

**Australia's Chemical Industry**  
**Options for development and potential roles for Government in Australia.**

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# 1 INTRODUCTION

Some thoughts and rough working notes yyy

This study compares the extensive observations and rigorous analyses made by Michael E Porter<sup>1</sup> on the success and failures of industries and roles of governments around the world with the development of Australia's chemical industry.

The observations made by Porter of industries and countries have a common thread being the importance of competitive environment and extensive domestic competition, etc..... Based on those worldwide observations it became clear that a vital business environment is like the resonance expressed by the "ring" of a crystal glass. Crystal needs to be shaped to "ring". Rivalry and competitive pressures on business are part of what Porter refers to as a four-pointed diamond to describe the vitality of a resonant business environment.

The fundamental concept is that increased competition, while thereby also increasing business failures by increasing risk; in a flexible economy the value to the country of the successful exceeds the cost of those that failed. In many highly politicised economies, the risk of failure is weighted with the political cost. Politicians therefore tend to reduce flexibility with regional costs being made more visible than awareness of national benefits (losses). This thesis suggests government should assume the role of a custodian of the capacity to change that reinforces the concept of the diamond. It thereby promotes the externalities that flow from the relationships within the diamond.

While part of a much more complex process, the importance of resonance is illustrated by two value-adding centres in Australia – one with abundant and cheap raw material and protected by import tariffs, the other using low grade raw material without government assistance.

Four years after starting in 1961, the petrochemical complex at Altona Victoria had access to low cost ethane gas from the newly discovered Bass Strait oil and gas fields. Though becoming very profitable, with up to 100 per cent after tax returns on shareholders funds per year, it barely took advantage of its windfall. It typically exported no more than one-tenth of its output and then only with a substantial discount on the home market price. It was also protected by import tariffs of at least 30 per cent. Plans for expansion in 1979 and 1989 were abandoned and today, with three to four decades old plant, it operates at scales one-quarter of locations such as Singapore and South Korea without indigenous feedstocks available to Altona.

*In Western Australia on the Darling Scarp south of Perth, Alcoa accesses some of the most organically contaminated bauxite in the world used for alumina production. Alcoa today has the world's largest production centre there, exports all of its production not used by nearby companies, and has operated without import tariffs or other forms of assistance. Alcoa, a large multinational company, has relocated its worldwide research centre to Western Australia. Not only today one of*

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<sup>1</sup> Porter, Michael 1998, *The Competitive Advantage of Nations*, Free Press, New York.

*the world's lowest cost production centre, it has patented new technology and supplies and serviced by chemical companies.*

Thus while Altona stands alone, around Alcoa's Kwinana operation are today companies that work with Alcoa to improve its technology, using products and by-products to produce other products that are exported.

Like Japan (16.4) and other developed countries, the chemical industry in Australia was stimulated by protectionist policies but unlike their success, the Australian government failed to provide the means for improving its competitiveness. Today the irony is of an abundance of raw materials and large growing markets in Asia, the industry is just one-half of its importance of a quarter-century ago. Once 3 per cent of the economy, it is now less than one-half that and one-half the percentage of countries without Australia's natural resource base.

Its stature is signalled by press-releases and expressions of low morale and lack of confidence in the industry. The CEO of a leading chemical industry association, speaking on the subject of Status of Australian chemicals industry in 1999, opened with "Wake up! You are Dead. Wake Up Your Dead."<sup>2</sup> It is an industry subject to the "nimby-nime" stigma.<sup>3</sup>

The thrust of this thesis is to assess a new paradigm that promotes a system where for example regulations could become promote advanced competitive products, reviews roles for government regulatory agencies to be party to its development becoming aware of international trends and ensuring these are vectored into the Australian economy. Changing trends and new regulations, traditionally regarded as a threat could in fact become the impetus to exploiting opportunities.<sup>4</sup>

This thesis shows how government has a very important role at promoting the competitive environment of business. It can lead to industry clusters – largely absent in Australia. It is a role that should focus on the competitiveness that lies outside of the firms as relationships and not as generally practiced, within the firm. It is also not a matter of considering competitiveness based on just factor costs, but on the system in which the business operates.

The primary role of industry development by government would be as a facilitator of change – recognising the capacity for change, is a public good and that consequent flexibility enables the creation of national wealth. It will require changes in attitude and acceptance that change, must by necessity bring with the winners some losses. It also requires some vision to avoid the long-term consequences of a decision made in 1979 that served to undermine the potential once presented to Australia of the feedstock available from Bass Strait.

The application of this thesis is therefore aimed at providing a basis for arresting the decline in the chemical industry and promoting conditions for it to assume the significance of that in similarly developed and resourced economies. It aims to provide an alternative to the policy

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<sup>2</sup> Second Australian Chemicals Summit, Melbourne, 1999, The CEO of PACIA, a leading Australian chemical industry association, address the topic of the 'Status of the Australian chemical industry'.

<sup>3</sup> *Nimby-nime* is an acronym for 'Not in my backyard – not in mine either'. It encapsulates the emotive often-antagonistic attitudes of the public and politicians to the chemical industry.

<sup>4</sup> An example was in 1997 when there was a move to promote a PVC-free Olympic Games for Sydney in 2000. A high profile opportunity to promote a new industry in Australia to replace a plastic about which there was international concern, was taken as a threat. With only around 100 persons involved in its manufacture in Australia, CSIRO was funded to demonstrate its safety by an industry association. Australia could have evaluated alternatives with little cost and prospects of a high profile promotion event (Indeed the author was approached in Shanghai China by a MD of a PVC manufacturing business expressing relief that Australia did not 'cave into the greenies'.

vacuum created by the substantial removal of import tariffs that fostered a large part of Australia's manufacturing sector that, with its withdrawal, contributed to its overall decline.

As well demonstrated by countries without resources, competitive industries can and commonly develop. The current focus on adding value to resources misses the opportunity to develop fundamentally competitive industries.

Some key points

Steps

## **2 THESIS STEPS**

Introduction 15 pages

Current Structure of Australian industry 10 pages

History – why we haven't optimised in this industry 30 pages

Model - Porter critically analysed and applied to the chemical industry 30 pages

Comparative study of industry policies and applied to chemical industries elsewhere (Asia, Europe, USA etc) 30 pages

Policy implications for Australia 30 pages

Conclusions 20/70 pages

Define Australia's chemical industry

How it was shaped

Role of government

Status by performance

Lessons from history.

Descriptive details of industry, associations and government

Australia's operating environment and markets

Opportunities. Markets, raw materials etc

Success elements: Porter

Comparisons of current and required success elements

Shaping the industry with government

Tools available to government with analysis.

Control mechanisms.

Outcomes.

## 3 OVERVIEW - WEALTH CREATION AND COMPETITIVENESS

### 3.1 Creating wealth

Broadly put, countries maximise their standard of living by promoting conditions for high wages and premium prices for their products<sup>5</sup> on international markets. The ability to maximise their value depends on the quality and features for which the market determines a market clearing value while on the other hand the cost depends on the efficiency<sup>6</sup> by which they are supplied to the market. The difference in those values is the margin that provides for a return on investment, and wealth for the firm and the country. That margin is therefore dependent upon competitiveness as indicated by industrial productivity and signalled by trade performance.

Competitiveness is however a more complex and difficult to measure concept with indicators that are subject to many disguising influences. For example, when measured by deficits and surpluses in trade, or by changes in the share of world trade, competitiveness can be exaggerated by subsidies, protection measures, currency controls, taxation and other fiscal measures that reallocate wealth or the competitiveness between industry sectors.

To further reflect the complexity of the concept of competitiveness is that today's investor is rarely an independent organisation but one that represents or integrates into a network and clusters of industries. Business and economies have developed into more dynamic and organisationally sophisticated and complex forms of economic management than implied by the neoclassical theory of comparative advantage.<sup>7</sup> Accordingly countries such as Taiwan and Singapore have developed sophisticated chemical complexes using imported feedstocks so that Singapore can export up to 90 per cent of its production of polyolefins and, unlike Australia, never resorts to anti-dumping <<< >>> protection.

Like most large industries, the world's chemical businesses have evolved from single sites to differentiated networks and diverse organisations that now make distinctive and interdependent contributions to their competitiveness. Competitiveness increasingly depends on the management of interorganisational relationships that rely more on infrastructure than is commonly accepted. This is particularly true of the chemical industry with its complex range of products that are generally the inputs for other products so promoting large integrated complexes. On acceptance of this principle, that complexity makes the micro management as assumed by Australian state governments that often promote limited product-range projects underpinned by competitive factor costs all the more prone to failure.

