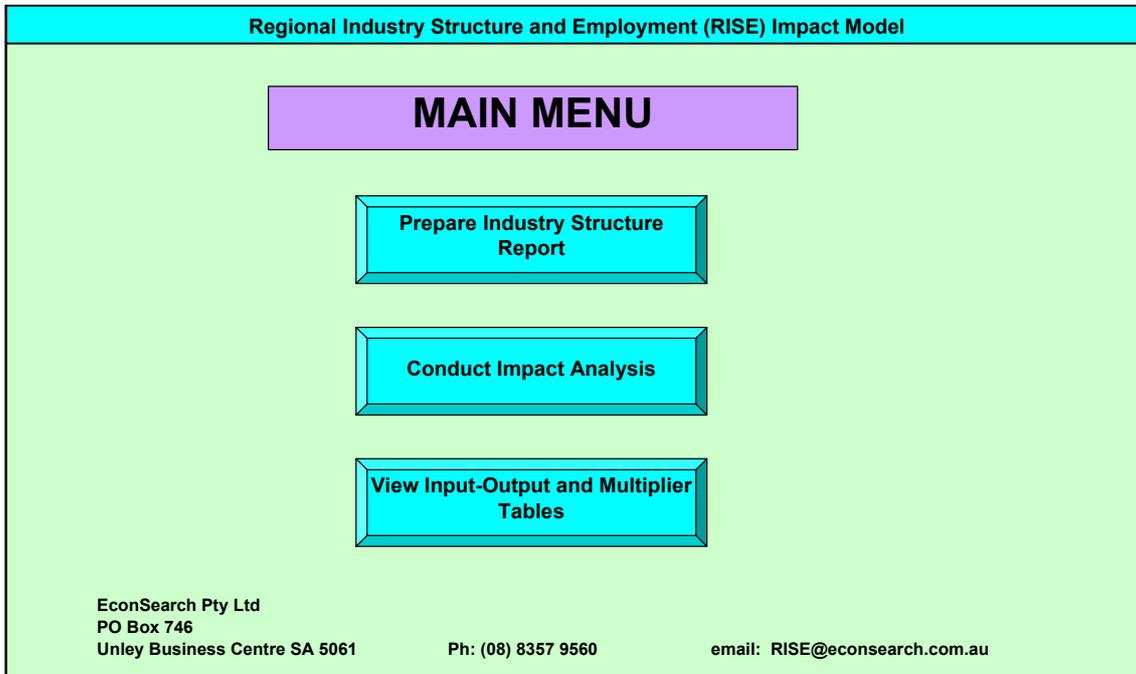
Household Income Impacts

Household income is a component of GSP/GRP and is a measure of wages and salaries and other payments to employees, including overtime payments and income tax, but excluding payroll tax. It also includes the drawings of working proprietors.

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[3] See Appendix 1 for glossary of input-output terminology.

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3. Using the RISE Impact Model

3.1 Main Menu

The Main Menu allows the user to access the three main functions of the RISE Impact Model. Click on one of the three buttons to take you to the menu for that function.

Regional Industry Structure and Employment (RISE) Impact Model

MAIN MENU

Prepare Industry Structure Report

Conduct Impact Analysis

View Input-Output and Multiplier Tables

EconSearch Pty Ltd
PO Box 746
Unley Business Centre SA 5061   **Ph: (08) 8357 9560**   **email: RISE@econsearch.com.au**

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3.2   Prepare Industry Structure Report

Click on one of the three buttons below "TABLES" to view regional data for the relevant indicators. A definition for each of the indicators is provided in the glossary in Appendix 1 of this User Guide. Click on one of the four buttons below "CHARTS" to view a graphical representation of the indicator of regional economic structure.

