The economic impact of the proposed AAco abattoir

An economic impact assessment of the proposed AAco Darwin beef processing facility

Prepared for AAco

May 2012

ACIL Tasman
Economics Policy Strategy
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Executive summary

ACIL Tasman was commissioned by the Australian Agricultural Company Limited (AAco) to undertake an analysis of the economic impact of the Company’s proposed Northern Territory abattoir. The analysis was also commissioned to present a wider economic and policy strategy that is required to optimise the economic benefits of the plant to; the Northern Australian, Australian, and Indonesian economies.

The analysis was prepared in four broad parts:
1. An analysis of the producer benefits of having access the AAco abattoir, and how these effects would impact on total cattle production in Northern Australia
2. The economy wide impacts on the Northern Territory economy
3. The benefits of productive profitable Northern Australian beef industry would have for Indonesia
4. The economic and policy strategy to optimise the benefits of the plant and overcome some of the barriers to its establishment

The proposed AAco abattoir

The proposed AAco abattoir will be located at Livingstone, 50 km south of Darwin on the Stuart Highway. It is proposed that it will:
- Process between 180,000 to 200,000 cattle per year (but can be modified to process 225,000 with minimal addition capital expenditure)
- ACIL Tasman has estimated that it produce 28m kg of saleable beef and 36m kg of by products
- When fully operational it will directly create up to 270 full time equivalent (FTE) positions made up of a mix of local and foreign workers

All of the beef produced will be exported as a mix of grades of meat (mostly manufacturing grades) and offal products.

It is likely that a substantial proportion of the capacity of the plant would be used to process AAco cattle.

The capital cost of the plant is forecast to be $83m and will be fully operational within three years of the commencement of construction.

Producers and northern beef production

There is no operating abattoir in the Northern Territory, northern WA or far north Queensland. The closest abattoir to this region is owned by JBS and is located in Townsville, 2,000 km from Darwin.
The economic impact of the proposed AAc0 abattoir

This means that northern beef producers have no regional market for cows surplus to requirements, or which are no longer productive (cull cows). The live weight cap (350 kg live weight) on live export cattle to Indonesia also means that there is no regional market for heavy steers and bulls.

By providing a regional market for cull cows, the impact of the AAc0 abattoir on the profitability of northern beef producers is substantial. This is because older cows can be sold and younger more robust and fertile cows retained in the herd. This reduces the mortality rate of the herd and increases the number of calves produced.

Table 1 shows the results of modelling this impact on a 3,000 cow beef production enterprise in the north. This modelling shows that earnings before interest and tax could increase by up to 100 per cent when producers have access to a regional cull cow market.

<table>
<thead>
<tr>
<th>Measure</th>
<th>Outcome</th>
<th>Change From Base</th>
</tr>
</thead>
<tbody>
<tr>
<td>EBIT/AE</td>
<td>$28.70</td>
<td>+$14.56 (103%)</td>
</tr>
<tr>
<td>Cost of Production ($/kg liveweight)</td>
<td>$1.12</td>
<td>-$0.09 (8%)</td>
</tr>
<tr>
<td>Beef Produced/AE (kg liveweight)</td>
<td>67</td>
<td>+8 (13.6%)</td>
</tr>
<tr>
<td>Mature Females Available for Sale</td>
<td>413</td>
<td>+117 (39.5%)</td>
</tr>
</tbody>
</table>

Data source: Holmes and Company

Being able to sell heavier steers to the plant also has the potential to substantially increase producer profitability.

Based on the proposed capacity of the plant, the flow on effects on the herd in the catchment regions of the plant are shown in Table 2. Our whole of herd modelling suggests that the plant, based on expected changes to the structure of the northern beef herd, could increase beef produced in the region by 36 per cent. The increased value of this beef could be as high as $130m per annum.

Table 2 shows the results of modelling this impact on a 3,000 cow beef production enterprise in the north. This modelling shows that earnings before interest and tax could increase by up to 100 per cent when producers have access to a regional cull cow market.
The economic impact of the proposed AAco abattoir

The Northern Australian economy

The economic impact on the plant on the Northern Economy is expected to be $126m per annum once fully operational. The plant will create over 800 direct and indirect FTE jobs. These positions will offer employment opportunities for people who are not currently or not likely to participated in mining and energy jobs in the region.

Table 3  Projected economic impacts for total Northern Australia under each Scenario

<table>
<thead>
<tr>
<th></th>
<th>1 Standard Tasman Global labour market</th>
<th>2 Unconstrained labour market</th>
</tr>
</thead>
<tbody>
<tr>
<td>Real income</td>
<td>A$m</td>
<td>A$m</td>
</tr>
<tr>
<td>Scenario A</td>
<td>47.43</td>
<td>79.35</td>
</tr>
<tr>
<td>Scenario B</td>
<td>41.96</td>
<td>71.98</td>
</tr>
<tr>
<td>Employment</td>
<td>FTE jobs</td>
<td>FTE jobs</td>
</tr>
<tr>
<td>Scenario A</td>
<td>71.0</td>
<td>161.3</td>
</tr>
<tr>
<td>Scenario B</td>
<td>66.2</td>
<td>153.6</td>
</tr>
</tbody>
</table>

Notes: Northern Australia comprises the Northern Territory plus the Kimberley and Pilbara Statistical Divisions. “Local” means 100% locally owned capital. “Joint Venture” means a 50/50 joint venture arrangement between owners situated in the Rest of Australia and overseas. FTE = full time equivalent. One FTE job is equivalent to one person working full time for one year, or two people working 0.5 of a full time job.

Data source: ACIL Tasman modelling

The plant will provide employment and training opportunities for members of the northern indigenous community in the plant, in associated industries, and on beef production properties.

Economic and policy strategy

However, the plant requires infrastructure assistance, and faces some significant risks that have to be managed to optimise the wider economic benefits of the plant.

Infrastructure

The infrastructure required by the plant is:

- Road access
- A training facility on site that will reduce employee down time during training
- Medical, child care and emergency services on site
- Assistance with utility connections
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Wider opportunities

There are three proposed initiatives that would improve the viability and economic impact of the plant:

- A northern beef production research and extension strategy directed at assisting producers to consistently meet slaughter cattle specifications
- The establishment of a northern beef processing, training and distribution research facility built in association with the plant
- The integration of the Indonesian and northern Australian beef sector through a direct investment in the plant by Indonesian investors, and collaboration between Indonesia and Australia in beef production, processing, distribution, and research and development

The inability to exploit these opportunities in a collective and coordinated way to date has been the principle reason a new processing facility in the north has not been built despite the extensive economic benefits a plant would produce.

The economic benefits that would be produced by the plant and its impact on northern beef production that would flow to the Indonesian economy are potentially large. Securing a supply of beef from a productive and profitable northern Australian beef herd (in conjunction with improvements to Indonesian beef production productivity) would contribute to addressing Indonesia’s food (beef) security concerns, and potentially avoid some of the significant economic costs incurred by pursuing beef self-sufficiency.

Modelling conducted by ANU shows that becoming self-sufficient in beef, assuming it can be achieved, would be expensive for the Indonesian economy (see Table 4).

| Table 4 Indonesian welfare impacts of alternative scenarios |
|-----------------|------------------|
| $m              |                  |
| Restrictions on imports of live cattle | -380 |
| Restrictions on imports of live cattle and beef | -458 |
| Domestic subsidy 70% | -20 |
| Productivity improvement | 196 |

Data source: (Vanzetti, Setyoko Rakhman, Trewin, & Permani, 2010)

The proposed AAco plant has the potential to unlock considerable economic value for both the Australian and Indonesian economies. However, to unlock this value AAco needs strategic assistance from:

- Cattle producers and their peak industry bodies
- The Northern Territory Government
- The Australian Government
In the following table a summary is presented of the activities and those best placed to undertake them to support the establishment of the plant.

### Table 5  Implementation tasks and responsibilities

<table>
<thead>
<tr>
<th>Task</th>
<th>What needs to be done</th>
<th>By whom</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Assisting producers realise the benefits of a processing facility</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Range land production</td>
<td>Identify and improve utilisation of areas able to grow out stock on</td>
<td>Producers and State Departments of agriculture</td>
</tr>
<tr>
<td>Cattle genetics</td>
<td>Consider more fertile, quicker maturing cattle</td>
<td>Producers, cattle studs</td>
</tr>
<tr>
<td>Business management</td>
<td>Extend the enterprise level benefits of culling cows, recruiting more heifers</td>
<td>Producers, Private Consultants Departments of Primary Industries</td>
</tr>
<tr>
<td><strong>Infrastructure</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Transport</td>
<td>Improved all weather access facilities on farm</td>
<td>Producers, all levels of Government</td>
</tr>
<tr>
<td>Staff</td>
<td>Training and recruiting</td>
<td>Agrifood Skills Australia, Indigenous agencies</td>
</tr>
<tr>
<td>Road access to the plant</td>
<td></td>
<td>All levels of Government</td>
</tr>
<tr>
<td>Improving cold chain logistics</td>
<td>Construction of refrigerator container points at the Darwin port</td>
<td>NT and Australian Government Logistics companies</td>
</tr>
<tr>
<td>Health care and emergency services facilities</td>
<td></td>
<td>NT Government</td>
</tr>
<tr>
<td>Skilled workforce</td>
<td>Onsite training facilities</td>
<td>NT and Australian Government</td>
</tr>
<tr>
<td>Utilities</td>
<td>Assistance with main utilities connections</td>
<td>NT Government and associated agencies and authorities</td>
</tr>
<tr>
<td><strong>Trading and raising capital</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Attracting foreign investment from Indonesia</td>
<td>Demonstrate the commercial returns likely to be produced by the plant</td>
<td>AAco</td>
</tr>
<tr>
<td></td>
<td>Present the case that an investment in the plant would improve food security in Indonesia, create employment, and increase Indonesian and Australian national wealth</td>
<td>Minister for Trade Craig Emerson Indonesian Australian Business Council DFAT AAco IABC DFAT NT Government</td>
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Data source: ACIL Tasman
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1 Introduction

ACIL Tasman was commissioned by the Australian Agricultural Company Limited (AAco) to prepare an economic impact assessment of the company’s proposed Darwin abattoir. The objective of the economic impact assessment is to demonstrate the economic value to the northern Australian economy of the establishment of a regional beef processing facility.

The economic impact of the plant will take two forms. The first is the additional contribution the plant will make to the gross regional product of the north of the country from the goods and services it will consume and produce. The second is the pastoral productivity improvements that will result from the establishment of a regional processing facility.

The regional pastoral productivity improvements take the form of:

- Avoidance of significant transport costs incurred to send cattle to southern processing facilities
- Providing a market for some classes of cattle that at present are not worth sending south for processing (have no commercial value)
- An ability to fatten some steers beyond the 350kg live weight restriction on live exports enabling pastoralists to produce more saleable read meat per unit of input

Individually each of these factors contributes to improving the returns to northern beef producers. However, collectively they will enable significant improvements in cow fertility and mortality to be made which will dramatically improve the profitability of beef production on those properties delivering stock to the plant.

This analysis also considers the advantages that would accrue to Indonesia from the establishment of the plant. The plant is likely not only to be commercially attractive to Indonesian private investors; it is also likely to improve Indonesian beef supply security. This analysis also considers the potential economy wide benefits for Indonesia of the establishment of the plant.

2 A profile of the northern beef industry

The northern cattle industry is subject to significant variations in climate between the wet and dry season and between years. The wet season underpins production in the northern pastoral regions by providing a period of high dry matter production. However the wet season also restricts the movement of...
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cattle within the property and between properties. Much of the regions soils are highly leached and lack nutrients. The climate and soils combine to create an environment suited to extensive grazing of cattle.

The result is that the region is sparsely populated and the cost of moving cattle is high and restricted during the wet season. The chart below shows the cattle production regions by density of cattle, major live export ports, existing abattoirs and the propose AAco plant.

The map in Figure 1 shows the population densities of cattle in the north, and the cattle related infrastructure in the region. This map clearly shows the long distances cattle producers have to transport cattle to existing processing facilities on the east coast.

The distance between Darwin and Townsville where the nearest existing abattoir is located is 1,864km. At current transport rates the cost differential\(^1\) between Darwin and Townsville is approximately $160 for a 500kg live weight animal. The total distance to the nearest processing facility in WA at Harvey is 4,176km and would cost approximately at least $360 per hd in transport costs.

In general terms a cattle producer would be indifferent between sending cattle to the east coast and the AAco facility when he is approximately 900 to 1,000km from Darwin if located on the eastern side of the north of Australia.

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\(^1\) Includes carcass shrinkage
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and approximately 2,000km on the western side of the proposed Darwin abattoir.

This therefore crudely defines the potential catchment boundaries of the proposed plant where in general terms the catchment for slaughter cattle is likely to be skewed west.

