

## CONTRIBUTION OF THE FERTILIZER INDUSTRY TO THE AUSTRALIAN ECONOMY

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### Abstract

About \$2 billion is spent each year in the Australian economy on fertilizers. About 55 per cent of this expenditure is on domestically manufactured fertilizers and 45 per cent on imported fertilizers.

Value added in basic fertilizer production in 1999-2000 is estimated at around \$260 million — about 0.04 per cent of Australia's national income (GDP). A further \$150 million of value added is generated by fertilizer blending activities, which modify both domestically produced and imported fertilizers for customers. These represent the direct contributions of the fertilizer industry to national income.

To measure the total contribution of the fertilizer industry to the economy, both the direct and flow-on effects need to be accounted for. An economy-wide model is used for this purpose. Flow-on effects occur through value added generated in industries that supply inputs to fertilizer manufacture and industries that transform and deliver fertilizers from factories or ports to final users.

The model accounts for production and use of domestic and imported fertilizers, the backward links to input supplying industries and the forward links to final consumers. The model has the capacity to analyse a range of policies and events affecting the fertilizer industry.

The contribution of domestic fertilizer manufacture can be measured by simulating with the model the effects of closing down domestic fertilizer manufacture. The economy loses value added and employment in fertilizer production and in industries supplying inputs to fertilizer production. However, the economy does not lose access to fertilizers. Users switch to imported fertilizers and downstream service industries are largely unaffected.

The results project: an annual loss in national income of 0.05 per cent (about \$290 million in 1999-2000); a decline in aggregate employment of about 4600 jobs; and a reduction in aggregate private consumption expenditure of \$300 million (equivalent to \$16 per person).

The contribution of all fertilizers can be measured by simulating with the model the effects of closing down domestic fertilizer manufacture and no access to imported fertilizers. The economy loses the value added and employment generated in fertilizer manufacture and blending, input supplying industries and downstream service industries. In addition, agricultural industries lose productivity, production and international competitiveness. On the basis of estimates provided by Chudleigh & Simpson at this conference, it is assumed that \$2 of the agricultural production is lost for each \$1 reduction in expenditure on fertilizer.

The results show that: GDP would be 1.3 per cent lower each year (\$8 billion in 1999-2000); aggregate employment would be 1.5 per cent lower — 136,000 less jobs throughout the economy; and aggregate private consumption expenditure by households would have to fall by 2 per cent (which represents nearly \$8 billion in 1999-2000 or over \$400 per person).

The model has been used to simulate the effects of a 20 per cent appreciation of the Australian dollar. If this were to occur: agricultural exports, production and expenditure by farmers on fertilizers would decline; the costs of domestic fertilizer manufacture would fall through cheaper imported inputs; but imported fertilizers will become cheaper relative to domestically manufactured fertilizers leading to a higher proportion of the reduced domestic fertilizer demand being met by imports; and fertilizer exports will become more expensive, reducing their sales.

Simulations with the model project that a 20 per cent exchange rate appreciation would reduce value added in the domestic fertilizer manufacturing industry by between 14 per cent (N based fertilizers) and 34 per cent (NP and P based fertilizers). This is equivalent to a loss in fertilizer manufacturing industry value added of \$85 million in 1999-2000.

The model has also been used to simulate the effects of a 20 per cent reduction in the cost of imported (and price of exported) fertilizers. Under this scenario, with no change in the exchange rate, agricultural production and hence agricultural demand for fertilizers is not directly affected. However, agricultural users switch toward imported fertilizers; and fertilizer export sales are lost.

The cost to domestic fertilizer manufacturers is a reduction in value added of 20 per cent (N based fertilizers) and 74 per cent (NP and P based fertilizers). This is equivalent to a loss in fertilizer manufacturing industry value added of more than \$100 million in 1999-2000.

The loss of export sales makes a major contribution to this result.

## **Introduction**

THE FERTILIZER INDUSTRY IS BIG BUSINESS. Each year around \$1.8 billion is spent by Australian agricultural industries on fertilizers to improve crop and pasture productivity. This in turn helps sustain agricultural production, exports and international competitiveness. A further \$17 million is spent by the forestry industry on applying fertilizers to tree growing. Other users include recreational industries and final consumers who use fertilizers to enhance sporting facilities, and private and public gardens. And the basic chemicals industry makes purchases of around \$225 million per year of ammonia and ammonium nitrate from the fertilizer industry for the production other basic chemicals and explosives.

This total domestic demand for fertilizers of more than \$2.1 billion annually is supplied by a domestic manufacturing industry and by imports. Domestic manufacturers use domestically produced and imported raw materials, labour and capital to produce a range of fertilizers. Local minerals extraction and processing industries and chemical industries are important suppliers for fertilizer manufacturing. The fertilizer industry is a major consumer of natural gas, sulfuric acid, ammonium sulfate and imported and locally mined phosphate rock. Finished products are also imported for blending, distribution and sale — by both manufacturers and importers. And, with the commissioning of Western Mining Corporation's (WMC) Phosphate Hill manufacturing complex, significant exports of fertilizers will occur.

The ex-factory value of domestically produced fertilizers and the cif value of imported fertilizers are added to considerably by a range of activities between the factory (wharf for imported fertilizers) and the farm. These activities include:

- bulk unloading facilities at the wharf to handle imported raw materials and finished product;
- transport services such as coastal shipping, road, rail;
- marketing services such as agents and agronomic advice; and
- spreading services.

In this report we analyse the contribution of the fertilizer industry to the Australian economy. The fertilizer industry encompasses manufacturers, importers, blenders, agents—distributors, contract suppliers and specialist service providers. Our analysis draws on an economy-wide quantitative framework (fertilizer model), which we have constructed for this exercise. The model incorporates the various activities that make up the fertilizer industry and how they are linked to other sectors of the economy and overseas.