Taking the scope of competition further, Porter's rationale is that competitive advantage is no longer measured simply by considering an individual business alone but in the

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<sup>5</sup> For brevity, the term *product* is used to describe goods *and* services.

<sup>6</sup> An efficient use of inputs, as measure by *productivity*, is helped by:

- Ready access to factor inputs, information, technology and support institutions.
- Effective relationships with related companies.
- The ready measurement of performance and consequent motivation for improvement.
- Better access to specialised and experienced employees that lowers recruiting costs
- Access to appropriate and competitive suppliers and service providers.

<sup>7</sup> Comparative advantage is the traditional basis for deriving competitive advantage being the benefit of access to low cost raw materials and energy, transport cost savings from being close to markets and scale of production. This advantage can be reduced by other factors such as inadequate infrastructure and relationships. See 3.2 for more details.

environment of clusters - networks of organisations that work together. It is the structure and relationships of an industry that determines its competitiveness - not merely low cost factor endowments. As shown later ( ), policy applications overwhelm fundamentals so that for example the petrochemical complex at Altona in Victoria though having access to very cheap and abundant natural gas and returning profits of around 100 per cent on shareholders funds<<footnote BRW>, has only ever been a marginal exporter and barely expanded since its formation in 1961.

The premise of Porter is therefore that wealth creation does not depend on a static point of time concept of "competitiveness" as promoted by Samuelson << Schumpeter?? and reference >>> and encapsulated in the term comparative advantage. Porter concluded the compelling evidence from around the world is that competitiveness is no longer exclusively derived from the traditional sources of comparative advantage - the input costs, scale, wages, utilities and taxes or cheap labour. So for example, cheap natural gas does not by itself promote competitive petrochemical projects as evident by the many high cost centres in Europe and Japan that have developed very competitive export-oriented operations. The observation was that businesses depend more on other related services and the effectiveness and adaptability of the industrial organisation's capacity to upgrade, innovate and adapt, than on simply the cheapness of their raw materials and energy.

Porter explains that the numerous and conflicting explanations of competitiveness illustrate that comparative advantage cannot be used to explain how countries sustain prosperity. Instead, the capacity to create wealth depends on the concept of productivity so that a high and rising level of productivity is a prerequisite to wealth creation.<sup>8</sup> Productivity promotes high levels of income by enabling countries to improve their standard of living as indicated by disposable income, leisure, health and safety, equal opportunity conditions and of environmental management.

Porter found that intense rivalry and competition<sup>9</sup> provides the incentive to improve performance and productivity while the roots of productivity lie in the national and regional environment for competition, which Porter<sup>10</sup> describes by a schematic diamond with four points or determinants (4.1). The diamond addresses the key determinants or the important influences on competitiveness including: information, incentives, competitive pressures and access to supporting firms, institutions, infrastructure and pools of insights and skills in locations that support productivity and productivity growth. Competitiveness therefore influences the extent to which a country is able to participate in foreign trade creating wealth for the country.

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<sup>8</sup> *Productivity* is defined as the value created per either: day of work, dollar invested or unit of the country's physical resource employed.

<sup>9</sup> *Competition is defined as the:*

- *Threat of new entrants. This might depend on barriers to entry including R&D, economies of scale including distribution in the home market.*
- *Threat of substitute products or services. The degree of price sensitivity, technology access.*
- *Bargaining power of suppliers. If commodity chemicals these may have little influence.*
- *Bargaining power of buyers.*
- *Rivalry of existing competitors. That may not be price but in R&D.*

<sup>10</sup> Porter, M.E. *The Competitive Advantage of Countries*, Macmillan Press Limited 1998.

### 3.1.1 Promoting trade through economic flexibility to build competitive advantage

Trade, the international exchange of goods and services, enables a country to expand its more productive industries to promote exports while allowing imports, including those produced from foreign investments, to replace the less productive activities. To maximise national wealth by participating in trade requires on-going change including losses in the weaker parts of industry. Clearly therefore, being part of an on-going adjustment process, implies that protection measures, such as import tariffs, subsidies and other forms of intervention that are aimed at weaker activities, serves only to slow the upgrading of the economy and by that improves the country's living standard. Equally a government helping achieve a trade balance, in the end only serves only to undermine the fundamentals for increasing its country's wealth. Reducing flexibility weakens the stronger parts and reduces the necessary losses among the weak. In other words, interventions in reducing flexibility reduce wealth creation. The aim therefore should be to promote international competitiveness with export-oriented firms and without implicitly promoting low wages or devaluations of the currency.

H-O-S is the Heckscher-Ohlin-Samuelson trade model, the standard model that sets out the theoretical basis for trade due to comparative advantage.

The key results are that:

1. A country will specialise in and export those commodities which use relatively intensively that factor which it has in relative abundance; (e.g. Australia tends to exports land and energy intensive goods and land is relatively abundant in Australia)
2. If, as a result of trade, the price of a good rises (and that good will be, generally, the good which uses intensively the factor in relative abundance), then return to the factor used relatively intensively will rise (and proportionately by more than the price rise); (e.g. as a result of trade, land intensive commodities prices rise - think of Aussie wine - and the return on land will increase - again, think of, say Margaret River land prices)
- 3 As a result, there is a tendency for factor incomes to equalise across countries. (e.g. Margaret River land prices are now converging on, say, Bordeaux or Napa land prices)

### 3.2 Comparing *competitive advantage* and *comparative advantage*

The classical concept of comparative advantage is underpinned by an assessment of the relative cost of input endowments such as energy, raw materials, land and financial capital to explain the patterns of investment and trade. There is growing evidence that such factor-based comparative advantage theories do not explain the basis of many successful industries as indicated by patterns of trade. While the composition of trade can sometimes be explained by a technology gap<sup>11</sup> it does not explain why such a disparity has developed and maintained against unfavourable movements of for example factor costs or the free flow and standardisation of technology. A large and growing part of world trade was observed by Porter to consist of exchanges that cannot be attributed to underlying factor advantages of the countries that export. Instead, trade often reflects arbitrary or temporary advantages

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<sup>11</sup> Wells, Louis T., Jr, ED. *The Product Life Cycle and International Trade*. Division of Research, Graduate School of Business Administration, Harvard University, Boston, 1972.

resulting from economies of scale or shifting leads in technological races.<sup>12</sup> Such temporary advantages become entrenched as competitive advantage with the development of related and supporting services.

While the failure of the factor advantage theory may in part be attributed to the greater mobility of input factors and the lowering cost of transport, Porter concluded that industry development is often due to other influences, that even included historical twists of fate. Where the traditional considerations of comparative advantage would preclude an industry's establishment and development, the result of such quirks can become an embedded source of comparative advantage.

Porter therefore introduces the broader term of competitive advantage that recognises the important role of the business environment and supporting institutions that enables the productive use and upgrading of factor inputs.<sup>13</sup> It is not signalled by a balance of trade and measured by traditional assessments of comparative advantage, but by a rising share of world exports and living standards.<sup>14</sup> In other words, international competitiveness by this concept is now not limited to countries with a favourable endowment.<sup>15</sup>

As defined by Porter, the concept of competitive advantage is more complex and dynamic than the traditional considerations and is not associated with any point of time or any static assessments of any attributes. A further divergence from the traditional assessments and expressions is that Porter observed that international advantage is often concentrated in narrowly defined industries or even segments of industry. It may even be expressed in such narrow expressions as general-purpose equipment in one country and a specialised form of the same product in another.

Porter's key conclusion is therefore that the often-claimed advantage derived from basic factor inputs such as raw materials and energy to be an ephemeral source of competitive advantage in a global economy as it can be eroded by external influences such as subsidies, shifting exchange rates, new technologies and integrated large scale production.

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<sup>12</sup> Krugman, Paul R. *Strategic Trade Policy and the New International Economics*. Krugman editor. The MIT Press, London England. 1993.

<sup>13</sup> *Factor conditions* are, in essence, what a country has to offer. Examples of these include land, raw materials such as iron ore, oil, coal, etc. The definition can be expanded to encompass human capital, and thus expanded further to incorporate the educational system and technology available to a particular country.

<sup>14</sup> Competitive advantage may be measured by the extent of:

- Exports, often to a variety of countries: and
- Outbound investment based on skills and assets created in the home country.