RISE Impact Model
INDUSTRY STRUCTURE MENU

TABLES	CHARTS
Profile GRP and Output	Output Chart
Profile Jobs, Income and H/H Expenditure	GRP Chart
Profile Imports and Exports	Employment Chart (fte)
Return to MAIN MENU	Household Income Chart
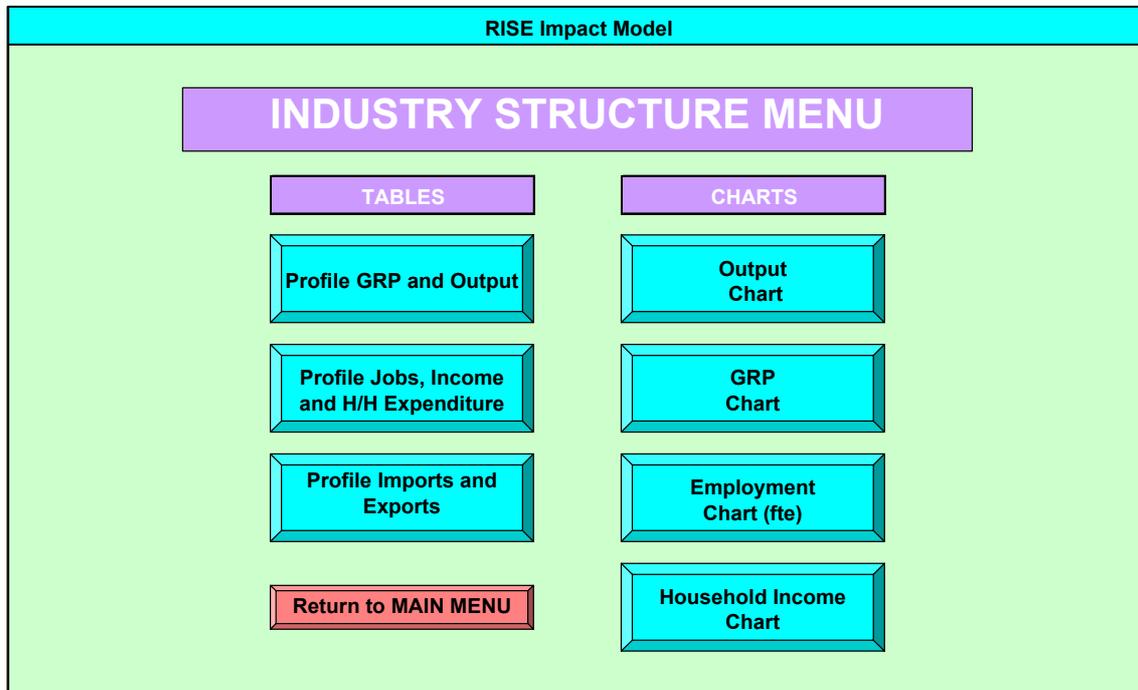
The Industry Structure Menu allows the user to access regional profiles that are presented either numerically in tables or graphically in charts. The data are provided on an industry-by-industry basis.

Printing: The tables and charts can be printed directly using the Excel print command.

Copying: The tables and charts can be copied for use in other applications using the Excel copy and paste command.

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3.3   Conduct Impact Analysis

The Impact Analysis Menu allows the user to input data for impact analysis and to view the results of the analysis.