Our economy-wide fertilizer model is a useful tool for analysing the effects on the fertilizer industry and the economy as a whole of a large range of events and policies. These include:

- those which impact directly somewhere in the industry's value chain — for example, impediments in bulk handling of fertilizer imports;
- those which impact on the economy generally — for example, fuel excises and the exchange rate; and
- those which occur overseas but to which the industry must adjust — for example, a change in the cif price of imported fertilizers or imported feedstock for domestic fertilizer manufacture.

We illustrate the model's analytical capabilities by reporting analysis of the effects on the fertilizer industry of a devaluation of the exchange rate and a decrease in the cif price of imported fertilizers.

## **How the fertilizer industry contributes to Australia's economic performance**

Fertilizers are key inputs to agricultural production and productivity. But for these gains to be realised fertilizers need to be produced and distributed to final users in the required form and used appropriately. The activities of fertilizer manufacture, blending and distribution (of domestic and imported fertilizers) and associated contractual services also contribute to economic activity, employment and living standards.

In analysing this contribution it is important to distinguish between the contribution of:

- domestic fertilizer manufacture;
- blending and distribution of imported and domestic fertilizers ; and
- the fertilizer induced improvement in production, productivity and international competitiveness of agricultural industries.

The process of domestic manufacture involves the purchase of inputs from other industries and overseas to produce fertilizers. Value added is generated in manufacturing through payments to labour and profits earned by manufacturers. This value added contributes directly to national income (gross domestic product or GDP). There are also flow-on effects. The demands by manufacturing plants for raw materials and other goods and services in turn provides a boost to output, employment, profits and value added in input supplying industries, which further increases GDP. If domestic fertilizer production were to cease, the economy would initially lose all this value added, though over time the resources released from fertilizer manufacture would contribute to the generation of value added elsewhere in the economy.

That part of the industry engaged in the blending and distribution of fertilizers, whether domestically produced or imported, also contributes directly to GDP through the value added it generates directly and through the stimulus it provides to input supplying industries. This contribution would occur irrespective of whether fertilizers were produced locally or imported.

### ***Direct contribution***

Chart 2.1 provides estimates of the value chain for domestic and imported fertilizers. The fertilizer industry's direct contribution to Australia's national income (GDP) is measured by the value added it generates. The estimated ex-factory value of basic fertilizer production in 1999-2000 is around \$800 million.

After deducting the cost of purchased materials and services, value added generated by the industry in basic fertilizer production is estimated at around \$260 million or 0.04 per cent of GDP. A further \$150 million of value added is generated by domestic fertilizer blending activities, which modify domestically produced and imported basic fertilizers. Together, basic fertilizer production and blending account for 0.06 per cent of GDP. Production of fertilizer and blending activities employs around 2500 persons.

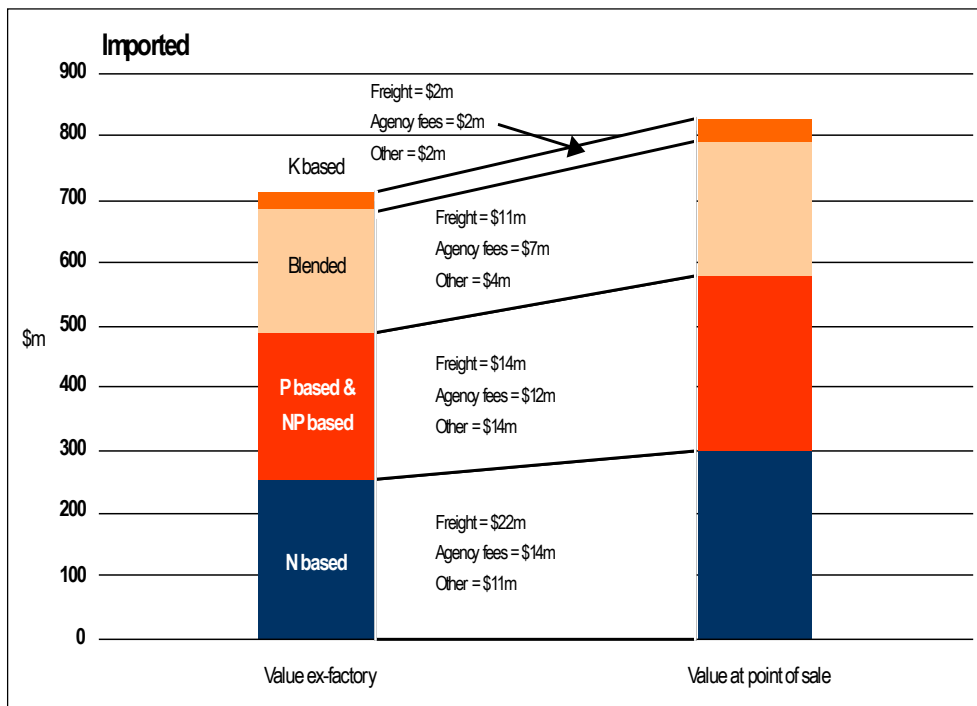
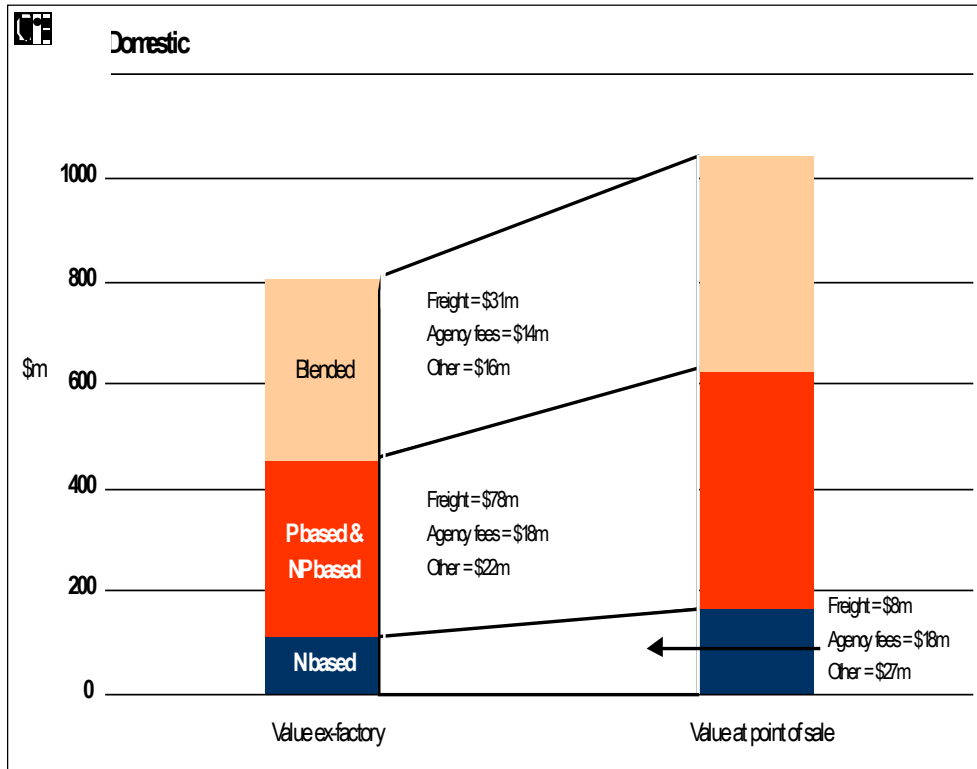
Expenditure on imported fertilizers accounts for about 45 per cent of total expenditure on fertilizers (chart 2.2). Within agriculture, the major using activity is winter cropping (chart 2.3).