<sup>15</sup> Leontief, Wassily. 'Domestic Production and Foreign Trade: The American Capital Position Re-examined,' *Economica Internazionale*, Volume 7, February 1954, 3-32. This was reviewed by Hindley, Brian, and Smith, Alasdair. 'Comparative Advantage and Trade in Services' *The World Economy*, Volume 7, Number 4, December 1984, 369-390.

## 4 COMPETITIVE ADVANTAGE OF COUNTRIES

Porter concluded that companies, not countries determine international competitiveness. While countries provide the framework to advance companies, such as through technology support and regulations, these only supplement the competitive advantage created by the company. Accordingly a country's prosperity is the result of the prosperity of the individual companies within the country.

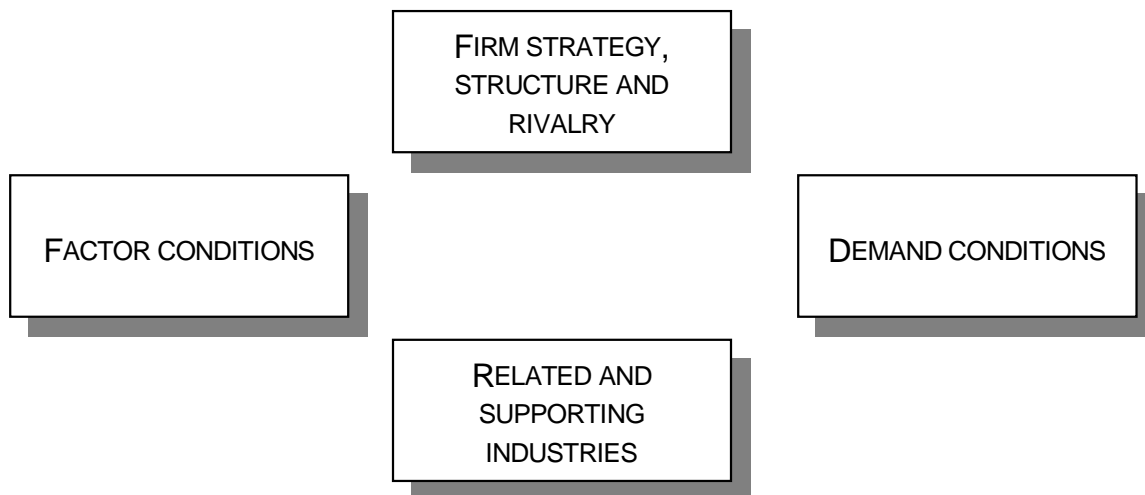
One deduction could be that if the nature of the competitive advantage can be considered for individual firms, it could be reasoned that for countries it is the sum of the competitive advantages of its constituent businesses. Porter however found the competitive advantage of individual countries is difficult to identify as the elements differ widely between industries and even segments of industry. Further, the nature of advantage may be obscured with some activities in the value chain being undertaken outside the home country through subsidiaries by foreign alliances or ownerships that contribute to the value chain.

Notwithstanding the difficulty of assessing the nature of a country's competitive advantage, Porter found all successful firms drew their source of advantage from the diamond.

<<<<National policies and impact on factors>>>

### 4.1 Determinants of advantage - the *diamond*

Porter observed that industries were successful because their home environment is the most dynamic and the most challenging, stimulating, prodding firms to upgrade and widen their advantage over time. A common feature was that all four influential determinants are required to successfully promote a location or an industry.



*Figure 1 The Diamond*

Porter refers to the key determinants as the four key points of a diamond. These determinants are; factor conditions; demand conditions; related and supporting services; and firm strategy, structure and rivalry. It is the interaction of these four determinants (4.1) of the diamond that shape an industry's competitive advantage.

### 4.1.1 Government

The extent and significance of the diamond varies between industries is influenced by the location, the culture of the operating environment (that may for example even support a dispersed industry) and the skill levels (that may be legacies of earlier activities). It is also commonly influenced by government which can either improve or undermine competitiveness with a range of influences that includes the nature of its anti-monopoly policies, regulations, investment in education and government purchasing practices (9.9).

### 4.1.2 Factor conditions - the first determinants

The factor conditions refers to the quality of the factors of production such as skilled labour, low cost materials and energy, and infrastructure. Significantly, while strong factor conditions were noted by Porter to be essential for promoting growth, competitive industries rarely used factors that were inherited or simply in abundance. Most competitive industries developed the factors to higher levels by committed investment using their own techniques.

In a static point of time model of comparative advantage, the disadvantage of inadequate basic factors is a source of disadvantage but in a dynamic competitive environment, Porter observed such shortages in fact promotes innovation to offset selective weakness and innovation to exploit strengths.<sup>16</sup> Accordingly too, while a deficiency of specialised (4.1.2.1) factors can impede the development of industry, a deficiency in basic factors such as raw materials, land or labour, creates the incentive to innovate to overcome that impediment. Further, a competitive industrial development would not have been based on exploiting abundance but on its creation; and has not developed to benefit from advantage, but from overcoming selective disadvantage. That environment of shortage is reflected in creating quality factors. So it is therefore the mechanisms for factor enhancement and the resultant quality of the factors that are more important for a country's competitiveness than simply their availability. Clearly therefore on-going investment is required to prevent factor depreciation in the face of unrelenting improvement of world standards. The selection and extent of upgrading depends on the industries, government, related and supporting industries, and the extent of rivalry between firms.<sup>17</sup> Based on that paradigm, appropriate roles for government and industry are defined.

Porter shows by example how certain countries, notably Japan (16.4) have developed advantages in their factors of production that have influenced the demand for products, their related and supporting industries, and in corporate strategy and government policy.

#### 4.1.2.1 Factor classification

Factors may be classified as being basic (generalised) or specialised (advanced).

Basic factors are those that are available to all activities, such as roads, education, communications and debt capital. Also described as generalised factors, they are important for resource development and agricultural industries where the requirement for technologies and skills simpler and widely available.

Specialised factors include skilled personnel, specific purpose infrastructure and specific knowledge bases. Also known as advanced factors, these provide more sustainable support

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<sup>16</sup> It is qualified however that the factor disadvantage must be selective to motivate and not discourage. Too much adversity can hinder development.

<sup>17</sup> Sophisticated factor-creating mechanisms connected to an industry will also attract students and firms who will learn and observe. These in turn will often provide foreign demand for a country's goods and services, as well as contributing to the existing firms' effort to make them more productive.

for competitive advantage than the basic ones, though often requiring more focused, and therefore higher risk investments. These factors were observed by Porter to have provided the most significant sources of competitive advantage enabling differentiated products that were often produced with proprietary technologies.

<<<develop by example>>>

<<<other examples>>>>

A significant observation made by Porter is that governments have generally failed to effectively develop advanced and specialised factors unless closely influenced and controlled by industry.<sup>18</sup> One conclusion is that government should focus on creating and upgrading the more basic generalised factors but allow the private sector to address those that are advanced and specialised. As described later, there are measures that include government regulations (9.9) that can stimulate a more sophisticated home market and by that promote industry to more advanced products than in other countries.

In the end however, and as with the other determinants, it is the strength of the other three determinants of the diamond that influence whether a country's firms will seek to innovate to overcome a factor disadvantage and pursue strategies for improving their competitiveness.

### 4.1.3 Demand conditions - the second determinant.

Demand in the home market is the second determinant of the diamond with consideration of growth and the nature of demand.

Porter found that a large and growing domestic demand promotes industry and its suppliers to participate and contribute to the dynamics of national advantage. In essence, strong demand stimulates specialised suppliers to enter the market to replace imports or perform previously ignored activities in a more efficient manner. In this process, the efficiency of domestic suppliers also improves with increasing domestic demand so influencing the development of related and supporting industries.

The process of upgrading is therefore helped if the domestic market also consists of sophisticated and demanding buyers that encourages industry to develop more sophisticated products helping to develop its competitive advantage. Further, if the home market provides a clearer indication of buyer needs than is available to foreign firms, it will further enhance an industry's competitive advantage.<sup>19</sup>

The quality of demand therefore helps shape the rate and the character of improvement and innovation. This enhancement influences the industry's response to foreign markets and gain market share with more sophisticated products in the home market. Generally, Porter found the quality of demand to be more important than its quantity so that a small, even absent home market has stimulated internationally competitive industries. Thus while the quantity of demand may reflect in economies of scale and other static efficiencies, its greatest influence is where it promotes change and not just more demand.