RISE Impact Model
IMPACT ANALYSIS MENU

DATA INPUT	IMPACT RESULTS	
Input Data for Final Demand Impact	Output Impacts	Employment Impacts (fte)
Input Data for New Industry Impact	GRP Impacts	Employment Impacts (total jobs)
Adjust Inflation Index	Household Income Impacts	Return to MAIN MENU
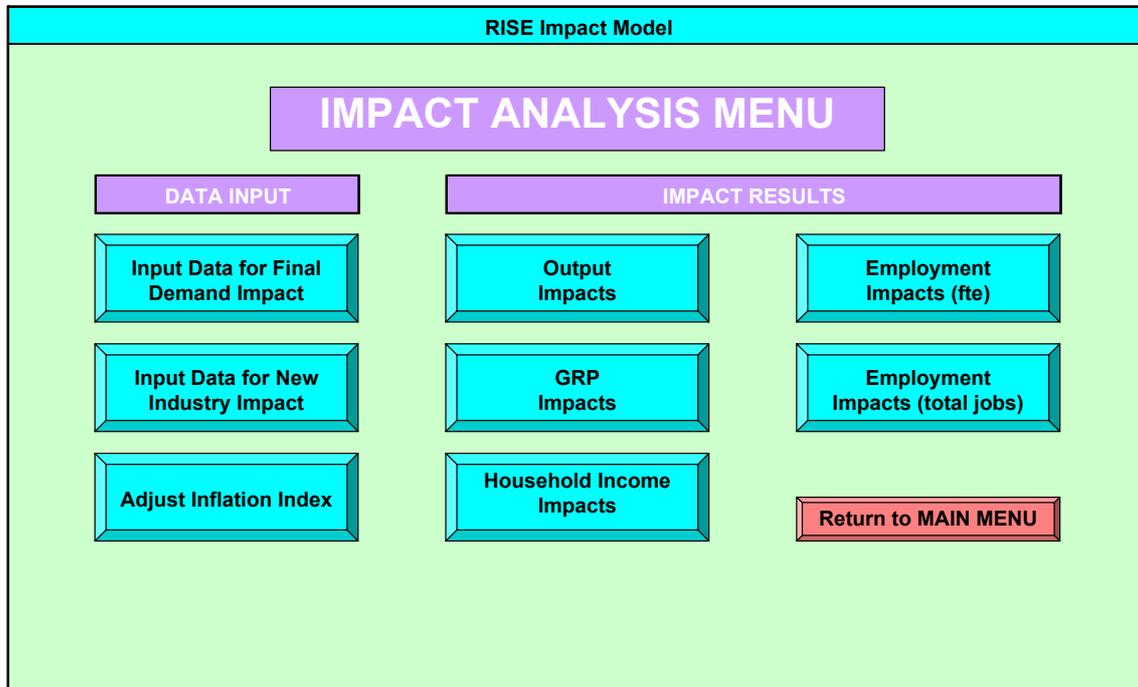
The RISE Impact Model allows the estimation of two type of regional impacts:

1.   the impact of a change in sales to final demand of one or more existing industries (this may be either growth or decline of those industries); and

2.   the impact of a new industry/business in the regional economy.

The steps involved in calculating each type of impact are described below.

Impact of a Change in Final Demand

1.   Click on the "Input Data for Final Demand Impact" button.

2.   Where the change in final demand is known, enter the amounts in the column titled "Final Demand". Values must be specified in basic values (producer prices). If the change in final demand includes demand for margin sector services (e.g. wholesale trade, retail trade and transport), these demands must be included separately against the relevant sectors.

3.   Where final demand is unknown but employment information is available, enter this information in the "Number of Jobs" column. These values must be full-time equivalents.

4.   Estimated output will be calculated automatically. These values can then be entered into the "Final Demand" column.

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Impact of a New Industry

1. Press the "Input Data for New Industry Impact" button.

2. Enter the aggregate parameters of the new industry or business.

3. Enter the expected annual demand from local suppliers in the "Intermediate Demand" column. Values must be specified in basic values (producer prices). If intermediate demand includes demand for margin sector services (e.g. wholesale trade, retail trade and transport), these demands must be included separately against the relevant sectors.

NOTE: Total intermediate demand, gross operating surplus and wages and salaries must be less than or equal to annual gross sales. If total intermediate demand, gross operating surplus and wages and salaries are greater than annual gross sales a warning will appear.