Expenditure by farmers and others on fertilizers comes to \$1.9 billion. The difference between the ex-factory or cif value (in the case of imported fertilizers) and purchaser value is made up of freight, agency fees and other mark ups. Each of these activities and services generates some value added, which also contributes directly to GDP.

### ***Flow-on effects***

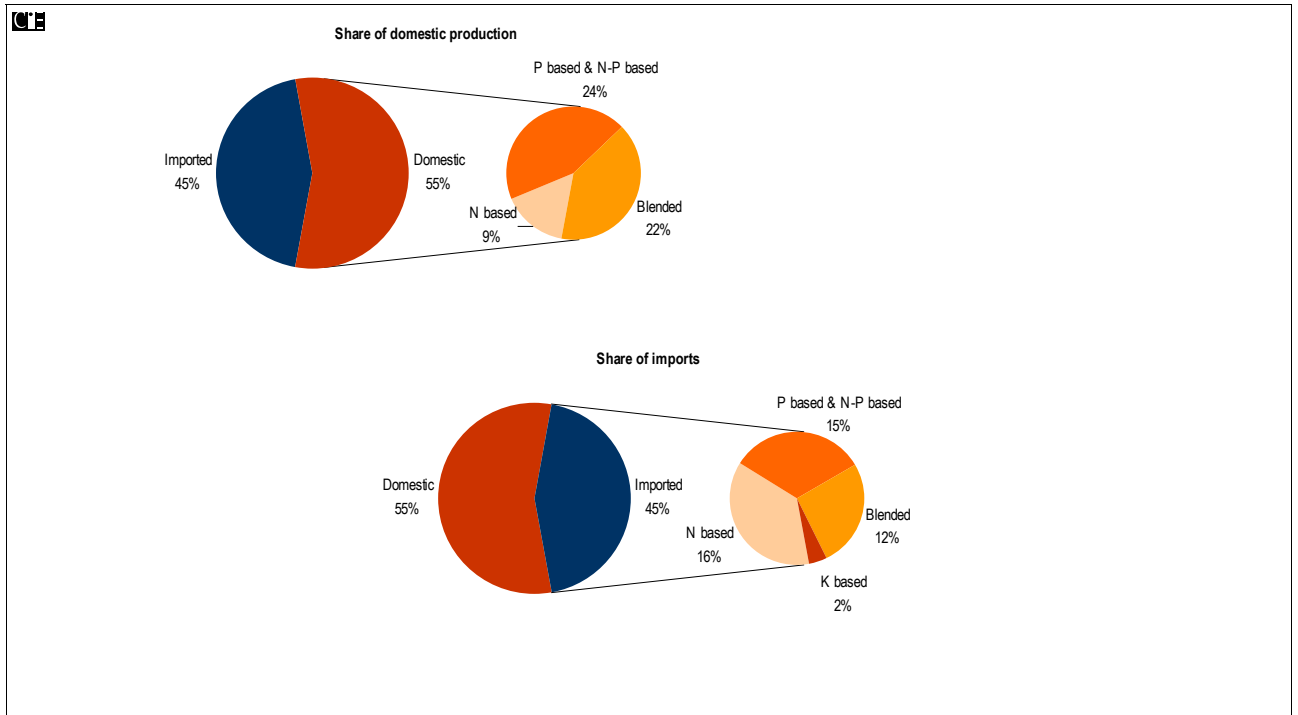
Each activity in the fertilizer value chain in turn makes purchases from other input supplying industries. This stimulates output profits and employment, and hence value added in these industries, which makes a further contribution to GDP. The size of the flow-on effects are calculated by our economy-wide model (see later).