<<<too American - is it relevant to Australia. Why different??>>>>

<<<<Requires critique>>>>

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<sup>18</sup> Examples include in the USA, Switzerland and Denmark where industry has been particularly successful in linking with educational facilities.

<sup>19</sup> Sometimes a segment of domestic demand is more representative of global demand than the whole market so that some firms have become globally significant though facing only a small segment of the home market.

Also influential on the quality of demand are government, industrial users and the growth history of the market.

Government can have an important influence on the quality of market demand through the imposition of appropriate regulations and standards that create a more sophisticated market (9.9).

Industrial buyers are more demanding commonly operating with selective factor disadvantages that are passed on to their suppliers. A substantial industrial sector in the market can therefore be helpful to help upgrade and increase competitiveness.

Rapid domestic market growth helps promote innovation, while slow growth promotes a conservative industry. An early saturation of the home market was observed to stimulate innovation and factor upgrading as firms strive to continue their more recent growth trend especially if there is opportunity to supply fast growing foreign markets.

### **4.1.4 Related and supporting services - the third determinant**

Related industries stimulate the development of competitive industries by allowing for the coordination and the sharing of activities in the value chain. Such cooperation promotes improved performance and efficiencies that in turn stimulates information flows and technical interchange. There may even be a spillover benefit as their success can pull through demand for complementary products or services.

The upgrading of products is helped by cooperation with supporting and supplier industries, especially those with strong linkages and important to the development of the product.

A pool of specialised and preeminent institutions provides dynamic advantages that are more important in the long term to sustain advantage than any static assessment of factor costs or the presence of a large domestic market. Such supporting services includes educational institutions, testing services and research facilities that can assist with the development of innovative products. Local supplier industries on the other hand can create products and services customised to the industry that may be sufficiently specialised to promote the establishment of specialist divisions to serve the industry. The existence of such related and supporting services tends to benefit local firms far more than foreign competitors, hence substantially promote national competitive advantage, providing an important impediment to the establishment of foreign competitors.

<<<supplier links with firms>>>><<<Japan illustrated>>>>

A group of aggressive competing suppliers were observed to be one of the most effective influences on the enhanced development of related and supporting industries while again those in the home market being more influential in promoting the upgrading and longer-term profitability than a foreign rival.

Equally, for the suppliers, the presence of competing customers in the home market reduces the risk of selling and reduces the bargaining power of any individual buyer. The presence of multiple customers therefore served to encourage the entry of more supplier industries in turn stimulating more investment and specialisation of services.

### **4.1.5 Firm strategy, structure, and rivalry - the fourth determinant**

The manner in which an industry is created, organised and managed and the nature of domestic rivalry were repeatedly seen by Porter to be the most important influences on the development of competitive advantage. Domestic rivalry too was always superior to that provided by a foreign competitor, whether in the home or foreign markets. Providing for longer-term profitability, competition stimulates a more sustained competitive advantage while the resultant presence in foreign countries helps transfer global characteristics to the home industry further strengthening international competitive advantage. Overall,

competition was observed to provide more important sources of advantage than any consequent economies of scale from consolidating competing firms through mergers and acquisitions (9.10.1). Rivalry not only serves to promote an internationally oriented industry that supports innovation and upgrading, but the resultant momentum promotes spills outside the firm with wider benefits to other industry and the country.<sup>20</sup> Domestic rivalry has also promoted other benefits such as the development of new products, the exploiting of new market segments, and industry restructuring to achieve increased efficiency former employees.

Porter in the end concluded that where a country is successful with an industry, it is rare if there had not been domestic rivalry. Rivalry may therefore be described as a national asset that should be actively supported by government as guardian of this public good. <<<Complex policy implications>>>

Porter observed however that there are significant variations in corporate strategies between countries that have been optimised to reflect local influences such as the nature of the local culture, factors of production, the products and markets. Others, include attitudes to authority, social norms, group behaviour, professional standards, types of company ownership, taxation and the nature of incentive-based management remuneration.<sup>21</sup>

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<sup>20</sup> Porter identifies another benefit of rivalry from many firms - it provides a restraint against government intervention (that serves to stifle innovation or dulls competition).

<sup>21</sup> Low worker mobility is an important influence in Italy creating commitment to the success of the regional business. Industries where there was the greatest commitment to the business, often also provided greatest competitive advantage.

## 5 THE DEVELOPMENT OF COUNTRIES

At a national level, the overall competitive advantage of a country is made sustainable by the widening and the upgrading of its sources of advantage. Countries are thereby either advancing or falling behind others - remaining stagnant observed to be rare. Their progress is influenced by their willingness to allow imports to replace less efficiently produced goods promoting and increasing exports from advanced industries. In other words, upgrading requires the loss of price-sensitive segments of industry that use less sophisticated skills and technology. Such dynamics implies a reduced sensitivity to losses especially so in politically sensitive electorates that is difficult to achieve in a highly politicised country like Australia, with extensive regional interests inevitably biased to labour-intensive, especially low-paying activities.

However, even with such inevitable sensitivity that reflects in moves to reduce industrial flexibility, government can introduce offsetting measures (8.2). It can influence declining rivalry, lagging factor creation, declining motivation and the reduced quality of demand. Nevertheless, if government policies do not accept and adapt to the progress of their economy, they undermine the fuller potential of the country. Porter noted that as a country's rate of progress is often constrained by its weakest link, the effect of protection by government may not be capable of compensation by its other endeavours to improve factor conditions.

Figure 2 describes some factor conditions necessary to advance an economy.

Factor creating mechanisms	Mechanisms for creating and upgrading.
Motivation	Motivated personnel with visible rewards for effort and ideas.
Domestic rivalry	Vigorous rivalry among domestic competitors in a wide range of industries.
Upgrading demand	Upgrading the quality of demand creates potential for more advanced industries and the stimulation of new ones.
Selective factor disadvantages	Disadvantages in some factors provide incentives to upgrade and innovate.
Capacity for new business formation	New business promotes rivalry and stimulus to promote new industry segments and clusters.

Figure 2 Factor conditions required promoting development to a more advanced stage.

The development phases can be considered by national stages <<and by product lifecycles??>>>>.

### 5.1 The four stages of development

Porter suggests countries and industries may pass through four stages of development. Though it is not inevitable that they pass through each, a country moves through them because of events that create the potential for higher-order competitive advantages. These are then reinforced by industry with the incentive to systematically upgrade the diamond. The following table highlights the key stages as described in the following sections.

	Factor Driven (5.1.1)
Three stages of advancement	Investment driven (5.1.1.2)
	Innovation driven (5.1.1.3)
The decline stage	Wealth driven (5.1.1.4)

*Figure 3 Stages of development*

### 5.1.1 Stage 1 - Factor driven

Stage 1 in the development of a country derives its competitive advantage from the basic factors (4.1.2.1) of production so industries develop based on simple comparative advantage. Nearly all developing countries and a few prosperous countries with abundant resources are at this stage of development.

Multinational firms will establish subsidiaries in Stage 1 countries as distribution outlets or to take advantage of low factor costs as complementary components to their value chain. It is rarely in their interest to establish major centres to produce sophisticated goods or conduct core R&D. Consequently their senior management is often drawn from their parent company while lower level management while more likely to be indigenous, will be selected only on their cost and production management skills with little or no value on export market development or international competition. Focussed on technical efficiency, multinationals will therefore implicitly limit the development of a domestic pool of senior management with the required skills to help domestic industry compete internationally.

To further disadvantage factor-driven economies, is that multinationals are prone to relocate with any resultant unfavourable shifts in wages, factor costs or industry protection with development. In contrast, indigenous firms while growing slower and more prone to failure are more loyal to the country as their home base. Indigenous firms are more likely to stimulate the creation and upgrading of specialised factors and promote the basic factor cost sensitive activities being shifted abroad to raise national productivity. Porter therefore concludes that a development strategy based solely on foreign multinationals may doom a (developing) country to remaining a factor-driven economy.

Porter concluded that most countries do not advance from this stage by failing to develop other competitive advantages. Their governments often attempt to promote a progression to the next stage of development by protecting the home market to stimulate local industry but in the end however, such protection was observed to nearly always reduce national productivity because of the consequent misallocation of factor resources.

#### 5.1.1.1 Status of the four determinants

The status of the four determinants of competitive advantage (4.1) during Stage 1 may be described as follows.