To calculate impacts of either final demand or new industry separately ensure that data are only entered on the appropriate screen. If data are entered in both screens the calculated impacts will reflect changes in both final demand and new industry data.
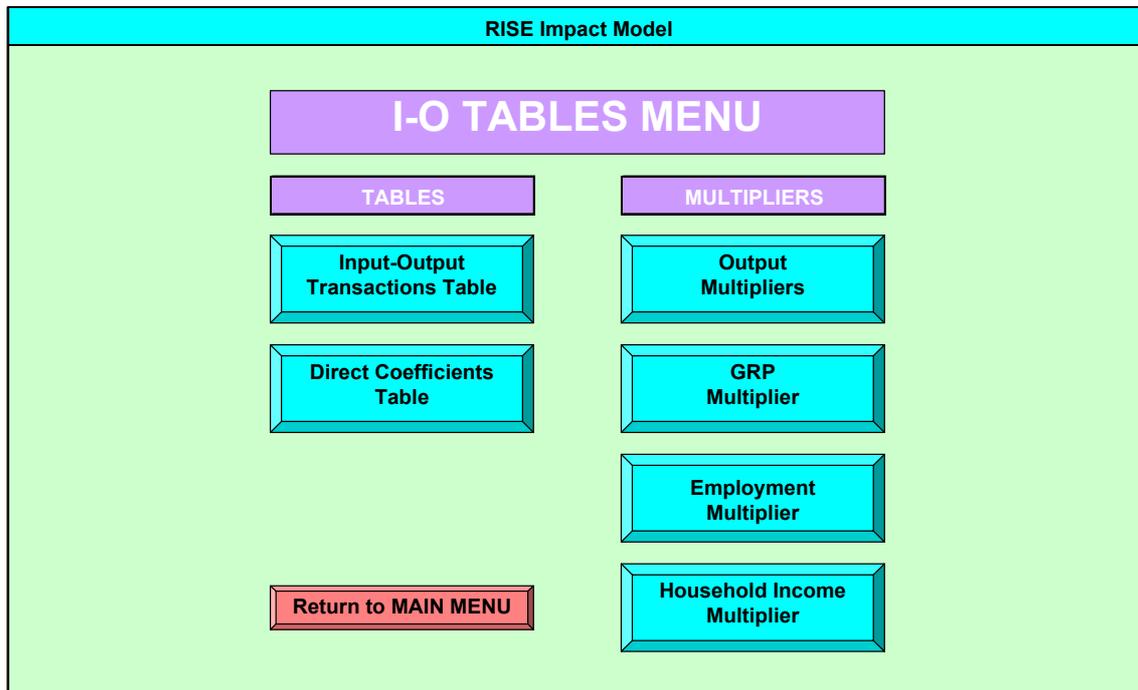

Adjust Inflation Index

1. Click on the "Adjust Inflation Index" button.
2. Input/change the region name.
3. Input/change the year of the transactions table
4. Enter the increase in CPI or GDP deflator from the input data year to the year of impact (eg. 15% = 1.15)

Printing: The various impact tables can be printed directly using the Excel print command.

Copying: The impact tables can be copied for use in other applications using the Excel copy and paste command.

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3.4   View Input-Output and Multiplier Tables

RISE Impact Model

I-O TABLES MENU

TABLES	MULTIPLIERS
Input-Output Transactions Table	Output Multipliers
Direct Coefficients Table	GRP Multiplier
	Employment Multiplier
Return to MAIN MENU	Household Income Multiplier

Input-Output Transactions Table

The rows of the Input-Output Transaction Table highlight the sales or disposal of output produced by the individual sector. The columns show the inputs purchased from other sectors. Accordingly each entry on the transactions table is shown as both a purchase and a sale.

The table is divided into four quadrants:
- Intermediate – top left
- Final Demand – top right
- Primary Inputs – bottom left
- Primary Inputs to Final Demand – bottom right

The intermediate quadrant is an interindustry matrix that highlights the economic interdependence among producing industries in the regional economy. A change in the output in any one of these sectors will lead to an economic reaction in the interdependent sectors.

The final demand quadrant represents disposal of outputs from each sector to final demand destinations. These include household expenditure, exports (including tourist expenditure) and other final demand (including government capital and recurrent expenditure, private sector capital expenditure, change in stocks).

The primary inputs quadrant shows inputs into each sector outside the production system. This includes inputs from outside the regional economy (i.e. imports) as well as payments to primary inputs (labour and capital).

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Primary inputs to final demand are transactions that directly link primary inputs to final demand. Such transactions are not directly involved in the production system.

Direct Coefficients Table

The top left quadrant of the input-output transactions table is called the intermediate quadrant and from it is derived the matrix of direct coefficients. This quadrant highlights the inter-dependencies between sectors in the regional economy. Coefficients indicate the amount of input required from one sector per unit of output of another sector.

Multipliers

Type I and Type II multipliers are calculated to establish a relationship between initial or own-sector effects and flow on effects. They can be summarised as follows:

Type I Ratio = Initial + production induced (i.e. first round + industrial support)

                            Initial

Type II Ratio =   Initial + production induced + consumption induced effects
                            Initial

The calculation and interpretation of multipliers is discussed in detail in Appendix 2.