According to an ABARES survey conducted in 2011 following the suspension of the live export trade to Indonesia the cattle population of the north of Australia in 2011 was approximately 6.7m head. However, not all of these cattle would be in the potential catchment area of the proposed plant.

<table>
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<th>Table 6</th>
<th>Northern cattle population and cattle turnover intentions 2011</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Beef cattle at 1 July 2011</td>
</tr>
<tr>
<td></td>
<td>no.</td>
</tr>
<tr>
<td>Cape York and Gulf of Carpentaria</td>
<td>565,000</td>
</tr>
<tr>
<td>Western north Queensland</td>
<td>952,000</td>
</tr>
<tr>
<td>Central north Queensland</td>
<td>1,936,000</td>
</tr>
<tr>
<td>Eastern north Queensland</td>
<td>109,000</td>
</tr>
<tr>
<td>Northern Queensland</td>
<td>3,562,000</td>
</tr>
<tr>
<td>Kimberley</td>
<td>687,000</td>
</tr>
<tr>
<td>Pilbara–Gascoyne</td>
<td>379,000</td>
</tr>
<tr>
<td>Northern Western Australia</td>
<td>1,066,000</td>
</tr>
<tr>
<td>Alice Springs District</td>
<td>266,000</td>
</tr>
<tr>
<td>Barkly–Tennant Creek</td>
<td>666,000</td>
</tr>
<tr>
<td>Victoria River District–Katherine</td>
<td>1,016,000</td>
</tr>
<tr>
<td>Top End–Roper–Gulf</td>
<td>129,000</td>
</tr>
<tr>
<td>Northern Territory</td>
<td>2,077,000</td>
</tr>
<tr>
<td>Northern Australia</td>
<td>6,705,000</td>
</tr>
</tbody>
</table>

* Export of live cattle to Indonesian for slaughter b. At time of 24 June to 1 July 2011

Data source: ABARES survey of northern live cattle export regions June 2011

Using the crude measure of relative transport cost we believe that the potential catchment areas of the plant would be based on the following ABARES regions:

- Kimberley
- Pilbara-Gascoyne
- Barkly-Tennant Creek
- Victoria River District-Katherine

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- Top End-Roper River-Gulf
- Cape York and Gulf of Carpentaria

It is unlikely that the western and southern areas of the Pilbara-Gascoyne would fall into the catchment zone, and some cattle would be supplied from the Gulf of Carpentaria, but not the Cape York region. If a portion of the cattle in the Pilbara-Gascoyne are excluded, and some of the Gulf cattle are included, the population of cattle in the proposed catchment is between 2.8m and 3.0m. A summary of the number of cattle in the potential catchment is presented in Table 7.

If western north Queensland is added to the catchment the amount of cattle rises by 35 per cent but the number of cattle being turned off only rises by 22 per cent. This is likely due to the cattle being turned off in western areas are predominately for domestic slaughter and are being turned off at higher live weights than those areas further from processing facilities. The further the distance from the processing facilities the more reliant producers become on the live export trade. However, the live trade has a 350kg live weight (lwt) cap on export cattle. This means that producers supplying the domestic slaughter market are selling fewer but heavier cattle.

Table 7  Cattle herd and intended turn off 2011

<table>
<thead>
<tr>
<th></th>
<th>NT and WA</th>
<th>NT, WA and Western Q</th>
</tr>
</thead>
<tbody>
<tr>
<td>A Beef cattle as of 30 June 2011</td>
<td>2,877,000</td>
<td>3,829,000</td>
</tr>
<tr>
<td>B Cattle intended for live export</td>
<td>531,000</td>
<td>538,000</td>
</tr>
<tr>
<td>C Cattle intended to be sold direct to domestic processing now</td>
<td>158,000</td>
<td>280,000</td>
</tr>
<tr>
<td>D Cattle intended for feedlots and back grounding</td>
<td>21,000</td>
<td>54,000</td>
</tr>
<tr>
<td>E Total beef cattle turnoff (B+C+D)</td>
<td>710,000</td>
<td>872,000</td>
</tr>
<tr>
<td>F Proposed processing capacity</td>
<td><strong>178,000</strong></td>
<td><strong>178,000</strong></td>
</tr>
<tr>
<td>G AAco percentage of total turnoff (F/E)</td>
<td>25.07%</td>
<td>20.41%</td>
</tr>
<tr>
<td>H AAco percentage of total cattle numbers (G/A)</td>
<td>6.20%</td>
<td>4.64%</td>
</tr>
</tbody>
</table>

Data source: (ABARES, 2011)

In this impact assessment we have used the smaller catchment figure of 2.8m to 3.0m head.

---

2 There are a number of factors that affect cattle supply including herd rebuilding where young female cattle are retained as breeders rather than sold, or adverse seasonal condition requiring more cattle to be turned off properties.
2.1 Seasonality of supply

Seasonality of supply of stock is driven by the wet season preventing the movement of many cattle and the large variation of pasture growth across the year required to graze cattle on.

Reducing seasonality of supply is dependent on increase investment in all-weather access:

- To cattle handling facilities on properties
- Improving arterial roads to allow access between the properties and the plant
- Extending the utilisation of pasture growth produced from wet season rainfall and extending the quality of pasture during the dry season

Reducing the seasonality of supply, and thus making processing investments more attractive requires investments in infrastructure and range land management by growers, research and development agencies and governments.

3 The proposed AAco plant

This section presents the statistics of the plant that are of relevance to this economic impact assessment. More detailed information about the plant may be obtained directly from AAco.

The proposed AAco abattoir will be located at Livingston 50km south of Darwin on the Sturt Highway. The plant capacity is planned to be between 180,000 and 200,000 head per year, but has the capacity to increase production to 225,000 head per year with minor additional capital outlays.

The plant has been designed to run with a combination of one to two shifts to optimise utilisation through the year where cattle supply will be constrained by the wet season and feed availability. AAco anticipates closing the plant in February each year and using this time for cleaning and conducting any repairs, maintenance and capital improvements that may be required.

This will allow the plant to better match costs with the expected seasonality of supply from the northern herd.

The types of cattle to be slaughtered at the plant will be a combination of cull cows, bulls and some steers and heifers. Advice provided by AAco is that the financial model is based on the large majority (up to 80 per cent) of the throughput of the plant being cull cows. However, there is no restriction on the types of cattle the plant could process and buying will be opportunistic,
purchasing available cattle that provide the largest processing margin for the plant.

ACIL Tasman modelling of the potential impact of the plant on cattle production in the catchment region of the plant suggests that the throughput may include a larger number of heavier steers than AAco currently anticipates. This is discussed in more detail in section 4.

AAco also anticipates that a substantial proportion of the capacity of the plant will be available each year to process its own cattle from the company’s Northern Territory pastoral assets. AAco currently has a 330,000 head herd on properties that would fall within the typical plant catchment area. It is likely that the majority of the plant processing capacity will be available for other producers in the north.

The plant’s financial modelling is based on processing cattle with an average live weight of 430kg dressing out at 50 per cent and a saleable meat yield of 72 per cent of the hot standard carcass weight (HSCW). This would produce approximately 28,000 tonnes of saleable meat, 36,000 tonnes of red offals, and 6,900 tonnes of hides.

When fully operational the plant will directly employ up to 270 full time equivalent employees when two shifts are operating.

The total cost to construct the plant is forecast to be $83m. This does not include the additional infrastructure AAco is currently seeking assistance for from the Northern Territory and Australian Governments. The plant is expected to be fully operational by 2014 and reaching full throughput by 2016.

The majority of the meat produced will be grinding beef for food products such as hamburger patties and meat balls. The entire output is expected to be exported to a range of countries. It is expected that the by-products of the plant will be processed locally before being exported.

4 Impacts on the northern cattle industry

The principle impact on the production of cattle in the north of Australia of the proposed AAco plant will be through providing a regional market for cull cows, and heavy steers.

The plant will also process cull bulls but these will be a small proportion of the total plant throughput.
The economic impact of the proposed AAco abattoir

4.1 A market for cull cows

At present, northern producers have two options when considering what to do with older cows; retain or send to slaughter in eastern/southern plants and incur transport cost of at least $160 per head or more.

If the value of a medium score cow 7-9 years old delivered to the meat works in Townsville is $430 ($1.00 x 430kg LWT) the net return after transport and shrinkage to the producer is $270. At this age the cow may still be able to bear and wean another calf. However, in the northern environment at this age the mortality rates are rising and fertility are starting to decline.

The producer must decide whether to retain the cow to attempt to get another calf or sell it. If the producer sells the cow it will make room for a heifer to be bought into the herd (assuming a one-to-one replacement rate, and cow numbers are remaining stable).

The effect of replacing the cow with a heifer reduces the herd’s average age. The effect of reducing the average age of the herd is twofold; a younger herd is more likely to be more fertile; the herd is also more robust and mortalities will decline.

Higher fertility and lower mortalities means more live calves will be born and raised.

However, at present with no regional market for the cow and a live export option for the heifer, the producer can get a higher immediate cash return by selling the heifer and retaining the cow. At present the heifer can be sold into live trade if it does not weight any more than 350kg but it would have to be independently verified by a vet that it is not pregnant before it can be exported live. The value of the heifer at current prices would be approximately $555 ex farm (300kg x $2.00 per kg LWT less vet and transport costs).

By selling the heifer and retaining the cow the producer is cash flow better off by $285. When cash flow is tight the producer will usually take higher cash return and forego any additional revenue which may accrue in the future from the potentially more productive heifer (and a cow herd with a younger average age).

---

The economic impact of the proposed AAco abattoir

The ability to sell the cow into a local processing market has the potential to change the economics of selling cows and retaining heifers. The decision about retaining or selling cows is stepped out in Figure 2.

When deciding to sell an older cow and replace her with a heifer there are a number of additional variables the producer is taking into account when making the decision beyond the immediate cash flow implications (although cash flow does influence the decision to the extent that any reduction in the first year cash flow can be financed through cash reserves or debt facilities).

Firstly the producer must consider the likely future cash flow of retaining the cow. The future cash flow is dependent on the:

1. Probability of the cow surviving (mortality rates increase as the cow gets older)
2. The probability of the cow conceiving and producing a weanable calf
3. The present value of the cow at the end of the next calving cycle

These variables are stepped out in upper branches of the following decision tree.

The cash flow of selling the cow and retaining the heifer is dependent on:

4. The net return of selling the cow to the producer
5. The present value of the cash flows that will be generated from the heifer

These variables are stepped out in the bottom branch of the decision tree.
The economic impact of the proposed AAco abattoir

Figure 2  Cow selling decision and possible outcomes

In Figure 3 the present value of each of the possible outcomes is calculated and assigned to the end of the relevant branch. The weighted average returns from each branch is then calculated and the highest returning branch is identified. This shows the relative returns from retaining a cow and selling and replacing with a heifer in the absence of the AAco plant. It shows that based on these assumptions, it is more profitable to sell the heifer and retain the cow.

Figure 3  Cow selling decision and possible outcomes

The decision tree is then calculated with the effect of being able to sell the cow locally and avoiding the $160 transport cost of getting the cow to Townsville for slaughter. The $160 Townsville trip has been replaced with a $40 trip to the AAco plant. This increases the value to the producer of culling the cow and replacing it with a heifer. Under these assumptions the producer is $182 (present value) better off selling and replacing the cow rather than keeping it and selling the heifer.
The economic impact of the proposed AAco abattoir

Impacts on the northern cattle industry

Figure 4  **Cow selling decision and possible outcomes**

The $182 is made up of selling the cow for a higher price and the relative difference in potential mortality between an older cow and a heifer, which is partially offset by the reduced calving rate of heifer compared to the cow in the first year.

This generic example demonstrates how the proposed AAco plant will change cow culling decisions of producers who have access to the plant. Clearly there will be variations to this decision based on individual property circumstances and seasonal conditions.

It also shows that to purchase cattle for the plant, AAco must offer a net farm price high enough for the producer to quit the older cow and replace her with a heifer. In this example we have used a sale price (delivered plant) for the cow of $1.20 per kg liveweight (lwt) (old cow) less $42 transport and selling costs. We have used $2.00 lwt less the $47 (inclusive of pregnancy testing costs) transport and selling costs for the heifer sold at 300 kg lwt into the live export trade.

The individual producer benefits of access to a northern processing market for cull cows are discussed in detail in section 5.

The implications of offering this selling option spread across the cow herd in the catchment area of the plant appear significant and are discussed in detail in the following section.