##### *Factor conditions*

The basic factors of land, natural resources, climate or availability of semi-skilled labour underpins Stage 1 development. Technology is inexpensive and widely sourced from other countries, with the more advanced forms available through passive investments in turnkey plants<sup>22</sup> that have been provided by foreign firms or by original equipment manufacturers arrangements with local producers.

##### *Demand conditions*

Local demand is often limited with foreign firms providing access to foreign markets. At this stage, the country is sensitive to world economic cycles and exchange rates that control

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<sup>22</sup> 'Turnkey plants' are where the owner takes delivery of the completed fully commissioned and operational project with the technology supplied under contract. (Requiring only a 'turn of the key' to begin.)

international demand and relative prices. At this stage too, the country is particularly vulnerable to declining competitiveness from inadequate growth in productivity.

### *Firm strategy, structure and rivalry*

There is generally limited competition between firms in the home market so that innovation and adaptation is not promoted.

### *Related and supporting industries*

Related and support industries are inadequate or non-existent unless promoted by government through industry protection measures.

#### **5.1.1.1 The role of government in Stage 1**

Broader industrial development policies are more fully described (8).

Clearly the key objective for government should be to free the economy from the restrictions and volatilities of a basic factor-based economy and promote its advancement to the next stage of development. Porter noted governments commonly promoted industries with only basic factor advantages including for import substitution using industry assistance and protection measures. Confining the country not only remaining vulnerable to volatile commodity-based products, but also to seeking government support including by guaranteed and protected markets that is counter productive to the long-term development of competitive industry. Porter therefore concluded that countries without abundant natural resources have an advantage in economic development by avoiding the temptation of relying on them.

The policy implications for governments in Stage 1 should therefore be to stimulate the competitive advantage of indigenous firms and the development of clusters. To achieve this broad aim, government promote the following:

Investments based on factor cost advantages to be complemented by local activities that have at least one competitive determinant or use cost sensitive factors capable of being upgraded to international competitiveness. Multinational firms that invest based on cost factors, should be encouraged to invest in industry sectors related to the country's existing firms.

Indigenous firms that complement major factor cost driven investments to be encouraged to acquire relevant technology and skills and gain direct access to foreign markets - even as multinational companies competing with the original investors.

Stimulate competition with more than one multinational to establish in an industry sector and, by that, supporting and related industries.

Investment with products using their own international brand names associated with the country of manufacture to create international awareness of the country and by that promote other local industries. <<<Tiwest>>>.

<<<<more details required>>>

#### **5.1.1.2 Stage 2 - Investment driven (technology enhancement)**

This stage is differentiated from the factor driven Stage 1 by the country now having the capacity to absorb and improve technology with a growing skill base. At Stage 2, firms begin to invest and construct modern, efficient and often large-scale facilities using the best technology available from other countries. The competitive advantage is then derived from scale, low cost labour and raw materials.

According to Porter, only a few countries successfully develop from a factor-driven Stage 1 for want of adequate domestic rivalry, adequate skills, innovation, indigenous firms capable

of upgrading their technologies and processes and lacking effective international marketing channels.

The four determinants at Stage 2 may be described as follows.

### *Factor conditions*

Like at Stage 1, basic factors still underpin the economy but their quality is being improved using skilled low wage technical personnel operating sophisticated facilities. Technology, while still imported from other countries through licenses and joint ventures, is now often near state of the art (first generation).<sup>23</sup> It is also being improved using skills developed within the country even though still being applied with only limited innovation.

### *Demand Conditions*

Firms still compete in the standardised, price-sensitive commodity segments of the market with a low service content based on readily transferable technology and subject to extensive international competition. While design is commonly still in response to the needs of foreign buyers though the employed technology, that reflects the incentives for investment, may now be far more advanced than in competing countries.

Home demand remains unsophisticated though marketing channels are being developed in foreign countries.

The competitive advantage at this stage may be summarised as being more supply-push factor cost driven, than demand-pull as evident at Stage 3 while there are more sophisticated markets.

### *Firm strategy, structure and rivalry*

The range of industries is beginning to broaden, entry barriers are being increased and successful firms are stimulating new industries.

Domestic rivalry is promoting more investment aimed at reducing costs and differentiating products. Product differentiation has begun as firms compete internationally as risk takers in response to growing competition.

### *Related and supporting industries*

Specialised educational facilities are being established and focussed with the potential to reinforce the trend to refine foreign technology still being used by industry.

#### **5.1.1.2.1 The role of government in stage 2**

Broader industrial development policies are more fully described (8).

The role for government should be to promote the difficult transition from Stage 1 by facilitating a national consensus favouring investment and long-term growth over current income distribution. During this transition and to confirm the foundation of Stage 2, government may need to steer the development of industry. In contrast with the indirect role required in Stage 3 (5.1.1.3), government may need to provide temporary assistance to reduce risk, improve the efficiency of infrastructure, acquire foreign technology, promote exports<sup>24</sup>, guide capital and develop sophisticated educational facilities (8.2.3). <<<infrastructure versus assistance>>. <<Role of trade associations>>

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<sup>23</sup> Technology is usually one generation old, as the owners are reluctant to sell the latest generation.

<sup>24</sup> Export promotion policy that favours some sectors will serve to bid up the cost of factors reducing the competitiveness of other sectors. Without a clear strategy and consideration of outcomes, a selective export program can be counterproductive.

This stage requires a sustained government commitment to promote the enrichment of relevant factors and the preconditions for the competitive upgrading to Stage 3. A common difficulty encountered by government, especially heavily governed countries like Australia, are regional interests that work against the national interest. Secular interests will often seek benefits from government and oppose the reduction of the assistance and protection status that may have been provided to promote this stage.

<<<technical innovation - how to promote and how to facilitate??>>

### 5.1.1.3 Stage 3 - Innovation driven

<<<<Give examples of each stage of developments. Also talk about product lifecycle>>>>Timbrol halocarbons. ICI and PVC?

At Stage 3, all four determinants of the diamond have become fully functional and interacting with firms beginning to innovate to create new technologies and methods. World-leading products, process technologies, and innovative marketing have become common and now stimulate other industries. With industry rationalisation, imports are satisfying the demand for price sensitive intermediates and products from less sophisticated industry segments. Basic products, earlier in the production chain and sensitive to price are sold to other industries for further processing, have closed or moved offshore. With increasing sophistication of its products sold more on performance than price and with less competition from the more volatile basic commodity products, the country has become less sensitive to macroeconomic fluctuations and exogenous events.

The four determinants may now be described as follows.

#### *Factor conditions*

Competitive advantage based on factor costs has become less common as innovation is now being stimulated to circumvent factor cost disadvantages that results in more advanced products and process technologies.

#### *Demand conditions*

Consumer demand is increasingly sophisticated with rising incomes and education levels seeking convenience, and goods and services that are more sophisticated. This trend is especially noticeable in the industrial sector that requires increasingly sophisticated services for engineering, marketing and testing.

#### *Firm strategy, structure and rivalry*

Industry has been restructuring away from the production of basic price-sensitive goods and to reduce costs, foreign suppliers and subsidiaries are supplying parts of the value chain, especially those with basic factor advantages. There is growing vertical integration with end-product industries integrating with suppliers. Clusters (14) have been developed and promoting others with spillovers that is promoting increasing integration.

Firms are beginning to market globally while operating against widespread domestic rivalry including from new entrants. They may now even have their own brands with international marketing and servicing networks.

#### *Related and supporting industries*

There is growth in well-developed support industries helped by sophisticated universities, research facilities and infrastructure.

### 5.1.1.3.1 The role of government in Stage 3

Broader industrial development policies are more fully described (8).

Government should by now be assuming a role of facilitating more than directing the development of industry, and less concerned about intervention, such as the allocation of capital, industry protection, export subsidies and other forms of direct intervention. It now operates indirectly to stimulate factors that are more advanced and improving the quality of domestic demand, new business formation and promoting domestic rivalry. The initiatives to define and promote relevant skills and resources are now largely provided by the private sector. It now guides the creation and enhancement of key factors of production. A role for government would be as facilitator of change, provider of information and opinion of experts such as provided by the Japanese agency MITI (16.4).

### 5.1.1.4 Stage 4 - Wealth driven

Accumulated wealth has become the driving force, rather than vigorous competition that had motivated the country through the previous three stages of development. It is the result from the reward of wealth from the dynamic process of the upgrading of national advantage through Stage 3. During this transition, the losses of the less productive segments of industry have been extended to now include losses in productive segments.