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References

EconSearch 2005, *Quantifying the Economic Contribution of Regional South Australia*, a report prepared for the Regional Communities Consultative Council, Local Government Association of SA and Regional Development SA.

EconSearch 1997, *Tourism Impact Model for ACT/Queanbeyan – Explanatory Notes,* prepared for Economic Policy and Research Section – Economics Branch, Office of Financial Management, ACT Administration.

West, G. 1993, *Input-Output Analysis for Practitioners Users Guide.*

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Appendix 1   Glossary of Input-Output Terminology

Basic value is the price received for a good or service by the producer. It is also known as *producers' price*. It excludes indirect taxes and transport, trade and other margins.

Consumption-induced effects are additional output, employment and income resulting from re-spending by households that receive income from employment in direct and indirect activities. Consumption-induced effects are sometimes referred to as "induced effects".

Contribution to gross state/regional product is calculated as the value of output less the cost of goods and services (including imports) used in producing the output. It represents payments to the primary inputs of production (labour, capital and land). Contribution to GSP/GRP is consistent with standard measures of economic activity, such as gross domestic, State or regional product and it provides an assessment of the net contribution to regional economic growth of a particular enterprise or activity.

Direct or initial effects are the initial round of output, employment and income generated by an economic activity.

Employment is the number of working proprietors, managers, directors and other employees, in terms of the number of full-time equivalent jobs.

Exports refer to the sale of goods and services to final consumers outside the region of interest. In a state input-output table, exports refer to the sale of goods and services interstate and overseas. In a regional input-output table exports refers to the sale of goods and services interstate, overseas and to other regions within the state.

Flow-on effects are the sum of the production-induced effects and the consumption-induced effects.

Household income is wages and salaries and other payments to labour including overtime payments and income tax, but excluding payroll tax.

Input-output analysis is an accounting system of inter-industry transactions based on the notion that no industry exists in isolation.

Input-output table is a transactions table that illustrates and quantifies the purchases and sales of goods and services taking place in an economy at a given point in time. It provides a numerical picture of the size and shape of the economy and its essential features. Each item is shown as a purchase by one sector and a sale by another, thus constructing two sides of a double accounting schedule.

Multiplier is an index (ratio) indicating the overall change in the level of activity that results from an initial change in economic activity. They are an indication of the strength of the linkages between a particular sector and the rest of the regional economy. They can be used to estimate the impact of a change in that particular sector on the rest of the economy.

Other Final Demand includes government expenditure, private and public sector investment (gross fixed capital formation) and change in stocks (inventories).

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Other Value Added includes gross operating surplus and all taxes, less subsidies.

Output is gross revenue of goods and services produced by commercial organisations plus gross expenditure by government agencies.

Purchasers' price is the price paid for a good or service paid by the purchaser. It includes indirect taxes and transport, trade and other margins.

Production-induced effects are additional output, employment and income resulting from re-spending by firms that receive income from the sale of goods and services to firms undertaking, for example, agricultural activities. Production-induced effects are sometimes referred to as "indirect effects".

Total impact is the sum of the direct effects and the flow-on effects.

Type I multiplier is calculated as (direct effects + production-induced effects)/direct effects.

Type II multiplier is calculated as (direct effects + production-induced effects + consumption-induced effects)/direct effects.

Appendix 2   The Mathematical Structure of Input-Output Models

Once a transactions table has been compiled, simple mathematical procedures can be applied to derive multipliers for each sector in the economy.

Input-Output Transactions Table

The transactions table may be represented by a series of equations thus:

$$X_1 = X_{11} + X_{12} + \ldots\ldots\ldots\ldots\ldots + X_{1n} + Y_1$$
$$X_2 = X_{21} + X_{22} + \ldots\ldots\ldots\ldots\ldots + X_{2n} + Y_2 \qquad (1)$$
$$X_n = X_{n1} + X_{n2} + \ldots\ldots\ldots\ldots\ldots + X_{nn} + Y_n$$

where X_i = total output of intermediate sector i (row totals);

X_{ij} = output of sector i purchased by sector j (elements of the intermediate quadrant);

Y_j = total final demand for the output of sector i.