### 4.2 Aggregate cattle production effects of the AAco abattoir

The analysis in Table 10 shows how a reduction in the weighted average cow age across the whole herd in the potential catchment area of the plant is achieved by culling cows at 8 and 9 and selling them to AAco, and recruiting more heifers into the herd. The table models the whole cow herd in the catchment area of the plant based on the ABARES survey of northern cattle producers conducted in 2011 following the suspension of the live trade.
Scenario A (without AAco abattoir) assumes a total cattle population of approximately 3.0m head with a cow herd of 2.34m. Scenario B assumes a cow herd of 2.29m head as fewer cows are needed under this scenario making room for more calves and to grow out steers to heavier weights. Both of these scenarios assume a static herd, where there is no increase in total cattle numbers. The modelling also maintains a constant adult equivalent (AE) between the ‘with’ and ‘without’ AAco plant scenarios.

The modelling also assumes the same average mortality and fertility rate for each scenario as well. That is, the only variable is the culling rate which changes the age distribution of the cows. The change in distribution can be seen in Figure 5.

Figure 5  Cow herd age profile

The effect of redistributing the cows and reducing the weighted average age is to have more cows in the age groups that have higher weaning rates. The effect this has on calf production can be seen in Figure 6.
Our modelling shows that as a result of this shift in cow age profile that there are:

- 111,000 more calves born
- 83,000 more heifers available for recruitment into the cow herd
- Total combined cow and heifer sales increase by 139,000 head
- A reduction of 56,000 mortalities

We then took the results from the cow herd modelling and put them into a livestock schedule. A livestock schedule lays out the total sources of cattle for the year and the total uses of the cattle and calculates that net improvement in gross profitability of the herd for the year.

The total sources of cattle are:
- Carry in numbers (the number of cattle at the start of the year)
- Births
- Purchases

The uses of cattle are the:
- Carry out stock (the number of cattle retained)
- Total sales
- Deaths

When these cow herd profiles along with changes to cull rates, mortalities and calving are put into an aggregate livestock schedule, the result is a significant increase in the total number of head sold and the total kg of saleable beef from the herd. These results are shown in Table 8.
The economic impact of the proposed AAco abattoir

Table 8  Summary results of the stock schedule for both scenarios

<table>
<thead>
<tr>
<th></th>
<th>Without AAco</th>
<th>With AAco</th>
<th>Difference</th>
<th>% change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total sales</td>
<td>718948</td>
<td>921775</td>
<td>202827</td>
<td>28.21%</td>
</tr>
<tr>
<td>Tonnes beef sold</td>
<td>235194</td>
<td>318867</td>
<td>83673</td>
<td>35.58%</td>
</tr>
<tr>
<td>Sales value</td>
<td>$412m</td>
<td>$542m</td>
<td>$129m</td>
<td>31.45%</td>
</tr>
<tr>
<td>Value beef sold</td>
<td>$1.75</td>
<td>$1.70</td>
<td>-$0.05</td>
<td>-3.045%</td>
</tr>
</tbody>
</table>

The detailed stock schedules for each scenario as shown in Table 11 and Table 12.

A portion of the additional saleable meat is from the slaughter of cows that would have experienced high mortality rates if left on farm. There are also additional heifers and steers produced from the increased fertility of the cows. The additional steers produced are assumed in our modelling to be retained, grown out to 450 – 500kg lwt and slaughtered at the AAco plant.

Based on our modelling the throughput of the plant would come from the additional production of beef from this region resulting from the structural changes to the herd the plant allows.

Based on this modelling we believe that the plant throughput is likely to be made up of cows, heavy steers and bulls as shown in Table 9.

Table 9  Possible plant throughput by cattle type

<table>
<thead>
<tr>
<th></th>
<th>Number</th>
<th>Lwt kg</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cows</td>
<td>112,650</td>
<td>430</td>
</tr>
<tr>
<td>Heavy steers</td>
<td>63,170</td>
<td>450-500</td>
</tr>
<tr>
<td>Bulls</td>
<td>3,000</td>
<td>500-60</td>
</tr>
<tr>
<td>Total plant slaughter</td>
<td>178,820</td>
<td></td>
</tr>
</tbody>
</table>

By providing a regional processing market for northern cattle producers, more saleable meat is produced from the region. This significantly increases the profitability of northern beef producers as most of this increase in production accrues to profit as there are few net additional costs incurred for the producers.

The productivity benefits of the plant for producers were combined with the range of goods and services utilised and produced by the plant to formulate an economic shock for our general equilibrium model (GE) to assess the regional economic impacts of the proposed AAco abattoir. The results of the GE modelling are presented and discussed in section 0.
### Table 10  
**Cow herd model**

<table>
<thead>
<tr>
<th>Year closing cow age</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
<th>13</th>
<th>14</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Background mortality</strong></td>
<td>15%</td>
<td>4%</td>
<td>4%</td>
<td>4%</td>
<td>4%</td>
<td>5%</td>
<td>20%</td>
<td>60%</td>
<td>60%</td>
<td>80%</td>
<td>100%</td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td><strong>Dystocia mortality</strong></td>
<td>7%</td>
<td>7%</td>
<td>7%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Lactation mortality</strong></td>
<td>4%</td>
<td>4%</td>
<td>4%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>First time calving mortality rate</strong></td>
<td>11%</td>
<td>11%</td>
<td>11%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td><strong>First time mating proportion</strong></td>
<td>10%</td>
<td>80%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td><strong>Weighted mortality</strong></td>
<td>1.1%</td>
<td>8.8%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td><strong>Mortality rate</strong></td>
<td>16%</td>
<td>13%</td>
<td>4%</td>
<td>4%</td>
<td>4%</td>
<td>4%</td>
<td>4%</td>
<td>5%</td>
<td>20%</td>
<td>60%</td>
<td>60%</td>
<td>80%</td>
<td>100%</td>
</tr>
</tbody>
</table>

**Without plant**

- **Cow numbers start**
  - 2,344,993
  - 494,046
  - 300,516
  - 262,050
  - 251,568
  - 241,505
  - 231,845
  - 222,571
  - 211,443
  - 121,791
  - 7,307
  - 292
  - 58

- **Mortalities**
  - 288,655
  - 79,541
  - 38,466
  - 10,482
  - 10,063
  - 9,660
  - 9,274
  - 11,129
  - 42,289
  - 73,075
  - 4,384
  - 234
  - 58

- **Average mortality rate** 12.31%
- **Culling rate** 28%
- **Sales**
  - 205,392
  - 113,989
  - 79,541
  - 10,482
  - 10,063
  - 9,660
  - 9,274
  - 11,129
  - 42,289
  - 73,075
  - 4,384
  - 234
  - 58

- **Cow numbers end**
  - 300,516
  - 262,050
  - 251,568
  - 241,505
  - 231,845
  - 222,571
  - 211,443
  - 121,791
  - 7,307
  - 292
  - 58

- **Weighted average age** 4.8

**With plant**

- **Cow numbers start**
  - 2,295,087
  - 577,120
  - 343,785
  - 299,780
  - 235,987
  - 226,548
  - 217,486
  - 208,786
  - 164,628
  - 13,170
  - 5,268
  - 2,107

- **Mortalities**
  - 232,648
  - 92,916
  - 44,604
  - 11,991
  - 9,439
  - 9,062
  - 8,699
  - 10,439
  - 32,926
  - 7,902
  - 3,161
  - 1,686

- **Average mortality rate** 10.14%
- **Culling rate** 29%
- **Sales**
  - 344,472
  - 140,419
  - 92,916
  - 44,604
  - 11,991
  - 9,439
  - 9,062
  - 8,699
  - 10,439
  - 32,926
  - 7,902
  - 3,161
  - 1,686

- **Cow numbers end**
  - 343,785
  - 299,780
  - 235,987
  - 226,548
  - 217,486
  - 208,786
  - 164,628
  - 13,170
  - 5,268
  - 2,107

- **Weighted average age** 4.12
### Table 11: Scenario 1: Aggregate northern cattle stock schedule (without AAco abattoir)

<table>
<thead>
<tr>
<th>A</th>
<th>Business as usual</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Start</td>
</tr>
<tr>
<td></td>
<td>Year 1 start</td>
</tr>
<tr>
<td>Cows</td>
<td></td>
</tr>
<tr>
<td>Heifers</td>
<td>300516</td>
</tr>
<tr>
<td>Mixed Age</td>
<td>1550431</td>
</tr>
<tr>
<td>Total</td>
<td>1850947</td>
</tr>
<tr>
<td>Weaners</td>
<td></td>
</tr>
<tr>
<td>M</td>
<td>527888</td>
</tr>
<tr>
<td>F</td>
<td>527888</td>
</tr>
<tr>
<td>Total</td>
<td>1055776</td>
</tr>
<tr>
<td>Steers</td>
<td>66205</td>
</tr>
<tr>
<td>Calves</td>
<td></td>
</tr>
<tr>
<td>66000</td>
<td>2000</td>
</tr>
<tr>
<td>Bulls</td>
<td>66000</td>
</tr>
<tr>
<td>Total</td>
<td>3038928</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Cow death rate</th>
<th>Non breeder death rate</th>
<th>Weaner death rate</th>
<th>Weaning per centage</th>
</tr>
</thead>
<tbody>
<tr>
<td>12.3%</td>
<td>4.0%</td>
<td>15.0%</td>
<td>48.5%</td>
</tr>
</tbody>
</table>
### Scenario 2: Aggregate northern cattle stock schedule (with AAco abattoir)

<table>
<thead>
<tr>
<th>B</th>
<th>Impact of the new plant</th>
<th>Cow death rate</th>
<th>Non breeder death rate</th>
<th>Weaner death rate</th>
<th>Weaning percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>10.1%</td>
<td>4.0%</td>
<td>15.0%</td>
<td>52.8%</td>
</tr>
</tbody>
</table>

#### Table 12

<table>
<thead>
<tr>
<th>Start</th>
<th>Sales</th>
<th>End</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year 1 start</td>
<td></td>
<td>Year 1 end</td>
</tr>
<tr>
<td>No</td>
<td>$/hd</td>
<td>Total</td>
</tr>
<tr>
<td>Cows</td>
<td>343785</td>
<td>630</td>
</tr>
<tr>
<td>Heifers</td>
<td>1374182</td>
<td>624</td>
</tr>
<tr>
<td>Total</td>
<td>1717967</td>
<td>1254</td>
</tr>
<tr>
<td>Weaners</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>M</td>
<td>581507</td>
<td>600</td>
</tr>
<tr>
<td>F</td>
<td>581507</td>
<td>600</td>
</tr>
<tr>
<td>Total</td>
<td>1163014</td>
<td>1261</td>
</tr>
<tr>
<td>Steers</td>
<td>132007</td>
<td>651</td>
</tr>
<tr>
<td>Heifers</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>132007</td>
<td>85936234</td>
</tr>
<tr>
<td>Calves</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bulls</td>
<td>66000</td>
<td>2000</td>
</tr>
<tr>
<td>Total</td>
<td>66000</td>
<td>132000000</td>
</tr>
<tr>
<td>Total</td>
<td>3078987</td>
<td>1989818304</td>
</tr>
<tr>
<td>Proportion mated</td>
<td>Total</td>
<td>10%</td>
</tr>
<tr>
<td>------------------</td>
<td>-------</td>
<td>-----</td>
</tr>
<tr>
<td>Cow age end of year</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Weaning rate</td>
<td>15%</td>
<td>55%</td>
</tr>
<tr>
<td>Calves without plant</td>
<td>1,099,768</td>
<td>4,507</td>
</tr>
<tr>
<td>Calves with plant</td>
<td>1,211,472</td>
<td>8,656</td>
</tr>
</tbody>
</table>
5 Producer benefits

5.1 Risk management

In attempting to increase the saleable meat yield of their properties under the 350kg live-weight-cap, northern beef producers deliver animals as close to the cap as possible. This often results in cattle breaching the cap and not being suitable for live export to Indonesia. When the cap is exceeded producers have limited options to dispose of them at present.

If the cattle are found to be over the live export weight cap before they leave the farm the producer can:

- Retain the animal on the farm and keep it for another year (wet season) to increase the weight of the animal. The additional weight of the animal will largely offset the transport costs of sending it to a southern processing facility
- If the producer cannot retain the animal, due to capacity constraints on the property, the animal can be sold to another producer who could put additional weight on and then send it south
- The least favourable option facing the producer would be to send the animal south immediately, incur the transport costs and sell the animal as a feeder steer or heifer. The returns to the producer would be the net value of the 350kg + animal less the transport costs to a southern processing facility estimated at between $100 and $150 per head.

The plant would provide an outlet for cattle that exceed the weight cap of the export market, and avoid the large transport costs that failing to meet export market specifications entails.

The plant also offers and avenue for processing cattle in the event that there is a disruption of the live export trade.

5.2 Financial performance of producers accessing the plant

The following section is based on modelling work prepared by Phil Holmes, of Holmes and Company.

As we have discussed far northern beef businesses are constrained by the lack of local processing facilities and therefore any surplus females that are sold do not make a significant contribution to herd revenue. Many females that would otherwise be saleable are often just retained until they die in the paddock and sometimes this is necessary because of the low reproductive rates and high death rates in the region. This section of the report is designed to shed some
light on the economic consequences of a local meatworks providing another market option for surplus females.