2.1 Value chain for domestic and imported fertilizers, 1999-2000



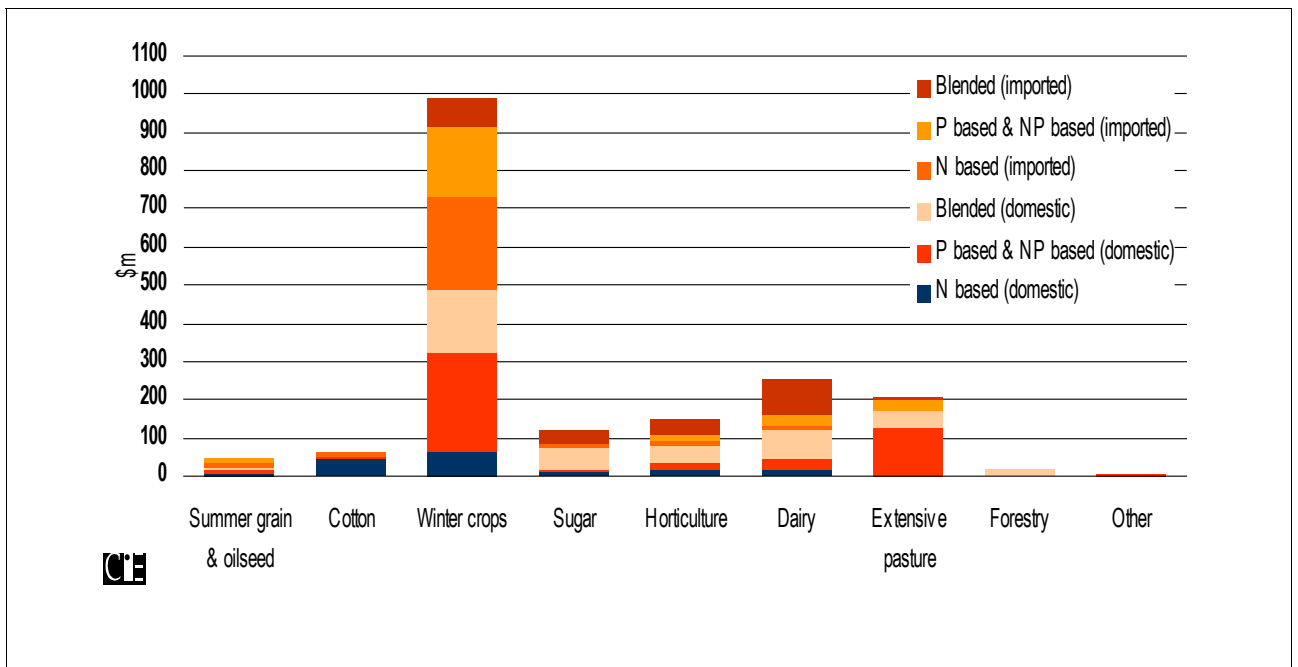
Data source: Estimates provided by FIFA.

### 2.2 Expenditure on domestic and imported fertilizers (point of sale), 1999-2000



Data source: Estimates provided by FIFA

### 2.3 Fertilizer use

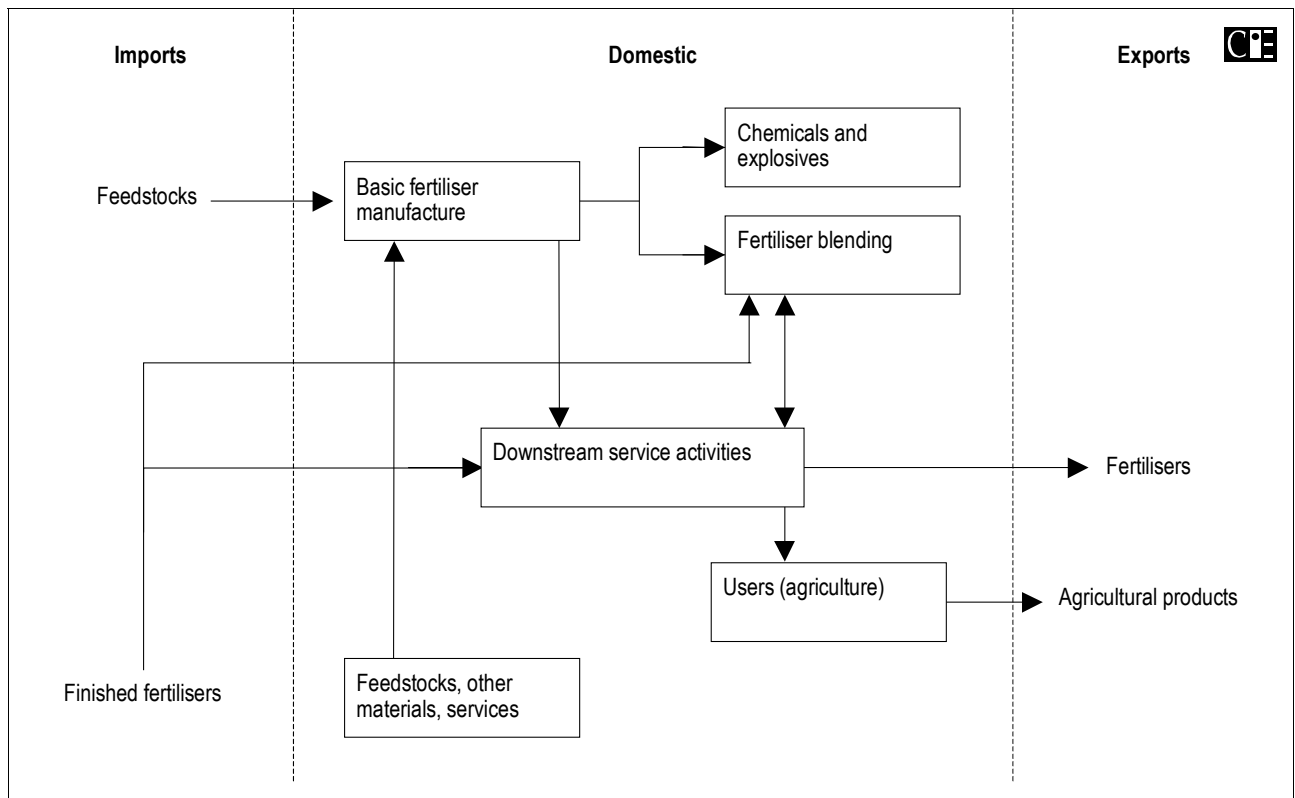


Data source: Estimates provided by FIFA

### Quantifying the fertilizer industry's economic contribution

To measure the contribution of the fertilizer industry to the Australian economy we need to account for both the direct and flow-on effects. We do this by including within the fertilizer model a set of input-output accounts describing the forward and backward links between fertilizer manufacture, fertilizer imports, blending and other downstream activities and all other industries. Some key links are set out in chart 3.1.