During this stage, the economy continues to narrow in its range of products but it has lost its competitive advantage not only in basic industries, but also now in final product components that is leading to more losses notably producers of more elaborately manufactured goods. Services now represent an increasing share of national income as the country becomes a “service based” economy. Depending on whether there are labour force rigidities and the extent of the welfare system, there may now be growing unemployment.

There is increasing pressure for industry protection as firms are now of such size to be able to lobby government to insulate them from competitive forces. Reflecting the value of lobbying and their public image, senior management now has the character of stewards rather than of the entrepreneurs characterising the previous stages of industry development. Operations are focussed on “formulae for success” rather than on innovation.

While outbound foreign investment continues to increase, it is now aimed more at neutral investments that do not contribute to the competitive diamond and improve the competitiveness of home-base industries. Such investments include in manufacturing with foreign management and others for “good returns”.

The four determinants of competitive advantage may now be summarised as follows.

#### *Factor conditions*

Factor creation has declined with chronic under-investment and with growing emphasis on financial assets. With falling incomes for work in industry and losses of skilled personnel, education reflects the growth of services and favours the soft options including arts, finance and law. In-bound investment is now attracted by low wages.

#### *Demand conditions*

Firms begin to compete on price and practice downsizing to remain competitive. Defensive roles are assumed and they will pursue government for assistance and industry protection.

#### *Firm strategy, structure and rivalry*

There is now less motivation for innovation with pressure to comply with norms and accepted standards. With growing inflexibility in management-labour relations, prospects for productivity improvement are reduced.

Instead of new investment in capital and in wealth creation, firms now pursue mergers and acquisitions without creating new business or enhancing their competitive advantage. Innovation slows and there is an emphasis on cash flow rather than on growth.

Foreign firms increase their presence in the country as subsidiaries to acquire parts of their value chain in domestic industries have been attracted by low labour and capital costs.

The industries begin to reduce their product range to those:

- Related to sophisticated demand, responding to accumulated wealth.
- With strong brand loyalty or with little change in technology.
- Relying on basic factor advantages or on inherited wealth.
- Related to supporting industries.

Generally clusters begin to disintegrate with the possible exception of those related to financial and legal services that are faster growing components of the economy.

### 5.1.1.4.1 The role of government in Stage 4

Broader industrial development policies are more fully described (8).

To attract investment in depressed regions, regardless of whether the conditions are favourable to the diamond, government will often attempt programs of funded industry research, regional policies and subsidies and other forms of assistance. However, Porter observed that endeavours by governments generally failed to advance industry.

### 5.1.1.5 Decline phase

In the absence of some of the precursors required for industry development (4.1), most countries do not progress beyond the factor-driven Stage 1. However where resource abundance is great enough, a country may move directly from a factor-driven Stage 1 to the wealth-driven Stage 4. Diminishing competition, adversarial labour-management and industry protection aimed at resisting the decline often ensures an eventual decline. Some countries in the wealth-driven Stage 4 may deteriorate to a factor-driven Stage 1 competing on price and attracting investment on factor costs though continuing their decline. Only in rare instances do policy changes, major discontinuities or shifts in social values arrest the economic decline. For the majority of countries that fail to progress from Stage 1, there is the prospect of a depletion of their natural resource base, their reduced value from changes in demand and technology, or reduced with competition from more competitive suppliers. <<<This is too simplistic. See Mancur Olsen>>

### 5.1.2 Transition through development stages

The transition through each stage of economic development is generally by capable management of industry and an appropriate participation of government. However good fortune, including exchange rate fluctuations, wars and shifts in factor prices were observed by Porter to also stimulate and motivate to exploit opportunities. Other stimulatory influences observed include the country's history that shaped a relevant skills base, prevailing values, norms of behaviour, needs, tastes, demand patterns and challenges.

While the rate, nature and priorities will differ between countries and their stage of development, resource-rich countries will normally attempt to upgrade from a resources dependent economy to one based on more sophisticated goods; while the resource-poor countries will attempt to begin development with labour-intensive goods. Both would benefit from a broadening of their economy.

For the majority of successful countries, Porter observed that at some time of their development, all had endured severe setbacks and adversity. The most rapid upgrading and the most significant economic advances were observed in countries with the greatest labour

shortages, sharpest wage increases, the highest energy costs and the fewest natural resources. Porter attributed a country's failure to develop to a failure of government policies to respond to the country's shifting competitive position.

## 6 COMPETITIVE ADVANTAGE OF FIRMS

Broadly put, firms create value for their customers by performing activities in an interdependent system or network of value activities whose collective cost determines the firm's competitiveness. For a competitive advantage, a firm either must perform those linked activities more efficiently or create a superior value for buyers than its competitors. The careful management of those activities requires skills to optimise the output to gain a decisive source of competitive advantage by cost or value. Thereby responding to the market and resources available to it, a firm will develop a strategy to guide its performance and to structure its value chain. The incentive for improving the competitive advantage is therefore provided by challenge and adversity - rarely according to Porter, from an easy life. Firms will succeed in an industry because these incentives and challenges of adversity are juxtaposed with particular advantages.

### 6.1 Sources of advantage for firms

Relationships and the competitiveness of firms are influenced by the four determinants of the diamond (4.1). The components of these influences, as the sources of advantage for a firm includes internal and external economies of scale<sup>25</sup>, cumulative learning, brand name recognition, customer relations, distribution channels, best locations, best sources of raw materials and technologies. These may be classified as low or high level sources of advantage.

*Low levels* of advantages are labour costs, cheap raw materials or other single factors that provide the competitive advantage that may be readily reduced and even nullified by competitors. For many of these activities, competitors can duplicate these low levels of advantage with alternative sources of materials, by locating in lower labour cost countries or with larger investments that provide economies of scale perhaps helped by new technologies or manufacturing methods.

*Higher level* sources of advantage are more difficult to imitate by competitors as these are derived from proprietary process technologies; product differentiation based on brand reputation; and customer relationships. Protection from competition is provided by the high costs that would be incurred by switching or gaining customers. Such sources of competitive advantage require skills and capabilities that are more advanced including close relationships with customers. They are normally derived from cumulative investment in facilities, learning, research, and marketing and so include intangible assets such as reputation, customer relationships and specialised knowledge. Clearly, the most durable advantage has a dynamic and changing character that promotes increasingly higher levels of productivity so as to represent a moving target for competitors. Other sources of advantage are management styles (6.1.2), location (6.1.3), technology (6.1.4) and innovation (6.1.5).

Porter summarised the ways a company could attain and keep a competitive advantage in an industry with four features:

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<sup>25</sup> *Economies of scale* allow fewer resources being used per unit of output as represented by a downward sloping average production cost curve with increased production, clearly important for commodity, raw material-intensive products such as petrochemicals. Economies that are internal to the firm including through its subsidiaries in overseas countries, are largely related to the scale of its operation. External economies from its relations with other firms, as recognised by the *clusters* (14) concept, are longer lasting and can provide more significant long term advantages. This raises an important implication for policies that where the economies of scale are external to the firm, but internal to the industry, the firm's marginal cost of production exceeds the industry's marginal cost. The competitive industry will produce less than the socially optimally level of output. This would imply a reason to assist production by the firm (eg. by a production or export subsidy) to correct for the distortion created by external economies.

- Always promoting improvement, innovation and change. Firms that remain static and do not develop new products or enhance existing products will be surpassed.
- To involve the entire chain of activities involved in a product's creation and use (value system), including suppliers, channels and buyers. New methods of business organisation such as new marketing or distribution techniques must be adopted to remain competitive.
- Companies must constantly seek to improve in all facets, because a competitive advantage can be overtaken. This includes investing in factor creation through the companies' own training and research as well as decreasing turnover by stimulating innovation and change from its employees.
- A global approach to strategy that exploits both the company's home-base advantages and foreign advantages.

<<Examples>>>>.

### 6.1.1 Clusters – providing external economies of scale

A cluster (14) is the combined assets of a group of firms that serve to reduce transaction costs, boost efficiency and improve incentives. Included in those assets are elements of information, specialised institutions, relations and even the firm's reputation. These provide benefits helping growth and productivity that sometimes override the traditional comparative advantage based analyses of factor costs (3.2) that stress the importance of locating near raw material sources or markets. The importance of clusters is such that firms in clusters may even contribute to improving their operating environment thereby enhancing the clusters in which they are involved. Many businesses were observed by Porter to have succeeded where an assessment of their comparative advantage would have predicted otherwise.