5.3 Methodology and Assumptions

The outcome in this section is based on computer modelling using system dynamics software. The base model was developed over a period of years specifically for northern beef herds and is validated against the historical benchmarked performance of businesses in any given northern region. In other words, the model has to be able to replicate historical herd and business performance before it can be interrogated with a range of changed assumptions. In this case, the model was validated against the historical performance of commercial beef businesses in the Katherine region. The base case variables used to replicate historical performance are shown in Table 14.

Table 14 Major Variables Used for Model Validation

<table>
<thead>
<tr>
<th>Variable</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Breeders</td>
<td>3,000</td>
</tr>
<tr>
<td>Weaning Rate (%)</td>
<td>53</td>
</tr>
<tr>
<td>Overall Herd Death Rate (%)</td>
<td>11</td>
</tr>
<tr>
<td>Total Expenses/AE (Variable and Fixed)</td>
<td>$74.90</td>
</tr>
<tr>
<td>Surplus Mature Cow Price ($/kg liveweight)</td>
<td>$1.32</td>
</tr>
</tbody>
</table>

Note: AE= Adult Equivalent (a 450kg non-reproductive bovine at maintenance)

The major outcomes for the herd, using the variables shown in Table 14, are presented in Table 15.

Table 15 Base Case Model Outcomes

<table>
<thead>
<tr>
<th>Measure</th>
<th>Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>EBIT/AE</td>
<td>$14.14</td>
</tr>
<tr>
<td>Cost of Production ($/kg liveweight)</td>
<td>$1.21</td>
</tr>
<tr>
<td>Beef Produced/AE (kg liveweight)</td>
<td>59</td>
</tr>
<tr>
<td>Mature Females Available for Sale</td>
<td>296</td>
</tr>
</tbody>
</table>

Note: EBIT= Earnings before Interest and Tax

Some of the underlying assumptions were changed in the model to reflect the presence of another market option for the herd, namely the AAco abattoir. With more potential breeders for sale, it is reasonable to assume that the younger more potentially productive herd would be slightly more fertile and would have fewer deaths. Some additional management input (mostly non-cash) would be required to facilitate these. The surplus cow price was increased marginally, but, otherwise all other variables remained unchanged. The entire steer drop was still consigned to the boat so as not to confuse where any potential economic benefit may be coming from. The operating expenses were held constant on the assumption that any savings would be cancelled out.
by increases elsewhere. This assumption is safe, but in any event, the major benefits will come, as always, from increased production and revenue. The changed assumptions are summarised in Table 16.

Table 16  Major Assumptions Used

<table>
<thead>
<tr>
<th>Variable</th>
<th>Value</th>
<th>Change From Base</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Breeders</td>
<td>3,000</td>
<td>Nil</td>
</tr>
<tr>
<td>Weaning Rate (%)</td>
<td>56</td>
<td>+3</td>
</tr>
<tr>
<td>Overall Herd Death Rate (%)</td>
<td>10</td>
<td>-1</td>
</tr>
<tr>
<td>Total Expenses/AE (Variable and Fixed)</td>
<td>$74.90</td>
<td>Nil</td>
</tr>
<tr>
<td>Surplus Mature Cow Price ($/kg liveweight)</td>
<td>$1.40</td>
<td>+$0.08</td>
</tr>
</tbody>
</table>

5.4  Results and Discussion

Using the assumptions in Table 16, the model produced a changed set of outcomes which are shown in Table 17.

Table 17  Changed Model Outcomes

<table>
<thead>
<tr>
<th>Measure</th>
<th>Outcome</th>
<th>Change From Base</th>
</tr>
</thead>
<tbody>
<tr>
<td>EBIT/AE</td>
<td>$28.70</td>
<td>+$14.56 (103%)</td>
</tr>
<tr>
<td>Cost of Production ($/kg liveweight)</td>
<td>$1.12</td>
<td>-$0.09 (8%)</td>
</tr>
<tr>
<td>Beef Produced/AE (kg liveweight)</td>
<td>67</td>
<td>+8 (13.6%)</td>
</tr>
<tr>
<td>Mature Females Available for Sale</td>
<td>413</td>
<td>+117 (39.5%)</td>
</tr>
</tbody>
</table>

These outcomes are dramatic. However, two important points need to be borne in mind here:

- All poorly productive herds (which, unfortunately, are too well represented in far Northern Australia) are extremely sensitive to very small changes in key herd productivity drivers, especially fertility and deaths. This is not a straight line relationship as highly productive herds are nowhere near as sensitive. Positive change in these herds becomes increasingly marginal in terms of the outcome.

- The key drivers of productivity that were changed in this modelling do not work in isolation, they compound on each other. For example, fewer deaths results in more breeders that have even more calves and the bigger sale cohort of breeders is sold at a slightly higher price. The nature of the compounding process is complex and can only be measured in a dynamic model as has been done here.

The potential gains demonstrated in this small modelling exercise are unlikely to be fully realised unless producers are educated on how a local meatworks can be used in the gain capturing process. The reliance on another market outlet for surplus females on its own, without simple low cost management changes will only go part way in total potential gain capture.
6 Wider economic benefits of the plant

ACIL Tasman took the inputs and outputs of the AAco abattoir financial model and the modelled northern territory cattle productivity impacts of the plant and modelled their impact on the northern Australian economy.

ACIL Tasman’s CGE model, Tasman Global, has been used to estimate the impacts of the construction and operation activities associated with the development of the AAco abattoir in the Northern Territory. Tasman Global is a large scale, dynamic, computable general equilibrium model of the world economy that has been developed in-house by ACIL Tasman. Tasman Global is a powerful tool for undertaking economic analysis at the regional, state, national and global levels. More detail of the Tasman Global model is provided in Appendix C.

Industries and regions in the model can be aggregated or disaggregated as required for a specific project. For this project the model has been aggregated to:

- five economies, namely the Northern Territory, the Pilbara Statistical Division, the Kimberley Statistical Division, the Rest of Australia and the Rest of the World.
- 45 industries/commodities as presented in Table 18.

The aggregation was chosen to provide the maximum detail possible for the key industries in the relevant areas of the Northern Australian economy.

<table>
<thead>
<tr>
<th>Industry/Commodity aggregation used in Tasman Global modelling</th>
</tr>
</thead>
<tbody>
<tr>
<td>Industry/Commodity</td>
</tr>
<tr>
<td>1 Crops</td>
</tr>
<tr>
<td>2 Northern Cattle</td>
</tr>
<tr>
<td>3 Live export</td>
</tr>
<tr>
<td>4 Northern abattoir</td>
</tr>
<tr>
<td>5 Feedlotting and agistment</td>
</tr>
<tr>
<td>6 Other cattle, sheep, goats and horses</td>
</tr>
<tr>
<td>7 Dairy cattle, sheep for wool, silk worm cocoons</td>
</tr>
<tr>
<td>8 Other animal products</td>
</tr>
<tr>
<td>9 Forestry</td>
</tr>
<tr>
<td>10 Fishing</td>
</tr>
<tr>
<td>11 Bovine meat products</td>
</tr>
<tr>
<td>12 Other meat products</td>
</tr>
<tr>
<td>13 Dairy products</td>
</tr>
</tbody>
</table>
The economic impact of the proposed AAco abattoir

6.1 Scenarios

Arrange of scenarios have been analysed to aid in understanding the potential wider economic impacts of the construction and operation of the AAco abattoir. There are a number of key variables that affect the projected economic impacts including:

- The capacity and location(s) of an abattoir
- The impact of access to a cull cow market on the effective stock of cattle in northern Australia
- The availability of suitable labour (either by tapping unemployed or underemployed labour locally or through increased migration from overseas or other parts of Australia)

In total four scenarios have been analysed for this report. These are comprised of two core scenarios (called A and B) under two alternative labour market assumptions.

The two core scenarios that have been assessed are:

- The construction and operation of an abattoir with a maximum processing capacity of 179,000 cattle a year by 2015/16 and the corresponding impact on the effective cattle stock in Northern Australia.
  - The facility is assumed to commence operations in 2013/14, initially processing 104,000 cattle that year. Over the course of the 2014/15 financial year that number rises to approximately 150,000 before reaching its capacity of 179,000 in 2015/16.
  - It is assumed that approximately 1.5 per cent of the returns to the operation and construction of abattoir remain in the Northern Territory, with the vast majority being repatriated to the Rest of Australia
  - 60 per cent of the cattle processed by the plant are assumed to come from the NT
The economic impact of the proposed AAc0 abattoir

25 per cent of the cattle processed by the plant are assumed to come from W.A. Specifically, these cattle are assumed to be sourced from the Kimberley and Pilbara regions in proportion with each region’s respective share of cattle exports.

The remainder is sourced from northern Queensland.

This scenario assumes the presence of the abattoir enables producers to increase the number and/or weight of their saleable cattle without incurring additional significant input costs. The scenario assumes that the previous stock which would have had little or no value due to live export regularity restrictions, can now be sold to the abattoir.

Thus, this scenario simulates the impact of the abattoir construction and operation as well as the almost costless increase of the marketable cattle stock in Northern Australia.

Scenario B emulates the scenario modelled in A, but with an assumption that 20 per cent of the value of the cattle stock in Northern Australia is owned by investors outside the region.

In this scenario, a smaller proportion of the productivity benefits associated with the increase in effective cattle stock remain in Northern Australia.

The 20 per cent figure is an arbitrary number used to frame the projected impacts of the increases in effective cattle supply since data was unavailable on the actual proportion of foreign owned cattle in northern Australia.

When undertaking CGE modelling, a key issue when estimating the impact of a project or policy is determining how the labour market will clear. As discussed in appendix A-1, increases in the demand for labour associated with an abattoir can be met by three mechanisms: increasing migration from the rest of Australia; increasing participation rates (or average hours worked); and by reducing the unemployment rate. The first two mechanisms are driven by changes in the real wages paid to workers while the third is a function of the additional labour demand relative to the reference case. Given the low-to-moderate unemployment rates across northern Australia; changes in the real wage rates accounts for most of the additional labour supply in the policy scenarios relative to the reference case.

Each scenario has been analysed with two assumptions regarding the availability of labour, namely:

---

4 CGE models place explicit constraints on the availability of factors and the nature of the constraints can significantly change the magnitude and sign of the results. In contrast most other tools used to assess economic impacts, including I-O multiplier analysis, do not place constraints on the availability of factors. Consequently, these tools tend to overestimate the impacts of a project or policy.
The economic impact of the proposed AAc0 abattoir

1. Standard Tasman Global labour market — where the scenario is analysed using the default representation of the Australian labour market which has a range of constraints on the availability and mobility of labour through the functional forms and elasticities.

2. Unconstrained labour market — in which the average real wage is assumed to remain the same as the reference case and the supply of labour is unconstrained (but maintaining the constraints on the supply of land, capital and natural resources).

It is the view of the ACIL Tasman that the standard Tasman Global labour market assumptions provide a realistic, although potentially conservative, view of the potential future employment impacts as a result of the policy scenarios — particularly in light of the tight labour market in the Northern Territory.

However, if a major economic downturn happens in the region or if as part of the policy, measures are undertaken to alleviate some of the constraints on the labour market, then it is possible that the future employment (and consequent economic) outcomes could be significantly higher than those projected using the standard labour market assumptions. In such a case, employment outcomes may approach those projected under the unconstrained labour market scenarios, which the authors consider to be an upper bound on the possible labour market impacts.

It should be noted that the CGE modelling does not predict whether or not a meat processing facility is financially viable for the individual stakeholders (this is the role of AAc0’s detailed financial modelling), rather it attempts to measure the broader economic impacts for the community from the interaction of the proposed abattoir with other industries (especially the competition for labour).

### 6.2 Economic impacts – Summary

Table 19 presents the projected impacts on the real income and employment for northern Australia under each of the scenarios.
The economic impact of the proposed AAco abattoir

Table 19  Projected economic impacts for total Northern Australia under each Scenario

<table>
<thead>
<tr>
<th></th>
<th>1 Standard Tasman Global labour market</th>
<th>2 Unconstrained labour market</th>
</tr>
</thead>
<tbody>
<tr>
<td>Real income</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Scenario A</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>A$m</td>
<td>A$m</td>
</tr>
<tr>
<td></td>
<td>47.43</td>
<td>79.35</td>
</tr>
<tr>
<td>Scenario B</td>
<td>41.96</td>
<td>71.98</td>
</tr>
<tr>
<td>Employment</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Scenario A</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>FTE jobs</td>
<td>FTE jobs</td>
</tr>
<tr>
<td></td>
<td>71.0</td>
<td>161.3</td>
</tr>
<tr>
<td>Scenario B</td>
<td>66.2</td>
<td>153.6</td>
</tr>
</tbody>
</table>

Notes: Northern Australia comprises the Northern Territory plus the Kimberley and Pilbara Statistical Divisions. “Local” means 100% locally owned capital. “Joint Venture” means a 50/50 joint venture arrangement between owners situated in the Rest of Australia and overseas. FTE = full time equivalent. One FTE job is equivalent to one person working full time for one year, or two people working 0.5 of a full time job.