It is possible, by dividing the elements of the columns of the transactions table by the respective column totals to derive coefficients which represent more clearly the purchasing pattern of each sector. These coefficients, termed 'direct' or 'input-output' coefficients, are normally denoted as a_{ij}, and represent the direct or first round requirements from the output of each sector following an increase in output of any sector.

In equation terms the model becomes:

$$X_1 = a_{11}X_1 + a_{12}X_2 + \ldots\ldots\ldots\ldots\ldots + a_{1n}X_n + Y_1$$
$$X_2 = a_{21}X_1 + a_{22}X_2 + \ldots\ldots\ldots\ldots\ldots + a_{2n}X_n + Y_2 \qquad (2)$$
$$X_n = a_{n1}X_{11} + a_{n2}X_2 + \ldots\ldots\ldots\ldots\ldots + a_{nn}X_n + Y_n$$

where $a_{ij} = X_{ij}/X_j$, where a_{ij} is the direct coefficient. This may be represented in matrix terms:

$$X = AX + Y \qquad (3)$$

where A = $[a_{ij}]$, the matrix of direct coefficients.

Equation (3) can be extended to:

$$(I-A)X = Y \qquad (4)$$

where (I-A) is termed the Leontief matrix

or $X = (I-A)^{-1}Y \qquad (5)$

where $(I-A)^{-1}$ is termed the 'general solution', the 'Leontief inverse' or simply the inverse of the open model.

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The general solution is often represented by:

$$Z = (I\text{-}A)^{-1} = [z_{ij}] \qquad\qquad (6)$$

The input-output table can be 'closed' with respect to certain elements of the table. Closure involves the transfer of items from the exogenous portions of the table (final demand and primary input quadrants) to the endogenous section of the table (intermediate quadrant). This implies that the analyst considers that the transferred item is related more to the level of local activity than to external influences. Closure of input-output tables with respect to households is common.

The 'closed' direct coefficients matrix may be referred to as A^*. The inverse of the Leontief matrix formed from A^* is given by:

$$Z^* = (I\text{-} A^*)^{-1} = [z^*_{ij}] \qquad\qquad (7)$$

Z^* is referred to as the 'closed inverse' matrix.

Input-Output Multipliers

A multiplier is essentially a measurement of the impact of an economic stimulus. In the case of input-output multipliers the stimulus is normally assumed to be an increase of one dollar in sales to final demand by a sector. The impact in terms of output, contribution to gross state product, income and employment can be identified in the categories discussed below.

(i) The *Initial Impact*. This refers to the assumed dollar increase in sales; it is the stimulus, or the cause of the impacts. It is the unity base of the output multiplier and provides the identity matrix of the Leontief matrix. Associated directly with this dollar increase in output is an own-sector increase in household income (wages, salaries, etc.) used in the production of that dollar. This is the household coefficient h_j. Household income together with other value added (OVA) provide the total contribution to gross state product from the production of that dollar of output. The contribution to gross state product coefficient is denoted v_j. Associated also will be an own-sector increase in employment, represented by the size of the employment coefficient. This employment coefficient e_j represents an employment/output ratio and is usually calculated as 'employment per million dollars of output'.

(ii) The *First Round Effect*. This refers to the effect of the first round of purchases by the sector providing the additional dollar of output. In the case of the output multiplier this is shown by the direct coefficients matrix $[a_{ij}]$. The disaggregated effects are given by individual a_{ij} coefficients and the total first-round effect by Σa_{ij}.

First-round income effects are calculated by multiplying the first-round output effects by the appropriate household income coefficient (h_j). Similarly, the first-round contribution to gross state product and employment effects are calculated by multiplying the first-round output effects by the appropriate contribution to gross state product (v_j) and employment (e_j) coefficients.