The success elements vary between similar industries in different locations. Economic structures, societal values and culture, supporting institutions and even their origins can substantially contribute to their influence on the success of industries. Consequently even the same industries in different countries have been observed to use unique strategies to achieve success. Porter found the role of the home country<sup>26</sup> is increasingly important in shaping businesses and their prospects for success and that reducing communication and transport costs in fact only served to reinforce the importance of proximity (14.2.1).

The benefits of clusters are often so substantial that if the fundamental core source of competitiveness is difficult to access in the region or even in the home country, firms may locate their subsidiaries or parts of their value chain elsewhere to capture it. Clusters therefore provide economies of scale external to the firms.

### 6.1.2 Management styles

Management provides a very important source of competitive advantage with styles that varies between industries, countries and the stage (5.1) of industry development. Porter additionally considers that competitive advantage requires a mindset not present in many companies and may require unnatural acts to promote innovation. As stability, and not change is valued in most companies, protecting old ideas and techniques may become a

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<sup>26</sup> The *home country* is where the essential competitive advantages of the business are created and sustained. It is where a firm's strategy is set and the core product and process technology are created and maintained while other activities may be carried out in other countries.

preoccupation of management. Consequently successful firms are often outsiders operating in supportive environments, that are unencumbered by conventional wisdom.

Further while innovation is in response to competition and challenge, appropriate management styles for meeting those conditions may have to be created that includes developing a culture of seeking and not avoiding such challenges and promoting challenge as important sources of competitive advantage.

National priorities and prestige too have been seen to be important to reinforce and sustain competitiveness while management, that stimulates clear corporate communications with a corporate ego to excel, helps develop and promotes an adaptive organisation.<sup>27</sup>

<<<<Amplify>>>> Abstract human capital. Nature of management in static industry. What shapes industry management. PACIA structure. What sort of management matters. Kemcor's Fairley Summit speech.

### 6.1.3 Location

Porter concludes that the location of an industry is often a stroke of history, while whether it is concentrated in clusters or dispersed depends on the activity and sometimes influenced by government (refer also Clusters location 14.2.1). <<<Krugman on location>>>.

Performance in the home base was often found by Porter to be critical to their international success and where strategy is determined, where the proprietary skills reside and where product and process development takes place. Firms supplement the advantages of the home country as a platform for activities in foreign countries. Unless they represent distinct businesses, even global firms have a single well-defined home base located within a diamond (4.1). Its importance is such that a home base is sometimes relocated to capture international advantage, not for administrative convenience, but to take advantage from the most favourable diamond.

Location disadvantages can also be overcome by alliances and subsidiaries that divide the value chain on a worldwide basis that can help economies of scale, access to local markets, and distribute the risk. However, if these are developed simply in response to a perceived risk, these only serve to reduce competition and competitive advantage (9.10.1). As global companies, firms may distribute their activities according to regional factor advantages, including from R&D, specialised local skills and relationships with specialised customers. Also very valuable is that with a global perspective, firms can identify trends before becoming apparent in the home market, so while the advantage of the home base helps their penetration into foreign markets, the international experience in turn helps their performance at home.

### 6.1.4 Technology

Firms may overcome the operating cost penalties from scarce or uncompetitive factors by developing technologies that enable new processes, lower production costs, or new products for new markets. In recognition of its importance, international firms commonly locate their subsidiaries to benefit from an important technological factor.

<<Alcoa and WA's low grade alumina>>> However while technology often provides factor-intensive industries a beginning to overcome a factor disadvantage, they may also lose that advantage by failing to adequately upgrade, by innovation that original source of advantage.

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<sup>27</sup> Porter observed that national passions translate into internationally competitive industries *with striking regularity*. <<<<NZ rugby>>>>

### 6.1.5 Innovation

A tough domestic industry structure or an unfavourable short-term influence, such as an energy shortage was commonly observed by Porter to promote internationally competitive firms. Such adverse influences were observed to have promoted an innovative culture with skills in perceiving new and better ways to compete; knowledge in specialised production and flexibility in assets or management. The expressions of adversity have enabled different processing techniques and even simply the ability to produce new products or services. Such incentives to innovate are perceived to be so important that Porter proposes the use of progressive regulations and standards (9.9) by government to stimulate their creation.

There is usually a substantial degree of interdependence between a particular technological change and prior development in the same technology and complementary activities in related technologies.<sup>28</sup> Successful innovation therefore normally occurs where a firm is related to a range of past and contemporary technologies related to their R&D efforts.

Porter notes there are often risks of developments that discourage innovation. Notable is corporate specialisation in response to increased competition that then serves to insulate a firm from the knowledge required to change and adapt. Another disincentive to innovation is simply the success of past strategies. As formulae for success, these can become entrenched in the culture, organisational structure and the reputation of a firm. Such formulae may be inconsistent with the flexibility required to remain competitive in an increasingly rapidly changing environment with implications on the need for an effective flexible corporate structure. In the end however, it is the absence or presence of a competitive environment that drives innovation, productivity and competitiveness.

<<<requires expansion>>>

#### 6.1.5.1 Promoters of innovation

Innovation is promoted by developments that promote change including some of the following.

*New technologies- management culture and education facilities*

Competitive advantage is created by responding to changes including the development of new technologies that requires an effective and receptive management culture to promote the necessary innovation.<sup>29</sup> Clearly too, as personnel and relevant support is required, educational facilities with the best skills should be identified not only to help with product development and provide highest quality personnel.

*Monitoring small competitors.- being more perceptive and flexible.*

The activities of small competitors can provide important signals of change as these are likely to be more perceptive to opportunities in markets, application of technologies and employ unconventional strategies.

*Shifting buyer needs – close cooperation of marketing and R&D personnel.*

Changing preferences, reflecting changing affluence, lifestyles and attitudes, can create important opportunities for the development of new products. Effective cooperation of marketing personnel with their firm's R&D division and with the firm's customers and

<sup>28</sup> For example, Richard Nelson, 'Policies in Support of High-Technology Industries', mimeo, 1984, and Richard Nelson (ed.), 'Government Support of Technical Progress: A Cross-Industry Analysis', Pergamon Press, New York 1982.

<sup>29</sup> Firms specialising, notably on marketing, can sometimes fail to recognise important technological changes that can influence their competitiveness.

suppliers, especially those with demanding and sophisticated needs, promotes innovative development and competitiveness.

### *Related industries – developing relations with progressive suppliers and customers*

Industries which are related can help innovation aimed at upgrading of products that is stimulated by sophisticated and demanding buyers, suppliers or customers.

### *Shifts in factor costs – importance of monitoring.*

Changing factor costs, such as raw materials, transport and packaging, and influences on factor costs such as energy and exchange rates, requires on-going optimisation of the components and relationships in the firm's value chain. This may include new ways of manufacturing, alternative management structures, locations or business structures. The trends and influences on factor costs should therefore be monitored and projected to identify strategies aimed at their minimisation in impact or for developing strategies to maximise competitive advantage.

### *Government regulations – monitoring overseas trends .*

Rigorous standards serve to stimulate the upgrading of products and processes with examples around the world where these have promoted advanced products and international competitiveness. Included are new product standards, environmental regulations, trade barriers, regulations on manufacture, employment and distribution. Given their impact on product development, government should monitor countries with more advanced regulations and promote their adoption to at least comparable standards.

### *Employee attitudes – promoting an innovative culture.*

The regular training and the introduction of “outsiders” in management can help identify and exploit opportunities. While personal commitment and innovation is encouraged in employees by being regarded as permanent while emphasising productivity.

<<<Tease out. Alignment of incentives. Principal agent theory. Management styles. HR management style. Differentiation>>>>

## **6.2 Changing competitiveness**

The nature of the competitive advantage of an industry is rarely evident at the time of its beginning and there is often only a single determinant of the diamond that provided the initial impetus. Even chance can play a key role in the establishment of a business without a competitive determinant playing an important role. <<<see Krugman>>> Once well established, the business may attract competitors creating or reinforcing the development of other determinants to form a cluster that helps underpin the industry's long-term success. In time, it may extend to the development of a more sophisticated home market that helps accumulate and accentuate those advantages. While a large home market is not even always necessary for some highly competitive industries, an important issue is the ability to sustain the competitive advantages of a firm.