Data source: ACIL Tasman modelling

Over the first three years of operation, the presence of an abattoir in Northern Australia is projected to increase the real incomes of residents in Northern Australia by an average of:

- $71.13 million per year under Scenario A (or $124.4 million per year if the labour market is unconstrained)
- $63.5 million per year under Scenario B (or $112.8 million per year if the labour market is unconstrained)

To place these numbers in perspective, the change in real income is equivalent to an annual average increase of all residents in Northern Australia of $284 and $254 per person per year under Scenarios A and B, respectively.

With respect to employment, over the first three years of operation, the presence of an abattoir in Northern Australia is projected to increase by an average of:

- 113 full time equivalent (FTE) jobs per year under Scenario A (or 917 FTE jobs per year if the labour market is unconstrained)
- 105 FTE jobs per year under Scenario B (or 866 FTE jobs per year if the labour market is unconstrained).

7  Indonesian benefits of investing in the plant

There are two stages in encouraging Indonesia to consider investing in the AAco northern beef processing plant. They are:

- That beef self-sufficiency (or any form of imposed self-sufficiency) does not lead to improve food security and may increase food insecurity
• Beef and other forms of food security can be enhanced by a strategic (and commercially attractive) investment in the northern beef industry, and in particular the AAco processing plant

To the Indonesian Government, Food Security is measured by three important indicators. These are:

• The availability of enough safe good quality food to meet the needs of Indonesia’s population
• The distribution at reasonable prices to all areas
• Adequate consumption to meet health and welfare needs

Food self-sufficiency policies (where the product is produced purely within national boarders) can increase poverty as it tends to redistribute wealth between consumers, who are paying higher prices and domestic producers, who are receiving higher prices (some of which are captured by the supply chain). This distribution of wealth tends to work against the distribution and consumption objective of food self-sufficiency.

In effect the Indonesian policy of beef self-sufficiency to improve food security is internally conflicted because transferring wealth from consumers to producers to increase supply increases the price of beef, which in turn reduces demand compared to what it could otherwise be. This redistribution of wealth however, is not just between consumers and small beef producers. Only a proportion of prices are passed onto producers as some of the price increase is captured by the wholesalers and traders in the supply chain (this assumes also that some or all of the restricted imports are substituted with similar quality locally produced beef).

If a redistribution of surplus from wealthy consumers (who consume more beef) and small poor farmers is part of the policy objective, this may not be being achieved either. This is because there is a separation in the Indonesian beef market. Small poor producers tend to supply the wet markets and lower end of the beef market. Therefore if wet market beef prices rise as a result of restriction on the importation of beef, the transfer occurs between lower socio-economic groups and poor farmers, not wealthy urban consumer and poor farmers.

If the policy is also intended to distribute surpluses to non-land owner rural poor through the sharing of the increase in cattle prices with workers by the farmers, there are risks with this. Farmers may decide to use the increased returns to increase non-labour inputs such as cattle genetics, feed, on farm infrastructure and mechanisation.

In the case of beef production in Indonesia, producers often respond to higher prices by selling cows to raise cash. This has the opposite effect as the cow
herd is liquidated reducing future supply. This is exacerbated if the farmer believes that the price increase is unlikely to persist particularly if it is due to Government intervention which is prone to changes.

In summary self-sufficiency policies predicated on restricting imports to create incentives for local production is a blunt policy instrument, with considerable risks to food security.

A more effective food security policy would contain the objectives of:

- Increasing domestic production through improving productivity (research and development)
- Improving access to all forms of domestic and imported beef and reduce costs in the supply chain (in this case provide access to imported beef that meets the needs of modern retail outlets) which increasing domestic supply can sell beef into over time
- Allowing competitively priced, high quality beef products into the country to increase per capita consumption

### 7.1 Indonesia's cattle and beef self-sufficiency policy

Indonesia over the past few years has been imposing strict import quotas on live cattle and boxed beef imports in an effort to push Indonesia's self-sufficiency in these products. The Indonesian government is aiming for 90 per cent self-sufficiency in domestic beef production by 2014.

The motives for this self-sufficiency are to strengthen and optimise smallholder beef production, to reduce import of beef and live cattle and to save foreign exchange reserves (Deblitz, Kristedi, U.Hadi, Triastono, Puspadi, & Nasrullah, 2011).

According to Ilham (2006), as translated in Benchmarking the beef supply chain in eastern Indonesia (Deblitz, Kristedi, U.Hadi, Triastono, Puspadi, & Nasrullah, 2011), the reasons for the policy are due to:

1. the livestock subsector growing faster than the average agriculture production
2. more than 6.5 million households being involved in the sector
3. cattle production being more important for the regional economy in both urban and rural areas
4. to support the national food security system.

There are numerous internal policies that the Indonesian Government has implemented in order to reduce the countries reliance on cattle and beef imports and encourage domestic growth. For example, in 1990 the nucleus-
plasma policy had feedlots provide cattle to smallholders who fattened the cattle and then the feedlot purchased the animal back, less pre-financed costs. The idea behind this is the transfer of stock and knowledge from larger, specialised establishments to smallholders.

7.2 Setting the scene

7.2.1 Self sufficiency versus food security

'Self sufficiency' can be formally defined as the ratio of production by a country to that production plus imports and minus exports. In contrast to this is the description of 'food security', "when all people, at all times, have physical and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life (World Food Summit/FAO, 1996). Self-sufficiency has trade implications associated with it, whereas food security is concerned with creating a sustainable supply of food that meets the consumers’ needs and demand. The achievement of food security is not necessarily through self-sufficiency.

In some instances the desire for self-sufficiency is borne out of a fear that the international market may not always be able to supply their countries needs for a good, and so reducing reliance on imported goods is a way of ensuring supply. What this does not account for is that these countries will still be subject to their own internal shocks that may disturb the flow of goods, such as floods, drought or disease (Vanzetti, Rakhman Setyoko, Trewin, & Permani, 2010). Another aspect to consider is that self-sufficiency may result in an inefficient use of resources. Generally, individual countries have comparative advantage in the production of certain goods or services and it is this advantage that they trade on the international market for goods or services they are not as efficient in producing.

7.3 Beef sales in Indonesia

There is a need to understand the supply chain for beef at the retail/distribution end and also the consumers’ preferences, to aid in determining where, and by whom, the effects of restricting live cattle and beef meat imports will be felt.

Beef in Indonesia goes into four major segments; the wet markets, supermarkets, meat shops and hotels and restaurants and institutions. Wet markets are the traditional outlet for meat in Indonesia, mainly catering to the household consumer and meatball soup peddlers. Meatballs are produced from the lowest quality meat on the carcass and often include non-meat filler. The meat shops represent a small percentage of sales, and mainly to the household...
The economic impact of the proposed AAco abattoir

consumer. Wet markets and meat shops source their produce from local abattoirs, aided by (often multiple) traders. These local abattoirs use domestic cattle and those imported live and finished in feedlots.

Super and hyper markets offer a safer meat product that is more tender and leaner than what is available in the wet markets plus it at a convenient location (Hadi, Ilham, Thahar, Winarso, Vincent, & Quirke, 2002). Generally, meat in these supermarkets is imported and of a high quality. The share of supermarket beef meat sales is much less than the wet markets. In Jakarta there are approximately 150 wet markets and 80 per cent of beef is sold in them (Sullivan & Diwyanto, 2007). These wet markets are being eroded by super markets though.

Beef imports are primarily fresh and frozen bone-in and boneless beef (Sullivan & Diwyanto, 2007). These cuts of meat cater to the wealthier class in Indonesia and also to the expatriate market. These people are concentrated in the larger cities, such as the capital Jakarta, and around West Java. Beef consumption in these areas is around 7 - 9 kg per capita, compared to the national beef consumption estimate of 1.7 - 1.8 kg per capita (Sullivan & Diwyanto, 2007). The hotels and restaurants segment are also major users of imported beef (Sullivan & Diwyanto, 2007). These industries are generally catering for tourists and the middle to upper classes.

There is a distinguishable difference between domestic and imported beef meat in Indonesia, so much so that it is often noted that local beef meat is a poor substitute for imported beef meat (Vanzetti, Rakhman Setyoko, Trewin, & Permani, 2010). This means that, on the whole, the market will not experience a situation where consumers of imported beef will turn to consuming domestic beef instead.

### 7.4 Policy implications for 2012

In 2012 the live cattle import quota will be at 283,000 head, down 29 per cent from the import quota of 400,000 head in 2011. This is in stark contrast to the 772,868 head of cattle Indonesia imported from Australia in 2009 (see Table 20). With respect to beef and veal meat, the countries import quota is at 34,000 tonnes in 2012, down nearly two thirds from the 100,000 tonne allowance in 2011. In 2009 and 2010 Australia alone was exporting around 50,000 tonnes of beef and veal meat to Indonesia each year (see Table 21).

According to the Ministry of Agriculture, six fully grown cattle provide approximately one tonne of beef. This implies that the 400,000 head import of cattle in 2012 will produce around 67,000 tonnes of beef for the domestic market. This, plus the imports of beef meat at 34,000 tonnes equals total imports of 101,000 tonnes of beef meat.
The economic impact of the proposed AAco abattoir

Table 20  
**Australian live cattle exports, 2007 - 2012**

<table>
<thead>
<tr>
<th></th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
<th>2011 *</th>
<th>2012 f</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indonesia</td>
<td>516,992</td>
<td>650,161</td>
<td>772,868</td>
<td>521,002</td>
<td>410,000</td>
<td>283,000</td>
</tr>
<tr>
<td>Malaysia</td>
<td>35,018</td>
<td>20,263</td>
<td>13,651</td>
<td>17,084</td>
<td>12,250</td>
<td>15,000</td>
</tr>
<tr>
<td>Philippines</td>
<td>20,354</td>
<td>10,791</td>
<td>12,860</td>
<td>16,244</td>
<td>22,000</td>
<td>23,000</td>
</tr>
<tr>
<td>Total</td>
<td>572,364</td>
<td>681,215</td>
<td>799,379</td>
<td>554,330</td>
<td>444,250</td>
<td>321,000</td>
</tr>
</tbody>
</table>

*e* = estimate based on 11 months data  
*f* = forecast

Data source: (McRae, 2012)

Table 21  
**Australian exports of tonnes of beef and veal to South East Asia, 2007 - 2012**

<table>
<thead>
<tr>
<th></th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
<th>2012 f</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indonesia</td>
<td>26,800</td>
<td>33,000</td>
<td>51,800</td>
<td>48,400</td>
<td>39,600</td>
<td>30,000</td>
</tr>
<tr>
<td>Philippines</td>
<td>3,400</td>
<td>14,100</td>
<td>17,000</td>
<td>19,200</td>
<td>21,000</td>
<td>23,000</td>
</tr>
<tr>
<td>Malaysia</td>
<td>3,300</td>
<td>6,200</td>
<td>8,000</td>
<td>11,700</td>
<td>14,400</td>
<td>14,500</td>
</tr>
<tr>
<td>Singapore</td>
<td>5,500</td>
<td>8,100</td>
<td>7,500</td>
<td>7,600</td>
<td>9,700</td>
<td>9,000</td>
</tr>
<tr>
<td>Thailand</td>
<td>1,500</td>
<td>1,400</td>
<td>1,600</td>
<td>1,800</td>
<td>2,500</td>
<td>2,500</td>
</tr>
<tr>
<td>South-East Asia total</td>
<td>40,500</td>
<td>62,800</td>
<td>85,900</td>
<td>88,700</td>
<td>87,200</td>
<td>79,000</td>
</tr>
</tbody>
</table>

*f* = forecast

Data source: (McRae, 2012)

### 7.5 Short term

As a result of this dramatic quota lowering, there is now a severe shortage of supply in Indonesia, resulting in soaring prices. The Jakarta Globe has been reporting "*retailers and processed beef manufacturers are facing a shortage of beef, as domestic suppliers cannot make up for the government’s cap on beef imports that is driving prices up*" (Nirmala, 2012). And "*...government quota on beef imports had driven prices up to Rp 80,000 ($8.70) per kilogram...beef is expected to reach Rp 120,000 a kilogram during the Idul Fitri, Christmas and New Year’s holiday.*" (Tambun, 2012).

Projecting Indonesia's consumption for 2012 based upon average consumption over the past few years, beef and veal consumption will be around 500,000 tonnes (OECD/FAO, 2011). This suggests that, after accounting for the 101,000 tonnes of imported beef meat, Indonesia will need to slaughter 2.4 million of their own domestic herd this year to make up the shortfall.