#### 3.1 Some key links between fertilizers and other industries



The model uses these links to quantify:

- production and value added in fertilizer manufacturing;
- the demands of fertilizer manufacturers for inputs from other supplying industries (mining, chemicals, electricity, water, etc.) and the contribution these demands make to value added in supplying industries; and
- the demands for each of the services required to transform and deliver fertilizers from the factory gate (domestic manufacture) or port of arrival (imports) to end users and the value added generated at each of these stages.

#### *The model*

Our starting point for the fertilizer model is the CIE's economy-wide model of the Australian economy. This model explains in considerable detail how particular events and policies impacting in any one part of the economy affect the performance of all other sectors and the economy as a whole. Performance outcomes are measured in terms of industry production, employment, value added, prices, imports, exports, etc. and the economy's overall macroeconomic performance — GDP, trade balance, aggregate employment, etc.

The economy-wide model is constructed around the national Australian Bureau of Statistics (ABS) input-output tables. These divide the economy's production, demand and trade into around 100

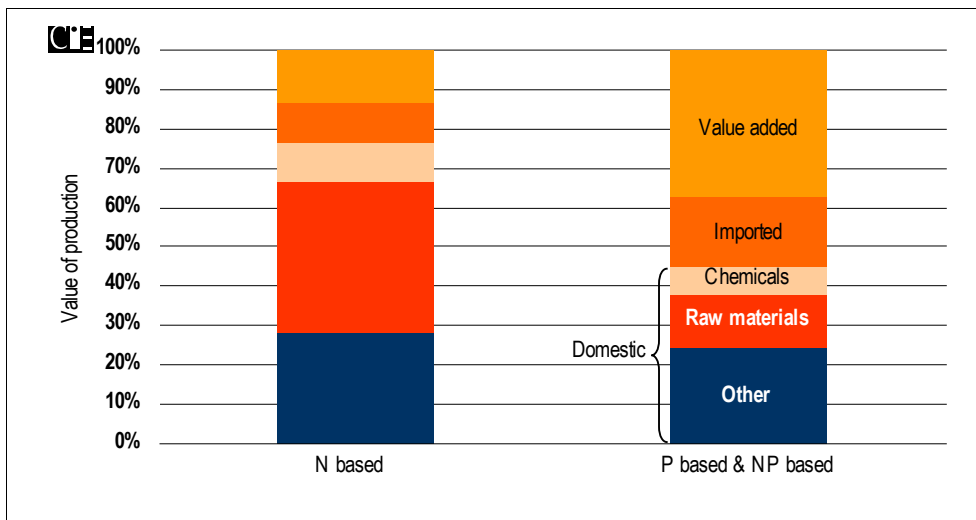
commodity and industry sectors, and describe the cost and sales links between sectors. In the ABS input-output tables, for confidentiality reasons, fertilizer activities are part of the basic chemicals sector. Using data supplied by FIFA for 1999-2000, we have disaggregated the basic chemicals sector to distinguish fertilizer manufacturing, importing and blending activities as follows.

- Basic fertilizer production is divided into two industries:
  - nitrogen based (anhydrous ammonia, granular urea, sulfate of ammonia); and
  - phosphorus and nitrogen-phosphorous based (calcium ammonium nitrate, di-ammonium phosphate, mono-ammonium phosphate, single super phosphate, triple super phosphate, others).

These industries purchase domestically produced and imported materials and services, and generate value added (payments to labour and profits — chart 3.2).

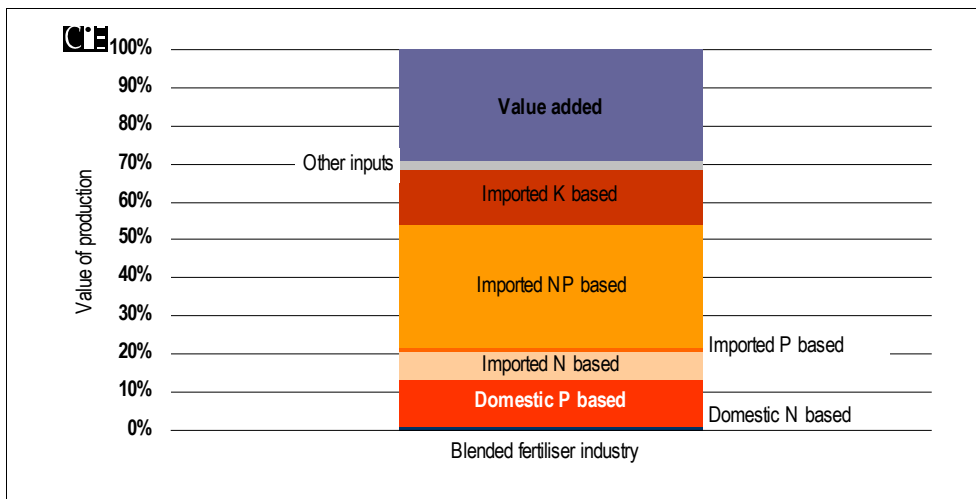
- A domestic fertilizer blending industry which purchases domestically produced and imported N based, and NP and P based fertilizers and imported K based fertilizers to produce higher value blended fertilizers (chart 3.3).

### 3.2 Cost structure of basic fertilizer industries



Data source: FIFA estimates.