(iii) *Industrial-support Effects*. This term is applied to 'second and subsequent round' effects, as successive waves of output increases occur in the economy to provide industrial support as a response to the original dollar increase in sales to final demand. The term excludes any increases caused by increased household consumption. Output effects are calculated from the open Z inverse, as a measure of industrial

response to the first-round effects. The industrial-support output requirements are calculated as the elements of the columns of the Z inverse, less the initial dollar stimulus and the first-round effects. The industrial support household income, contribution to gross state product and employment effects are defined as the output effects multiplied by the respective household income, contribution to gross state product and employment coefficients.

The first-round and industrial-support effects are together termed the *production-induced effects*.

(iv) *Consumption-induced Effects*. The consumption-induced effect is defined as that induced by increased household income associated with the original dollar stimulus in output. The consumption-induced output effects are calculated in disaggregated form as the difference between the corresponding elements in the open and closed inverse i.e. $z^*_{ij} - z_{ij}$, and in total as $\Sigma(z^*_{ij} - z_{ij})$. The consumption-induced household income, contribution to gross state product and employment effects are simply the output effects multiplied by the respective household income, contribution to gross state product and employment coefficients.

(v) *Flow-on Effects*. The flow-on impacts are calculated as total impacts less the initial impact. This allows for the separation of 'cause and effect' factors in the multipliers. The cause of the impact is given by the initial impact (the original dollar increase in sales), and the effect is represented by the first-round, industrial-support and consumption-induced effects, which together constitute the flow-on effects.

Each of the five effects are summarised in the table below. It should be noted that income, contribution to gross state product and employment multipliers are parallel concepts, differing only by their respective coefficients h_j, v_j and e_j.

The output multipliers are calculated on a 'per unit of initial effect' basis, i.e. output responses to a one dollar change in output. Income, contribution to gross state product and employment multipliers as described above refer to changes in *income* per initial change in output, changes in *contribution to gross state product* per initial change in output and changes in *employment* per initial change in output. These multipliers are conventionally converted to ratios expressing a 'per unit' measurement, and described as Type I and Type II ratios. For example, with respect to employment:

Type I employment ratio = [initial + first round + industrial support]/initial

and

Type II employment ratio = [initial + production induced + consumption induced]/initial

remembering that (first round + industrial support) = production induced.

The Structure of Input-Output Multipliers for Sector j

Effects	General formula
Output multipliers ($)	
Initial	1
First-round	$\Sigma_i a_{ij}$
Industrial-support	$\Sigma_i z_{ij} - 1 - \Sigma_i a_{ij}$
Consumption-induced	$\Sigma_i z^{*}_{ij} - \Sigma_i z_{ij}$
Total	$\Sigma_i z^{*}_{ij}$
Flow-on	$\Sigma_i z^{*}_{ij} - 1$
Income multipliers ($)	
Initial	h_j
First-round	$\Sigma_i a_{ij} h_i$
Industrial-support	$\Sigma_i z_{ij} h_i - h_j - \Sigma_i a_{ij} h_i$
Consumption-induced	$\Sigma_i z^{*}_{ij} h_i - \Sigma_i z_{ij} h_i$
Total	$\Sigma_i z^{*}_{ij} h_i$
Flow-on	$\Sigma_i z^{*}_{ij} h_i - h_j$
Contribution to gross state product multipliers ($)	
Initial	v_j
First-round	$\Sigma_i a_{ij} v_i$
Industrial-support	$\Sigma_i z_{ij} v_i - v_j - \Sigma_i a_{ij} v_i$
Consumption-induced	$\Sigma_i z^{*}_{ij} v_i - \Sigma_i z_{ij} v_i$
Total	$\Sigma_i z^{*}_{ij} v_i$
Flow-on	$\Sigma_i z^{*}_{ij} v_i - v_j$
Employment multipliers (persons)	
Initial	e_j
First-round	$\Sigma_i a_{ij} e_i$
Industrial-support	$\Sigma_i z_{ij} e_i - e_j - \Sigma_i a_{ij} e_i$
Consumption-induced	$\Sigma_i z^{*}_{ij} e_i - \Sigma_i z_{ij} e_i$
Total	$\Sigma_i z^{*}_{ij} e_i$
Flow-on	$\Sigma_i z^{*}_{ij} e_i - e_j$

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