The Wall Street Journal for South East Asia reports that "*industry players said Indonesia's meat consumption for 2012 was projected at 484,000 tons or equal to 2.6 million head of live cattle, but only 1.9 million of local cattle were ready for slaughter*" (Pathoni, 2012).

The question is does Indonesia have enough cattle available for slaughter? The current shortage in meat supply would imply they do not, or do not have the resources for processing. Figures surrounding Indonesia's cattle herd have
been questionable, the Indonesian Directorate of Livestock estimate 12.6 million head in 2009, a stable figure that has fluctuated between 10.5 to 12.6 over the years 2002 to 2009. Recent data on BPS Statistics Indonesia for 2010 state the herd is at 13.6 million in 2010. With respect to processing capacity, data for cattle slaughtered in abattoirs and reported outside of abattoirs in 2009 is 1.3 million head (BPS Statistics Indonesia, 2009). Over the last 10 years this figure has only fluctuated slightly, the lowest was 1 million head in 2006 and the highest 1.5 million head in 2000.

The Chairman of the National Meat processors Association said that the processed beef industry, on the recommendation of the Ministry of Agriculture, has been trying to source cattle from the Sulawesi and East Java region, but to no avail. He said "it turned out that there were no cattle, and the slaughterhouse was way below standard" (Nirmala, 2012).

7.6 Long term

If the Indonesian self-sufficiency policy in beef meat is pursued it can be expected that the import quotas will continue to be lowered. Over the long term there will be some distinct effects on the beef industry in Indonesia.

The shortage of supply is already creating price hikes in the beef meat market, these movements in price will cause volatility of the market and drive demand for beef down. In the supermarkets and hotels/restaurant industries this decrease in demand is due to the consumers' unwillingness to substitute domestic beef for imported and for the wet markets and meat shops demand is lower due to high prices, as beef is not a staple of the Indonesian diet. Due to the elasticity of demand for beef, demand will fall further than price will compensate for.

The next section looks at a study that has modelled the effect of different policies on the beef industry in Indonesia. It specifically measures the effect that Indonesia's proposed self-sufficiency policy will have in the long term. It confirms that higher prices reduce demand and the size of the market overall (Vanzetti, Rakhman Setyoko, Trewin, & Permani, 2010).

The volatility and lower demand that will be experienced discourages players all along the supply chain from participating. Retailers will no longer promote beef in their stores due to the smaller demand and have no incentive to invest further in the supply chain. Beef dependent traders in the market will be forced out due to the smaller size of the market. The wet markets too will contract due to the smaller market. For the processors and producers, the effect is followed through, although domestic production will increase by a small amount to supply the marginal substitution effect. The bigger picture is that
the Indonesian beef industry is at risk of stagnating, and due to this will not attract investment.

### 7.7 Alternative policies and their modelled impacts

The Crawford School of Economics and Government, at the Australian National University, analysed four different policies encouraging self-sufficiency in live cattle and beef production in Indonesia. Each of these scenarios measured the welfare effects and examined impacts on production, price and imports. The four scenarios were:

1. imposing import quotas on live cattle into Indonesia to 10 per cent of baseline levels
2. imposing import quotas on live cattle and beef meat into Indonesia to 10 per cent of baseline levels
3. implementing a two per cent live cattle production subsidy ($40 million worth), and
4. achieving a 10 per cent productivity improvement in live cattle production in Indonesia

(Vanzetti, Rakhman Setyoko, Trewin, & Permani, 2010)

### 7.8 Results from banning 90 per cent of live cattle imports

Under a policy where the Indonesian Government was to ban 90 per cent of live cattle imports, the major modelled impacts are:

- a rise in the production of domestic cattle by approximately 17 per cent, in response to the 6 per cent higher price received by the producer
- however, domestic production and consumption of the final beef product would fall by 13 per cent, driven by the 27 per cent higher end product price
- obviously live cattle imports would fall by 90 per cent, but in response to this there would be more than a doubling of imported beef meat
- the beef industry is producing more cattle but less is being demanded due to the high price increases, plus there is now a greater reliance on imported beef

### 7.9 Results from banning 90 per cent of live cattle and beef meat imports

Under a scenario where there is a restrictive policy on 90 per cent of imports of both live cattle and beef meat, the major modelled impacts are;
The economic impact of the proposed AAco abattoir

- the domestic production of cattle would increase by 28 per cent and the price the producer receives would also increase, by 11 per cent
- the production and consumption of beef would increase by seven per cent, and be accompanied by a 32 per cent price rise, reflective of the higher cost of production in Indonesia as opposed to the imported product
- the final consumptive market is slightly higher but the consumer is disadvantaged by the dramatic increase in price

7.10 Results from a two per cent production subsidy

If the Indonesia Government were to approach self-sufficiency by providing a two per cent subsidy to domestic cattle producers, then the modelled impacts are;

- the price received by the producer will increase by the level of the subsidy, but,
- the price of the final beef product will decrease as the additional cattle produced in response to the policy dampens consumer prices
- as the level of domestic support increases this measure becomes less effective as a way of achieving self-sufficiency, as it becomes very expensive and even at a full subsidy rate (that is 100 per cent) there is still a more than 20 per cent being imported

7.11 Results of improving productivity by 10 per cent

The productivity improvement approach has many positive aspects to it, including the fact that it is a long lasting investment and unlike subsidy credits does not need to be continuously paid, and unlike import quotas does not distort the market. If the Indonesian Government were to target productivity improvements of 10 per cent and not interfere with the market in any other way then the modelled impacts are;

- the production of domestic cattle lifts by three per cent, however there is a decrease in the price received by 11 per cent (producers benefit through productivity improvements, most of the price benefit though flows through to the consumer)
- the production and consumption of the final beef product lifts by four per cent, as the price for it has fallen by eight per cent
- interestingly it has the effect of reducing the countries reliance on both the live and beef meat imported product. Live cattle imports fall by seven per cent and beef meat imports by 24 per cent
- the beef industry has grown in size whilst becoming more affordable to the consumer and the producer is benefiting from greater productivity, a benefit that can continue to be built on
An example of an area for productivity improvement is calf mortality. The number of calves lost between live births and weaning in some areas of Indonesia are reported as high as 17 per cent. Other areas of the island are only reporting calf mortality losses of three per cent (Deblitz, Kristedi, U.Hadi, Triastono, Puspadi, & Nasrullah, 2011).

7.12 The overall welfare effects for Indonesia and Australia

Under the scenarios where import quotas are applied to live cattle alone or both live cattle and beef meat imports welfare losses are huge, $380 and $458 million, respectively (see Table 22). This negative welfare effect is partly due to the consumer being worse off due to the higher prices experienced, partly due to negative allocative efficiency and also to the Government foregoing any tariff revenue previously captured or that could have been (Vanzetti, Rakhman Setyoko, Trewin, & Permani, 2010). Australia’s national welfare loss is $17 million when live cattle imports are restricted, and more than double that when both products are restricted (Vanzetti, Rakhman Setyoko, Trewin, & Permani, 2010).

The policy where a subsidy is supplied creates a significantly smaller welfare loss, $20 million. The subsidy rate of 70 per cent is used here because it is the level of assistance required to achieve 90 per cent self-sufficiency in beef. On top of this negative $20 million welfare effect there is the cost of the actual subsidy itself, equal to $998 million annually.

The only policy to create positive welfare effects is the productivity improvement scenario, a welfare gain of $196 million for the nation. It must be noted though that this does not account for the cost of the program, however, it is assumed that the cost would be less than the benefit as the estimated rate of return to research is 7:1 (Vanzetti, Rakhman Setyoko, Trewin, & Permani, 2010).

The recommendations of the ACIAR project, aimed at benchmarking the Eastern Indonesian beef supply chain, centred around research and development and extension efforts in the country. They included recommendations such as "the improvement of herd, production and trade statistics...and... the creation of a national Beef Forum as a platform for professional exchange of information, expertise and technologies" (Vanzetti, Rakhman Setyoko, Trewin, & Permani, 2010).
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8 Implementation strategy

The success of the plant will also be substantially improved by:

- Producers making a number of herd management changes to enable them to cull cows and recruit heifers into the herd more efficiently
- Assistance with infrastructure
- An investment in the plant by Indonesian public or private interests particularly an Indonesian state owned enterprise (SOE) or the Indonesian Government Investment Unit (Pusat Investasi Pemerintah (PIP))

This analysis has identified a number of economic beneficiaries of the plant. They include:

- Northern cattle producers and those companies that provide them with goods and services
- Indigenous cattle enterprises
- Northern Territorians through an increase in employment opportunities in the plant and from industries supply goods and services to the plant
- Beef consumers in general and beef consumers in Indonesia in particular if a large proportion of the plant’s output is exported to Indonesia

As beneficiaries of the plant these groups therefore have an interest in maximising the benefits that flow from the operation of the plant. They appear also able to contribute to reducing the risks and improving the performance of the plant.

The tasks that are required to optimise the economic benefits of the plant are summarised in the following table.

### Table 22 Welfare impacts of alternative scenarios

<table>
<thead>
<tr>
<th>Scenarios</th>
<th>$m</th>
</tr>
</thead>
<tbody>
<tr>
<td>Restrictions on imports of live cattle</td>
<td>-380</td>
</tr>
<tr>
<td>Restrictions on imports of live cattle and beef</td>
<td>-458</td>
</tr>
<tr>
<td>Domestic subsidy 70%</td>
<td>-20</td>
</tr>
<tr>
<td>Productivity improvement</td>
<td>196</td>
</tr>
</tbody>
</table>

Data source: (Vanzetti, Setyoko Rakhman, Trewin, & Permani, 2010)
The economic impact of the proposed AAco abattoir

Implementation strategy

Table 23 Implementation tasks and responsibilities

<table>
<thead>
<tr>
<th>Task</th>
<th>What needs to be done</th>
<th>By whom</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Assisting producers realise the benefits of a processing facility</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Range land production</td>
<td>Identify and improve utilisation of areas able to grow out stock on</td>
<td>Producers and State Departments of agriculture</td>
</tr>
<tr>
<td>Cattle genetics</td>
<td>Consider more fertile, quicker maturing cattle</td>
<td>Producers, cattle studs</td>
</tr>
<tr>
<td>Business management</td>
<td>Extend the enterprise level benefits of culling cows, recruiting more heifers</td>
<td>Producers, Private Consultants Departments of Primary Industries</td>
</tr>
<tr>
<td><strong>Infrastructure</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Transport</td>
<td>Improved all weather access facilities on farm</td>
<td>Producers, all levels of Government</td>
</tr>
<tr>
<td>Staff</td>
<td>Training and recruiting</td>
<td>Agrifood Skills Australia, Indigenous agencies</td>
</tr>
<tr>
<td>Road access to the plant</td>
<td></td>
<td>All levels of Government</td>
</tr>
<tr>
<td>Improving cold chain logistics</td>
<td>Construction of refrigerator container points at the Darwin port</td>
<td>NT and Australian Government Logistics companies</td>
</tr>
<tr>
<td>Health care and emergency services facilities</td>
<td></td>
<td>NT Government</td>
</tr>
<tr>
<td>Skilled workforce</td>
<td>Onsite training facilities</td>
<td>NT and Australian Government</td>
</tr>
<tr>
<td>Utilities</td>
<td>Assistance with main utilities connections</td>
<td>NT Government and associated agencies and authorities</td>
</tr>
<tr>
<td><strong>Trading and raising capital</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Attracting foreign investment from Indonesia</td>
<td>Demonstrate the commercial returns likely to be produced by the plant</td>
<td>AAco</td>
</tr>
<tr>
<td></td>
<td>Present the case that an investment in the plant would improve food security in Indonesia, create employment, and increase Indonesian and Australian national wealth</td>
<td>Minister for Trade Craig Emerson, Indonesian Australian Business Council, DFAT, AAco, IABC, DFAT, NT Government</td>
</tr>
</tbody>
</table>

*Data source: ACIL Tasman*

Table 23 lays out the main tasks and those best placed to carry them out that will maximise the economic value of the plant. Below the role and tasks for key organisations are discussed in more detail.

### 8.1 Specific initiatives associated with the plant

There are several infrastructure/research and development initiatives that could be established in association with the plant that would benefit the plant, and the beef industry and the Northern Territory beyond the economic and productivity impacts of the plant. These initiatives would require a range of potential joint venture partners.

While these initiatives would have benefits for the plant, the establishment of the plant creates the incentive for them to be established. Without a regional processing facility, there is no incentive for research and development to be undertaken to improve the value of beef production in the north of Australian
The economic impact of the proposed AAco abattoir

as the live trade, as it is currently structured does not post incentives for producers to improve meat quality or increase the amount of saleable meat that they produce per animal.