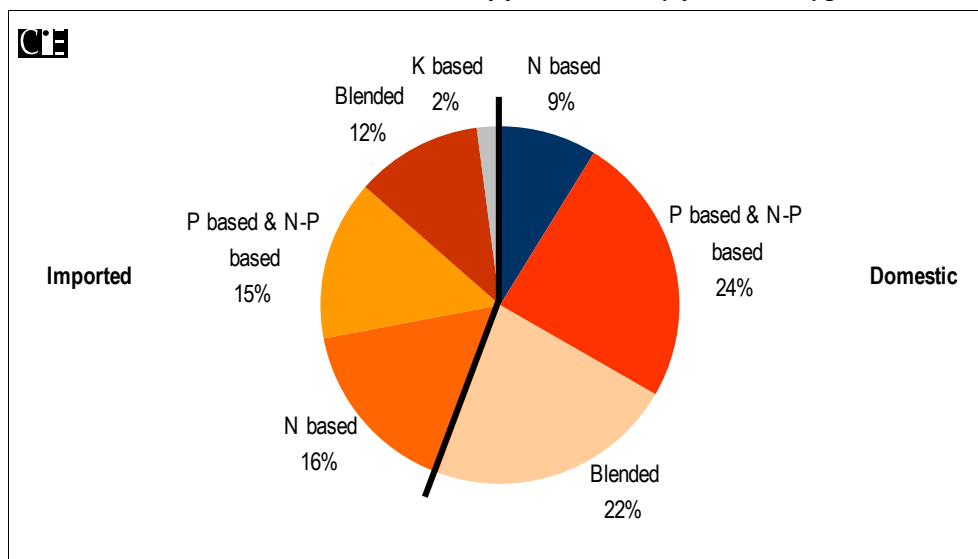
### 3.3 Cost structure of blended fertilizer industry



Data source: FIFA estimates.

- Seven categories of fertilizer products (chart 3.4):
  - domestically produced N based
  - domestically produced P and NP based
  - blended products from both domestic and imported basic fertilizers
  - imported N based
  - imported P and NP based
  - imported K based (there is no domestic production of K based fertilizers).

3.4 Use of fertilizers by fertilizer type



Data source: FIFA estimates.

To ensure that our starting point fertilizer specific data set accurately describes current industry activities, we have modified the 1999-2000 production and trade data to allow for production, import replacement and exports from WMC's newly commissioned plant at Phosphate Hill at its 2001 level of production.

With these fertilizer specific industries and products included, the model can trace:

- production and value added in domestic fertilizer manufacturing and blending;
- the demands of the manufacturing industry for inputs from other supplying industries (mining, chemicals, electricity, water, etc.) and from imports;
- the demands for domestically produced and imported fertilizers by agricultural industries;
- the demands for each of the services required to deliver fertilizers from the factory gate (domestic) or ship (imported) to be spread on the farm and the activities of the industries engaged in supplying these services; and
- how each of the above industries — input suppliers, service providers, manufacturers, etc. — is linked directly and indirectly to all other industries in the economy.

These are essential prerequisites for determining the contribution of the Australian fertilizer industry to the Australian economy.

### ***The industry's economic contribution***

We measure the industry's economic contribution in two parts, as follows:

- contribution of domestic fertilizer manufacturing and blending
- contribution of all fertilizers (domestic and imported).

To measure the contribution of domestic manufacturing and blending, we project outcomes for the economy assuming domestic fertilizer production is zero. The economy loses value added and employment in fertilizer production and in industries supplying inputs to fertilizer production. It does not, however, lose access to fertilizers. Agricultural and other users switch to imported fertilizers. This means that downstream service industries are largely unaffected, as they are still needed to facilitate the delivery of imported fertilizers to users.

To measure the contribution of the fertilizer industry (domestic and imported) to the economy we simulate a scenario of no domestic production and no access to imported fertilizers. In this situation the economy loses the value added and employment generated in fertilizer manufacture and blending, input supplying industries and in downstream service activities engaged in handling, blending and selling fertilizers. In addition, agricultural industries experience a reduction in their production, productivity and international competitiveness. This in turn further reduces national income and living standards.

The loss of the local fertilizer industry will lead to a deterioration of the balance of trade (loss of fertilizer exports and increase in fertilizer imports). The deterioration in the balance of trade reflects a reduction in national income relative to aggregate expenditure. In other words, some of the adjustment to the loss of value added from fertilizer manufacture occurs through increasing Australia's foreign liabilities rather than reducing expenditure. In a welfare sense, the contribution of fertilizer manufacturing to Australia's living standards is best measured by looking at the reduction in aggregate expenditure that needs to occur to match the economy's reduced national income (balance of trade constant). This is the approach we have taken in our analysis.

### ***Some results***

Projections for key variables are shown in table 3.5. The first two columns refer to the contribution of domestic fertilizer manufacture and the second two columns refer to the contribution of fertilizers in general.

#### ***Contribution of domestic fertilizer manufacture***

If domestic fertilizer manufacture were to cease, the economy would lose the value added and employment in N based, NP and P based fertilizer industries. As noted earlier, the direct loss to value added from this is about \$260 million.

But the economy does not lose access to fertilizers. Agricultural and other using industries switch toward imported fertilizers. This means that downstream service industries are largely unaffected, as they are needed to facilitate the delivery and application of imported fertilizers to users. Handling and blending of imported fertilizers would still continue when local production of fertilizers ceases.

After accounting for direct and flow-on effects, table 3.5 shows that GDP will fall by 0.05 per cent or \$290 million. In addition to the loss of value added and employment in fertilizer manufacture, the economy loses some value added and employment in industries such as basic chemicals and mining that supply inputs to domestic fertilizer manufacture. It also loses value added in industries supplying goods and services for consumption. To maintain the balance of trade, there must be a fall in real consumption expenditure by households. The result indicates a reduction in aggregate private consumption expenditure of \$300 million (equivalent to \$16 per person) would be needed to compensate for the loss in income from fertilizer manufacturing.