In the rest of Australia carcass weights have continued to increase as producers are paid based on a range of quality and weight scales that post incentives to produce large, higher yield and higher quality carcasses. The trend in increasing carcass weight can be seen in Figure 7. When the national trend is disaggregated between states it shows that the NT (a proxy for northern beef production) has failed to maintain the same rate of gain experience by other regions. There are other factors affecting this lower rate of growth in the NT, such as difference in feed quality and availability, and the need to balance cattle survival with productivity. However, with no price incentives to increase carcass weight, as is the case with the live weight cap on cattle going into the live trade, there is no incentive to invest in R&D to improve carcass performance.

Figure 7  
Average carcass weight per head slaughtered by state between 1973 and 2011

Data source: GrainGrowers Information Services 2011

8.1.1 Training and research facilities

There is an opportunity to establish in association with the AAco abattoir, a ‘tropical’ beef processing, packaging and distribution research and development centre. The focus of the centre would be to improve the quality and food safety of beef sold in developing countries, which according to most forecasts is where the greatest increase in demand will be in the next decade. A
component of this would be how to increase the consumption of processed beef products through wet and limited cold chain supply chains.

The facility would also provide training for meat workers processing beef in tropical and sub-tropical environments. This would be directed at the Indonesian meat industry in particular. This would over time lead to an improvement in processing of all forms of beef in Indonesia and assist the local industry and lead to an increase in total demand for beef in the country.

One of the additional benefits of the establishment of a northern processing capacity is the opportunity for employment and training for Indigenous Australians in the region. Therefore an important contribution to the establishment of the facilities could be a contribution from an Australian agency and/or Indigenous enterprise to underwrite in the first instance the employment and training of regional Indigenous people in the plant. The training received by Indigenous Australian’s in the plant would also improve the productivity of some of the regionals localised abattoirs serving local communities.

This facility would complement Australian investments in improving beef production in Indonesia and could be an important element in an Indonesia’s food security policy. It would also act as an additional incentive for Indonesian interests to invest directly in the plant.

The research facility would focus on three of four main areas of tropical and sub-tropical beef processing and distribution:

- Processing meat (slaughter and boning)
- Packaging (developing packaging suited to developing markets)
- Distribution
- Food safety in tropical and limited cold chain markets

Potential partners in this initiative could be:

- ACIAR
- AMPC/MLA
- MINTRAC/Agrifood Skills Australia
- Asian Development Bank
- Australian Government (under its Northern Australian Strategy)

8.1.2 Dedicated northern beef production and extension program

An important contribution to the success of the plant, particularly if small to medium producers are likely to the supply the plant, would be to assist producers identify and make management changes that would maximise the
benefits their business would get from the plant. That is, realise the on farm benefits described section 5.2.

The key features of this production research, development and extension initiative would be:

- Improve dry matter production and utilisation from range land in the region:
  - Develop tools for producers to identify areas of the region and their properties that would allow them to achieve live weights suitable for domestic processing
  - Improve grazing management
  - Improve the use of supplements

8.1.3 Trade reform initiatives

The central focus of a reform to the beef trade between Australia and Indonesia would be to encourage the Indonesian Government that the country’s food security concerns can be addressed more effectively and efficiently through a productive and profitable northern Australian beef industry. Improving the productivity of the northern beef industry requires the establishment of a northern processing sector. Having access to this market would reduce the risks, improve the profitability and encourage investment in the beef industry in Australia and Indonesia.

Therefore the Australian Government needs to develop a diplomatic strategy to encourage Indonesian beef policies directed at food security by incorporating investments in the Australian beef industry and the AAco plant in particular.

The diplomatic package would include:

- Continuation of assistance with tropical beef production research in Indonesia but make this conditional on Indonesian recognising the benefits of a profitable Australian industry
- Facilitation of direct investment in the AAco plant by making the appropriate introductions and assistance with Foreign Investment Review Board investigations
- A northern beef production strategic package (made up of the production and processing research and development initiatives discussed in the previous section)
- Negotiate with the Indonesian Government to reduce the protectionist measures in the Indonesian beef market
- Inclusion of beef trade in the Indonesian and Australian Free Trade Agreement (FTA) and the Comprehensive Economic Partnership Agreement (CEPA)
The economic impact of the proposed AAco abattoir

The principle objective of CEPA is the integration of elements of the Australian and Indonesian economies to exploit the relative competitive advantages of both countries:

The AIBC vision for the IA-CEPA is for a comprehensive economic partnership agreement which transcends the traditional concept of a free trade agreement to encompass opportunities for a deeply entrenched economic partnership between two large neighbours and strategic partners.

The AIBC also suggests the IA-CEPA should include provisions for:
- Liberalised trade in goods and services
- Greater facilitation of two-way investment
- Reducing at-the-border and behind-the-border barriers
- Harmonisation and mutual recognition of standards and qualifications
- Facilitation of cross-border, integrated industries
- Development of cooperative supply chains (to external markets)
- The movement of skilled people
- Capacity building and economic cooperation (AIBC, 2011).

There is an opportunity to present the AAco abattoir, and a wider strategic plan for the integration of the Australian and Indonesian beef markets, as a practical and realistic initiative under CEPA.

8.2 Potential partners in the specific initiatives and supporting a case for government contributions

There are a range of potential Australian partners for the initiatives surrounding the plant. Most represent constituents that stand to benefit from maximising the economic impact of the plant. Each will need to be called on to make a contribution that is entirely consistent with their current range of responsibilities and activities.

Each will have to be engaged separately and be given a clear statement of how they may be able to contribute. Their contribution can be categorised as:

- Meat and Livestock Australia (MLA)
  - Marketing investments in Indonesia to support processed beef consumption
  - Establishing a northern beef research and extension package based largely on existing technologies and research capabilities
  - Invest in a northern beef production research and extension initiative
- Cattle Council/NFF/Northern Territory Cattlemen’s Association
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- Support the concept of the plant with governments and lobby for infrastructure investments
- Assist in getting the Indonesian Australian beef market relevant initiatives included in the Australian Indonesian FTA and CEPA
- The Australian Government
  - Development a diplomatic strategy to encourage greater Indonesian (or other foreign investors in the northern beef industry and the AAco in particular)
  - Provide assistance with infrastructure
  - Provide a ‘Ministerial champion’ (preferably from Cabinet) for the plant and the northern beef industry more broadly
- Northern Territory Government
  - Infrastructure assistance
- Animal welfare groups
  - Provide public endorsement of the plant

9 Works Cited


The economic impact of the proposed AAco abattoir


A The Tasman Global model

The economic impacts of a policy, project or other activity can be estimated using a variety of economic analysis tools, with the most often utilised generally being input-output (I-O) multiplier analysis and computable general equilibrium (CGE) modelling. The selection of the right tool is critical to the accuracy of the estimated impacts and depends upon the characteristics of the project/industry. Sometimes a range of tools are required.

Fundamentally, although various aspects of a policy or project – such as the number of jobs or the size of the investment expenditure – are of relevance to certain stakeholders, the key aggregate measure of the impact of a project is the extent to which the total wealth of the economy has changed as a result of the policy or project. Typically this is measured by real gross national disposable income (RGNDI), although real gross domestic product (GDP) and consumer surplus (among others) can also be important aggregate measures depending on the nature of the policy or project being analysed.

The main factors that need to be considered when analysing the economic impacts of a project or policy include:

- the direct and indirect contribution to the economy as a result of the activities associated with the project
- any ‘crowding out’ implications, which is where the use of scarce resources in one project means that resources are diverted from other productive activities, potentially ‘crowding out’ those activities by delaying or preventing them from occurring
- any productivity effects generated as a direct result of the policy or project activities – particularly any enduring productivity changes or productivity spillovers to other activities not directly associated with the project or policy
- any changes to the factors of production in the economy
- any welfare implications associated with changes in terms of trade or foreign income transfers
- whether there is a dynamic element to the size of any of the above effects (due to different phases of the project for example).

Analysis of any non-market impacts (such as the loss of biodiversity, changes in air quality, social justice implications, etc.) may also be relevant in assessing the full implications of a project or policy.
Figure 8 shows these components graphically. Some of these effects may have negligible impact while others may be very significant and an understanding of the relative size of these effects helps determine the most appropriate tool(s) for the analysis.

For many projects, static estimates of the direct economic contribution and supply chain implications can be obtained through the use of I-O multipliers. Estimating the size of other components using multiplier techniques is either not possible or very complex, as is estimating the economic impacts through time. In contrast, most CGE models are able to estimate all of the components shown in Figure 8 with dynamic CGE models able to estimate the impacts through time. The greater complexity of CGE models introduces a range of additional uncertainties, but they enable a much broader range of economic impacts to be considered within a single framework compared to using I-O multipliers.

These injections and flow-on effects will result in changes in consumption and welfare for the people of northern Australia. Due to the nature of the impacts CGE modelling has been chosen as the preferred tool to undertake the economic impacts assessment in this report, rather than I-O multiplier analysis.
9.2 The Tasman Global CGE Model

CGE models mimic the workings of the economy through a system of interdependent behavioural and accounting equations which are linked to an input-output database. These models provide a representation of the whole economy, set in a national and international trading context, starting with individual markets, producers and consumers and building up the system via demands and production from each component. When an economic shock or change, such as the establishment of an abattoir, is applied to a model, each of the markets adjusts according to the set of behavioural parameters which are underpinned by economic theory. The generalised nature of CGE models enables a much broader range of analysis to be undertaken (generally in a more robust manner) compared to I-O multiplier techniques, which are also often applied in economic impact assessments.

This theory and the use of the models are generally well understood and respected by decision makers from various Australian Governments. CGE can be a powerful tool for understanding the implications of a project to affected regions, the state and nationally as the models recognise not only the direct and second round impacts but the third and fourth round etc. impacts of a project. More detail on the Tasman Global model is provided in Appendix A-1.

Database aggregation

The database which underpins the model contains a wealth of sectoral detail. The foundation of this information is the set of input-output tables that underpin the database.

Micro industry approach

To accurately assess the economic impacts or economic contribution of a project, it must be accurately represented in the model’s database. An accurate representation can be guaranteed by establishing the proposed project as a new ‘micro’ industry in the database.

The micro industry approach is so called because it involves the creation of one or more new, initially very small, industries in the Tasman Global database. The specifications of each of the micro industry’s costs and sales structures are directly derived from the financial data for the project to be analysed. At the outset, the new industry is necessarily very small so that its existence in the Tasman Global database does not affect the database balance or the “business-as-usual” reference case outcomes.

Using the micro industry approach for project evaluations is the most accurate way to capture the detailed economic linkages between the project and the other industries in the economy. This approach has been developed by ACIL
The economic impact of the proposed AAco abattoir

Tasman because each project is unique relative to the more aggregated industries in the Tasman Global database.

Consequently, one of the industries identified in Table 18 is the operation phase of a Northern Australia abattoir with its own input cost structure, sales, employment, tax revenues and emissions based on detailed information developed by ACIL Tasman for this analysis. (In addition, the database also identified the construction phase of an abattoir with its own input cost structure.)

9.3 Measures of macroeconomic impacts

Although changes in real economic output are useful measures for estimating how much the output of an economy may change under different industry or policy scenarios, differences in the real income of a region are more important since they provide an indication of the change in economic welfare of the residents of a region. Indeed, it is possible that real economic output can increase with no, or possibly negative, changes in real income. In Tasman Global, changes in real income at the national level is synonymous with real gross national disposable income (RGNDI) reported by the ABS.

The change in real income is equivalent to the change in real economic output, plus the change in net foreign income transfers, plus the change in terms of trade (which measures changes in the purchasing power of a region’s exports relative to its imports). As Australians have experienced first-hand in recent years, changes in terms of trade can have a substantial impact on people’s welfare independently of changes in real GDP. The change in real income (as projected by Tasman Global) is ACIL Tasman’s preferred measure of the change in economic welfare of residents.

9.4 Scenarios

ACIL Tasman’s computable general equilibrium (CGE) model Tasman Global is a powerful tool for undertaking economic impact analysis at the regional, state, national and global level.

There are various types of economic models and modelling techniques. Many of these are based on partial equilibrium analysis that usually considers a single market. However, in economic analysis, linkages between markets and how these linkages develop and change over time can be critical. Tasman Global has been developed to meet this need.

Tasman Global is an analytical tool that can capture these linkages on a regional, state, national and global scale. Tasman Global is a large-scale computable general equilibrium model which is designed to account for all sectors within

The Tasman Global model
an economy and all economies across the world. ACIL Tasman uses this modelling platform to undertake industry, project, scenario and policy analyses. The model is able to analyse issues at the industry, global, national, state and regional levels and to determine the impacts of various economic changes on production, consumption and trade at the macroeconomic and industry levels.