Aggregate employment declines by about 4600 jobs throughout the economy— the direct effects are losses of 1700 jobs in basic fertilizer manufacture.

The sector results in table 3.5 show that users of basic fertilizers are largely unaffected as they switch easily between domestic and imported fertilizers. The local chemicals industry experiences a small decline in output. In most cases, the fertilizer industry represents a small part of total demands for inputs of goods and services throughout the economy. Many of these inputs can be imported.

Imports of N based and P and NP based fertilizers increase by over \$500 million as a result of closure of the local industry. Imports of other basic chemicals, which are used in domestic fertilizer production, decline by 2 per cent.

### 3.5 Contribution of the fertilizer industry to the economy, 1999-2000

<i>Projection</i>	<i>Contribution of domestic fertilizer manufacture (no domestic production of fertilizers )</i>		<i>Contribution of all fertilizers (no domestic use of fertilizers )</i>	
	% change	\$m	% change	\$m
<b>Economy-wide</b>				
GDP	-0.05	-286	-1.31	-8 106
Aggregate employment (persons)	-0.05	-4 633	-1.53	-135 647
Aggregate exports	0.17	197	-2.81	-3 217
Aggregate imports	0.14	146	-2.26	-2 951
Real consumption <sup>a</sup>	-0.08	-300	-2.09	-7 839
<b>Industry production</b>				
<i>Fertilizers and chemicals</i>				
N based fertilizers	-100.0	-342	-100.0	-342
NP and P based fertilizers	-100.0	-492	-100.0	-492
Blended fertilizers	0.0	0	-99.9	-549
Other basic chemicals	-1.4	-60	-1.5	-68
<i>Agriculture</i>				
Sheep and wool	0.0	0	-9.5	-323
Grains	0.0	1	-7.7	-437
Beef cattle	0.0	1	-8.6	-367
Dairy cattle	0.0	1	-8.1	-242
Other agriculture	0.0	2	-8.2	-823
Services to agriculture <sup>b</sup>	0.0	0	-3.9	-115
Total agriculture and forestry	0.0	4	-7.7	-2 195
<i>Mining</i>	0.0	23	0.3	110
<b>Exports</b>				
<i>NP and P based fertilizers</i>	-100.0	-93	-100.0	-93
<i>Agriculture and food processing</i>				
Sheep and wool	0.0	0	-17.0	-259
Grains	0.0	1	-11.4	-562
Other agriculture	0.6	5	-68.9	-592
Meat products	0.2	11	-23.3	-1 126
Milk products	-0.2	-5	-23.6	-550
Sugar processing	0.8	12	-5.9	-86
<i>Mining</i>	0.5	178	1.5	476
<b>Imports</b>				
<i>Fertilizers and chemicals</i>				
N based fertilizers	43.6	117	-100.0	-268
NP and P based fertilizers	102.9	401	-100.0	-389
K fertilizers	0.0	0	-100.0	-102
Other basic chemicals	-1.9	-88	-2.9	-136

<sup>a</sup> Change in real consumption to ensure no change in the balance of trade. <sup>b</sup> Includes fertilizer spreading services.

Source: CIE economy-wide fertilizer model.

#### ***Contribution of all fertilizers***

In this scenario the economy loses the value added and employment generated in fertilizer manufacture and blending. It also loses value added and employment from the flow-on effects on industries supplying inputs to domestic fertilizer manufacture and downstream service industries

engaged in facilitating the delivery and application of both domestically manufactured and imported fertilizers. In addition, agricultural industries suffer a reduction in their productivity, which in turn affects their international competitiveness, value added and employment. How large the reduction in agricultural productivity if fertilizer use were to cease depends on previous fertilizer history and the length of time without fertilizers.

The accompanying paper to this conference by Chudleigh and Simpson provides guidance on the size of the reduction in agricultural production if fertilizer use were to cease. Chudleigh and Simpson report the results from a series of trials analysing the additional value of crop and livestock production from fertilizer use. Results vary significantly between trials and reflect different situations with respect to fertilizer history, nutrient level and hence response to fertilizer (table 3.6).

### 3.6 Benefits from fertilizer use

<b>Trial</b>	<b>Dollar output benefit to dollar fertilizer cost</b>
Long term phosphate experiment, western Victoria (sheep)	5.5:1
Sulphur on north west slopes of New South Wales (livestock)	5.0:1
Potassium use in increasing livestock production (coastal New South Wales)	3.6:1 – 2.5:1
Cereal yield in subtropics (nitrogen)	3.9:1 – 2.6:1
Sugar cane (potassium)	6.5:1
Cotton (potassium)	9.0:1 – 3.0:1
Canola (nitrogen)	2.9:1

Source: Chudleigh and Simpson (2001).

These results refer to experimental trials only. Farm yields can be expected to be less than experimental yields for valid economic reasons (Davidson, Martin and Mauldon, 1967).

Chudleigh and Simpson consider that a fair estimate of the contribution of fertilizers to Australian agricultural production would be \$2 to \$3 of additional production for each \$1 spent on fertilizers. They also report an earlier estimate (Pulsford 1989) of \$3 additional return for each \$1 spent on fertiliser.

We adopt the conservative Chudleigh and Simpson estimate by including in the model \$2 of lost agricultural production for each \$1 reduction in expenditure on fertiliser. This is equivalent to an 11.8 per cent reduction in agricultural production (close to \$4 billion in 1999-2000) if all expenditure on fertilizers were to cease.

Table 3.5 shows that national GDP would be at least 1.3 per cent or \$8 billion lower than otherwise without the contribution of all fertilizers. Aggregate employment would be 1.5 per cent lower, representing 136 000 less jobs throughout the economy. Real consumption by households would have to fall by 2 per cent, or over \$7.8 billion, to leave the trade balance unchanged. This represents a fall in consumption of over \$400 per person.