A.1 A dynamic model

Tasman Global is a model that estimates relationships between variables at different points in time. This is in contrast to comparative static models, which compare two equilibriums (one before a policy change and one following). A dynamic model such as Tasman Global is beneficial when analysing issues where both the timing of and the adjustment path that economies follow are relevant in the analysis.

In applications of the Tasman Global model, a reference case simulation forms a ‘business-as–usual’ basis with which to compare the results of various simulations. The reference case provides projections of growth in the absence of the changes to be examined. The impact of the change to be examined is then simulated and the results interpreted as deviations from the reference case. (See Figure A1)

A.1.1 The database

A key advantage of Tasman Global is the level of detail in the database underpinning the model. The database is derived from the latest Global Trade Analysis Project (GTAP) database which was released in 2008. This database is a fully documented, publicly available global data base which contains complete bilateral trade information, transport and protection linkages among regions for all GTAP commodities.
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Figure A1  Illustrative scenario analysis using Tasman Global

The GTAP model was constructed at the Centre for Global Trade Analysis at Purdue University in the United States. It is the most up-to-date, detailed database of its type in the world.

*Tasman Global* builds on the GTAP model’s equation structure and database by adding the following important features:

- dynamics (including detailed population and labour market dynamics)
- detailed technology representation within key industries (such as electricity generation and iron and steel production)
- disaggregation of a range of major commodities including iron ore, bauxite, alumina, primary aluminium, brown coal, black coal and LNG
- the ability to repatriate labour and capital income
- a detailed emissions accounting abatement framework
- explicit representation of the states and territories of Australia
- the capacity to explicitly represent multiple regions within states and territories of Australia.

Nominally the *Tasman Global* database divides the world economy into 120 regions (112 international regions plus the 8 states and territories of Australia) although in reality the regions are frequently disaggregated further. ACIL Tasman regularly models projects or policies at the statistical division (SD) level, as defined by the ABS, but finer regional detail has been modelled when warranted.

The *Tasman Global* database also contains a wealth of sectoral detail currently identifying up to 70 industries [Table A1]. The foundation of this information is the input–output tables that underpin the database. The input–output tables
account for the distribution of industry production to satisfy industry and final demands. Industry demands, so-called intermediate usage, are the demands from each industry for inputs. For example, electricity is an input into the production of communications. In other words, the communications industry uses electricity as an intermediate input. Final demands are those made by households, governments, investors and foreigners (export demand). These final demands, as the name suggests, represent the demand for finished goods and services. To continue the example, electricity is used by households – their consumption of electricity is a final demand.

Each sector in the economy is typically assumed to produce one commodity, although in *Tasman Global*, the electricity, diesel and iron and steel sectors are modelled using a ‘technology bundle’ approach. With this approach, different known production methods are used to generate a homogeneous output for the ‘technology bundle’ industry. For example, electricity can be generated using brown coal, black coal, petroleum, base load gas, peak load gas, nuclear, hydro, geothermal, biomass, wind, solar or other renewable based technologies – each of which have their own cost structure.

The other key feature of the database is that the cost structure of each industry is also represented in detail. Each industry purchases intermediate inputs (from domestic and imported sources) primary factors (labour, capital, land and natural resources) as well as paying taxes or receiving subsidies.
## Sectors in the Tasman Global database

<table>
<thead>
<tr>
<th>Sector</th>
<th>Sector</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Paddy rice</td>
<td>36 Paper products, publishing</td>
</tr>
<tr>
<td>2 Wheat</td>
<td>37 Diesel (incl. nonconventional diesel)</td>
</tr>
<tr>
<td>3 Cereal grains nec</td>
<td>38 Other petroleum, coal products</td>
</tr>
<tr>
<td>4 Vegetables, fruit, nuts</td>
<td>39 Chemical, rubber, plastic products</td>
</tr>
<tr>
<td>5 Oil seeds</td>
<td>40 Iron ore</td>
</tr>
<tr>
<td>6 Sugar cane, sugar beef</td>
<td>41 Bauxite</td>
</tr>
<tr>
<td>7 Plant– based fibres</td>
<td>42 Mineral products nec</td>
</tr>
<tr>
<td>8 Crops nec</td>
<td>43 Ferrous metals</td>
</tr>
<tr>
<td>9 Bovine cattle, sheep, goats, horses</td>
<td>44 Alumina</td>
</tr>
<tr>
<td>10 Animal products nec</td>
<td>45 Primary aluminium</td>
</tr>
<tr>
<td>11 Raw milk</td>
<td>46 Metals nec</td>
</tr>
<tr>
<td>12 Wool, silk worm cocoons</td>
<td>47 Metal products</td>
</tr>
<tr>
<td>13 Forestry</td>
<td>48 Motor vehicle and parts</td>
</tr>
<tr>
<td>14 Fishing</td>
<td>49 Transport equipment nec</td>
</tr>
<tr>
<td>15 Brown coal</td>
<td>50 Electronic equipment</td>
</tr>
<tr>
<td>16 Black coal</td>
<td>51 Machinery and equipment nec</td>
</tr>
<tr>
<td>17 Oil</td>
<td>52 Manufactures nec</td>
</tr>
<tr>
<td>18 Liquefied natural gas (LNG)</td>
<td>53 Electricity generation</td>
</tr>
<tr>
<td>19 Other natural gas</td>
<td>54 Electricity transmission and distribution</td>
</tr>
<tr>
<td>20 Minerals nec</td>
<td>55 Gas manufacture, distribution</td>
</tr>
<tr>
<td>21 Bovine meat products</td>
<td>56 Water</td>
</tr>
<tr>
<td>22 Meat products nec</td>
<td>57 Construction</td>
</tr>
<tr>
<td>23 Vegetables oils and fats</td>
<td>58 Trade</td>
</tr>
<tr>
<td>24 Dairy products</td>
<td>59 Road transport</td>
</tr>
<tr>
<td>25 Processed rice</td>
<td>60 Rail and pipeline transport</td>
</tr>
<tr>
<td>26 Sugar</td>
<td>61 Water transport</td>
</tr>
<tr>
<td>27 Food products nec</td>
<td>62 Air transport</td>
</tr>
<tr>
<td>28 Wine a</td>
<td>63 Transport nec</td>
</tr>
<tr>
<td>29 Beer a</td>
<td>64 Communication</td>
</tr>
<tr>
<td>30 Spirits and RTDs a</td>
<td>65 Financial services nec</td>
</tr>
<tr>
<td>31 Other beverages and tobacco products a</td>
<td>66 Insurance</td>
</tr>
<tr>
<td>32 Textiles</td>
<td>67 Business services nec</td>
</tr>
<tr>
<td>33 Wearing apparel</td>
<td>68 Recreational and other services</td>
</tr>
<tr>
<td>34 Leather products</td>
<td>69 Public Administration, Defence, Education, Health</td>
</tr>
<tr>
<td>35 Wood products</td>
<td>70 Dwellings</td>
</tr>
</tbody>
</table>

*A detailed beverage database and model structure covering 52+ alcoholic and non-alcoholic sub–categories and alternative sales channels is also available.*

*Note: nec = not elsewhere classified*
A.1.2  Detailed energy sector and linkage to PowerMark and GasMark

*Tasman Global* contains a detailed representation of the energy sector, particularly in relation to the interstate (trade in electricity and gas) and international linkages across the regions represented. To allow for more detailed electricity sector analysis, and to aid in linkages to bottom–up models such as ACIL Tasman’s *GasMark* and *PowerMark* models electricity generation is separated from transmission and distribution in the model. In addition, the electricity sector in the model employs a ‘technology bundle’ approach that separately identifies twelve different electricity generation technologies:

- brown coal (with and without carbon capture and storage)
- black coal (with and without carbon capture and storage)
- petroleum
- base load gas (with and without carbon capture and storage)
- peak load gas
- hydro
- geothermal
- nuclear
- biomass
- wind
- solar
- other renewables.

To enable more accurate linking to *PowerMark* the generation cost of each technology is assumed to be equal to their long run marginal cost (LRMC) while the sales price in each region is matched to the average annual dispatch weighted prices projected by *PowerMark* – with any difference being returned as an economic rent to electricity generators. This representation enables the highly detailed market based projections from *PowerMark* to be incorporated as accurately as possible into *Tasman Global*.

A.1.3  Factors of production

Capital, land, labour and natural resources are the four primary factors of production. The capital stock in each region (country or group of countries) accumulates through investment (less depreciation) in each period. Land is used only in agriculture industries and is fixed in each region. *Tasman Global* explicitly models natural resource inputs as a sector specific factor of production in resource based sectors (coal mining, oil and gas extraction, other mining, forestry and fishing).
A.1.4 Population growth and labour supply

Population growth is an important determinant of economic growth through the supply of labour and the demand for final goods and services. Population growth for the 112 international regions and for the 8 states and territories of Australia represented in the Tasman Global database is projected using ACIL Tasman’s in–house demographic model. The demographic model projects how the population in each region grows and how age and gender composition changes over time and is an important tool for determining the changes in regional labour supply and total population over the projection period.

For each of the 120 regions in Tasman Global, the model projects the changes in age–specific birth, mortality and net migration rates by gender for 101 age cohorts (0–99 and 100+). The demographic model also projects changes in participation rates by gender by age for each region, and, when combined with the age and gender composition of the population, endogenously projects the future supply of labour in each region. Changes in life expectancy are a function of income per person as well as assumed technical progress on lowering mortality rates for a given income (for example, reducing malaria-related mortality through better medicines, education, governance etc). Participation rates are a function of life expectancy as well as expected changes in higher education rates, fertility rates and changes in the workforce as a share of the total population.

Labour supply is derived from the combination of the projected regional population by age by gender and the projected regional participation rates by age by gender. Over the projection period labour supply in most developed economies is projected to grow slower than total population as a result of ageing population effects.

For the Australian states and territories, the projected aggregate labour supply from ACIL Tasman’s demographics module is used as the base level potential workforce for the detailed Australian labour market module, which is described in the next section.

A.1.5 The Australian labour market

Tasman Global has a detailed representation of the Australian labour market which has been designed to capture:

- different occupations
- changes to participation rates (or average hours worked) due to changes in real wages
- changes to unemployment rates due to changes in labour demand
- limited substitution between occupations by the firms demanding labour and by the individuals supplying labour; and
The economic impact of the proposed AAco abattoir

- limited labour mobility between states.

Tasman Global recognises 97 different occupations within Australia – although the exact number of occupations depends on the aggregation. The firms who hire labour are provided with some limited scope to change between these 97 labour types as the relative real wage between them changes. Similarly, the individuals supplying labour have a limited ability to change occupations in response to the changing relative real wage between occupations. Finally, as the real wage for a given occupation rises in one state rise relative to other states, workers are given some ability to respond by shifting their location. The model produces results at the 97 3–digit ANZSCO (Australian New Zealand Standard Classification of Occupations) level.

The labour market structure of Tasman Global is thus designed to capture the reality of labour markets in Australia, where supply and demand at the occupational level do adjust, but within limits.

Labour supply in Tasman Global is presented as a three stage process:
1. labour makes itself available to the workforce based on movements in the real wage and the unemployment rate
2. labour chooses between occupations in a state based on relative real wages within the state; and
3. labour of a given occupation chooses in which state to locate based on movements in the relative real wage for that occupation between states.

By default, Tasman Global, like all CGE models, assumes that markets clear. Therefore, overall, supply and demand for different occupations will equate (as is the case in other markets in the model).

### A.1.6 Greenhouse gas emissions

The model has a detailed greenhouse gas emissions accounting, trading and abatement framework that tracks the status of six anthropogenic greenhouse gases (namely, carbon dioxide, methane, nitrous oxide, HFCs, PFCs and SF₆). Almost all sources and sectors are represented; emissions from agricultural residues and land–use change and forestry activities are not explicitly modelled but can be accounted for in policy analysis.

The greenhouse modelling framework not only allows accounting of changes in greenhouse gas emissions, but also allows various policy responses such as carbon taxes or emissions trading to be employed and assessed within a consistent framework. For example, the model can be used to measure the economic and emission impacts of a fixed emissions penalty in single or multiple regions whether trading is allowed or not. Or, it can used to model the
The economic impact of the proposed AAco abattoir emissions penalty required to achieve a desired cut in emissions based on various trading and taxation criteria.

A.1.7 Model results

*Tasman Global* solves equations covering industry sales and consumption, private consumption, government consumption, investment and trade. The model therefore produces detailed microeconomic results, such as:

- output by industry
- employment by industry; and
- industry imports and exports.

*Tasman Global* also produces a full range of macroeconomic results, for each Australian and international region including:

- total economic output – i.e. gross domestic product (GDP), gross state product (GSP) and gross regional product (GRP)
- total employment
- gross national product (GNP)
- private consumption
- public consumption
- investment and savings
- imports; and
- exports.
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