Output of the agricultural industries is projected to fall by 7 to 10 per cent across the board over the medium term. In total the gross value of production of agriculture and forestry is projected to fall by 7.7 per cent or just over \$2 billion. Output of the services to agriculture industry, which includes fertilizer spreading services, is projected to fall by 4 per cent.

Exports of related food processing commodities also fall sharply — over 23 per cent for meat and dairy products and 69 per cent for other agriculture (which includes horticulture).

#### Policy analysis with the fertilizer model

The fertilizer model is an ideal tool for industry policy analysis. In particular, it can be used to address:

- the payoffs to the fertilizer industry and the economy as a whole of a large number of events and policies impacting directly on the industry somewhere in the value chain (an example being removal of impediments in bulk handling);

- the payoffs to the industry and the economy of events and policies impacting somewhere else in the economy (an example would be the impact of changes in fuel excises);
- the effects on the fertilizer industry and the economy of changes outside the industry, but to which it must adjust — for example, changes in the cif prices of imported fertilizers or imported feedstock for domestic fertilizer manufacture; and
- the effects on the fertilizer industry of macroeconomic changes such as a change in the value of the Australian dollar.

***How sensitive is fertilizer industry performance to changes in the value of the Australian dollar?***

The value of the Australian dollar against the US dollar has fallen over the last year to historically low levels. Many commentators consider that a significant appreciation (perhaps up to 20 per cent) is likely over the medium term. The impact of, say, an appreciation of the Australian dollar on the profitability of the Australian fertilizer manufacturing industry is determined by the outcome of a number of opposing forces.

- The value of agricultural exports and farm profitability will decline. This in turn can be expected to reduce demand by farmers for all fertilizers, domestically produced and imported.
- The cost of imported inputs (such as basic chemicals and rock phosphate) to domestic fertilizer manufacture will fall. This in turn will reduce domestic fertilizer manufacturing costs, encouraging their use relative to imported fertilizers.
- The cost of imported fertilizers for blending and use domestically will fall. This will encourage their use relative to domestic fertilizers.
- Australia's fertilizer exports will be more expensive, reducing their demand.

The results in the first two columns of table 4.1 show the effects of an assumed 20 per cent appreciation of the Australian dollar against foreign currency exports and imports, which are in US dollars.

The appreciation causes an export led contraction in agricultural production of between 3 per cent (sheep and wool) and 9 per cent (beef, dairy), which averages about 6 per cent for agriculture as a whole. This in turn reduces the demand by agricultural industries for fertilizers. But, because imported fertilizers are now cheaper relative to domestically produced fertilizers (even after taking into account the lower costs to domestic producers of imported inputs to fertilizer production), the contraction in domestic fertilizer production is significantly greater than the contraction in imported fertilizers. The net outcome for the domestic fertilizer industry is a contraction in value added (profits plus wages) of \$85 million.

***Effects of a 20 per cent reduction in the cost of imported fertilizers***

In this simulation (see columns three and four of table 4.1) the exchange rate is assumed constant. The reduction in the cost of imported fertilizers relative to domestically produced fertilizers can be thought of as arising through higher productivity in fertilizer manufacturing overseas or other events which reduce foreign costs of fertilizer manufacture and delivery to Australia. Lower import prices also mean lower export prices (by 20 per cent) for Australian exports of P and NP based fertilizers.

Unlike with the exchange rate appreciation, agricultural production and hence the demand by the agricultural sector for fertilizers is not directly affected. But there are two sources of adverse affects for domestic fertilizer manufacturers.

- Agricultural users switch some part of their fertilizer demands toward imports. This costs the domestic manufacturing industry production and profits.

#### 4.1 Projections of the effects of a 20 per cent appreciation of the Australian dollar and a 20 per cent decrease in the landed cost of fertilizers

Projection	20 per cent appreciation of the Australian dollar		20 per cent decrease in the landed cost of imported fertilizers	
	% change	\$m	% change	\$m
<b>Industry value added</b>				
N based fertilizers	-13.9	-5	-20.1	-7
NP and P based fertilizers	-33.8	-47	-73.5	-103
Blended fertilizers	-30.0	-33	1.5	2
<b>Industry production</b>				
<i>Fertilizers</i>				
N based	-7.1	-24	-6.2	-21
NP and P based	-10.6	-52	-15.3	-75
Blended	-6.6	-36	0.2	1
<i>Agriculture</i>				
Sheep and wool	-3.1	-103	0.0	2
Grains	-5.3	-299	0.4	25
Beef cattle	-9.0	-382	0.0	1
Dairy cattle	-9.2	-275	0.1	4
Other agriculture	-3.7	-646	0.1	12
Services to agriculture <sup>a</sup>	-3.7	-109	0.0	1
Total agriculture and forestry	-6.3	-2 050	0.1	44
<i>Mining</i>	-11.1	-4 575	0.0	-6
<b>Exports</b>				
NP and P based fertilizers	-26.3	-24	-89.8	-83
<b>Imports</b>				
<i>Fertilizers</i>				
N based	-3.6	-10	8.4	23
NP and P based	-5.4	-21	2.7	11
K	-6.4	-7	0.2	0

<sup>a</sup> Includes fertilizer spreading services.

Source: CIE economy-wide fertilizer model.

- Export demands for Australian product fall sharply. With export prices 20 per cent lower relative to production costs, the model projects a contraction in P and NP based fertilizer exports of nearly 90 per cent, which is worth \$83 million in lost export sales.

Cheaper fertilizers to domestic users through lower cost imported fertilizers means reduced agricultural production costs relative to product prices. This encourages a small expansion in agricultural production.

The overall effect of domestic fertilizer manufacturers losing market share to imports and losing export sales is a reduction in value added in the domestic manufacturing industry of \$108 million. This turns out to be more severe than in the case of a 20 per cent exchange rate appreciation, the main reason being the big reduction in export sales in the latter simulation

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