### **6.2.1 Initiating competitive investment**

Porter variously observed that competitive advantage seems to be initiated not by an underlying national characteristic or the static advantages of large-scale production, but from knowledge generated by firms through R&D and experience.<sup>30</sup> Whether as a result an

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<sup>30</sup> Including Krugman, Paul R. *Strategic Trade Policy and the New International Economics*. Krugman editor. The MIT Press, London England. 1993.

investment develops depends on if there is adequate infrastructure and support to complement the more tangible and easy to quantify input factors as the traditional sources of comparative advantage. Increasingly today, the absence of local knowledge and relationships undermines such factor-based assessments of competitiveness. Investment is increasingly flowing to where the traditional factor inputs are used more innovatively and productively in well-developed quality business environments. Porter found the current pool of factors to be less important for industry than the presence of sources of factor creation. <<<Schumpeter factor creation>>>Accordingly, today's industries must constantly adapt to change; with their competitiveness being their ability to match their rivals' ability to change. It requires the firm to be sensitive to incentives and its management that promotes competitiveness within the corporate culture and a system that is capable of adapting and changing.

Innovation that expresses change (6.1.5), is therefore especially important as it can promote the introduction of sophisticated methods and advanced technologies and is very important at the beginnings of a business and a strong influence on competitiveness. It is also helped by the close proximity of relevant institutions and businesses groupings, referred to as clusters (14).

The nature of an industry's competitive advantage is rarely evident at the time of its establishment; with only a single determinant in the diamond often having provided the incentive for its beginning. It is often created around one firm, with even chance sometimes playing a key role.<<<see Krugman>>> Once established however, the founding business attracts competitors that create or reinforce the development of the other determinants to form a cluster that will help the industry's competitiveness and long-term success. In time, the new business may help the development of a more sophisticated home market further accumulating and accentuating those advantages. As Porter observed, a large home market is not even always necessary for a competitive industry though the key issue is the ability to sustain the competitive advantage.

Accordingly, a foreign firm may attempt to establish a subsidiary in the country but it would need to replicate the determinants of competitiveness of the diamond - to take it from being just a subsidiary to a worldwide business centre. The diamond is however difficult and costly to replicate especially when reinforced by the more sophisticated determinant advantages including advanced buyers in the home market, an improving pool of technical knowledge, skilled personnel, economies of scale, brand reputation and an established global network. To overcome disadvantages in the home market on the other hand, a firm may replace parts of its value chain in the home country from other countries to offset any disadvantages. If such substitution occurs, it is fundamental for its long-term survival in the home market that its core, which develops its strategy or technology, remains in the home country.

### 6.2.2 Losing advantage

Broadly, competitive advantage declines when the determinants in its diamond are eroded to no longer stimulate investment and innovation. The source may be internal from a perception of management that the industry no longer needs to change or invest or, as commonly happens, it is simply the inability to modify the assets and skills base to adapt to new conditions. Such decline of advantage is therefore not only often self-perpetuating, but also reinforcing with the degrading of important relationships. Though industry may ultimately shrink to the least exposed segment, Porter noted that once the loss of advantage has gathered momentum, recovery is exceedingly rare. Attempts by government to revitalise industry generally failed for not effectively addressing the determinants of competitive advantage as the actual, though less visible causes for decline.

There are many ways competitive advantage is lost. Expressed as a loss of industry segments from product lifecycle changes and inability to change to accommodate the

necessary changes to adapt to changing technology or demand that driving the change. Some examples are described.

*Deteriorating factor conditions.* Common sources of reduced competitive advantage include: loss of skills including from supporting institutions, and the rising cost of factors without innovation to more advanced segments of industry. Appropriate innovation in other segments as part of the normal development would normally replace such losses unless hindered by industry protection measures and subsidies to industry. Porter concluded such support for weak industry only serves to create resistance to change and adaptation that in the end further weakens competitiveness.

<<<rent seeking behaviour of professional and industry associations>>>

*Local demand is different to foreign demand.* The character of local demand may diverge from that in other countries. Contributing to this variance may be unusual local regulations (such as controls on energy); failure to deregulate industries in keeping with those in other countries; low buyer sophistication; and barriers to international trade. Such variations provide disincentives to develop products for international markets and invariably reducing sources of competitiveness.

*Technological change.* New technology may develop that erodes the initial advantage that now requires skills and support that are inaccessible or uncompetitively supplied.

Narrow focussed corporate goals. The rate of investment in some of the determinants of competitive advantage (such as R&D, information and skills) may be inadequate to remain competitive. This is more common if the firm is owned by a diversified corporation seeking only a steady cash flow, or from management instigated to focus on its survival. <<<PACIA % R&D>>

*Loss of flexibility.* The capacity to change may diminish. Some influences on this include management attitudes (eg. locked into a proven formulae for success), excessive specialisation, local regulations that are divergent from international regulations, prestige associated with a product, past investments in fixed capital and skills, corporate structures reflecting past strategies, and the nature of installed technology. These rigidities create openings for new competitors to enter the industry with new products.

*Reduced domestic rivalry.* The management of mature industries may promote consolidation with competitors to reduce uncertainty and risk (9.10.1). Excessive consolidation of industry and cooperative agreements reduces the incentive for innovation. Competition may also be reduced notably in Stage 3 (5.1.1.3) of industry development or, in gaining political influence, seek forms of protection to insulate from competition.

*Clusters become insular and inward looking.* An industry, notably in a cluster (6.1.1), that lacks international activities or with well established commercial relationships to provide international perspectives, will be insensitive to international trends and become vulnerable to structural change and chance events.

*Loss of a component of the cluster.* The loss of an industry or institution that is key component of a cluster (14) can lead to losses of dependent and supporting industries particularly if they are not active in international markets.

*Industry associations that successfully lobby government for reduced incentives to improving competition.* Industry associations, by the nature of their support and funding aim to improve the operating conditions and competitiveness of its members. The focus is therefore the maintenance of protective influences, regulations that serve to reduce their competitiveness, and the entry of new firms that can become competitors for their members. Undermining competition as one of the four determinants of the “diamond”, it stresses the importance of maintaining competition among industry associations.

## 7 ASIA'S CHEMICAL INDUSTRY AND ROLE OF GOVERNMENT

### 7.1 Asian chemical industry development

With the exception of China and India, Asian countries began their industries with the production of commodity consumer chemicals, notably polymer resins (plastics) for which there was fast growing consumer demand with economic development. China and India, with their controlled and protected economies, began with a broader base. Other than Singapore, the petrochemical industries in Asia developed largely to replace imports of high volume commodity chemicals for their large, fast growing domestic markets. Singapore's chemical industry developed as an offshoot of its large export-oriented petroleum refining centres to export more than one-half its production. Nearly all countries have drawn their comparative advantage from scale, provision of government-funded infrastructure, government participation, and like in Singapore and China, helped by supporting petroleum refineries that provide the feedstocks, notably naphtha <<define naphtha and gas-oil etc>>.

Except Singapore, their infant industries were protected from foreign competition by import tariffs and, from competing investment in the home country by requiring investments to be approved. All countries were proactive in creating and shaping the environment for investment which took the form of government funding for common user infrastructure, such as the world-class industrial estates such as Map Ta Phut in Thailand () and the large Jurong Island project in Singapore (). <<<more detail>>>

Their industries are now at different stages of development, from new large-scale commodity chemical production plants in Thailand, small-scale production in India and China, to higher value added production in Taiwan and Japan. For commodity chemicals, Taiwan and Japan now have older and modest scale production facilities and increasingly shifting to higher value added technology-intensive production. The rest of Asia is importing their higher value added, technology-intensive chemicals from Japan, US and Europe. They also import primary chemicals, such as VCM, caustic and methanol from the Middle East as inputs for chemical and other industries. The nature of the markets, feedstocks, the age and scale of industry and levels of industry and protection influence the balance between what is manufactured and imported. The region clearly recognises this trend and has begun to provide incentives for technology-intensive investments.

Again, the face of the industries in the region is changing with China's chemical industry set for extensive expansion with large scale, current technology plants. Today, the Asian countries have already liberalised their industries by opening up to foreign competition with tariffs reducing to below 10 per cent, generally below 5 per cent, and increasingly allowing market forces to determine investment and trade flows. Each country is described later (Appendix 16).

#### 7.1.1 Sources of competitiveness

With exceptions for the older industries in China and India, and now with the aging commodity chemical sector of Japan, competitiveness is drawn from scale, current technology, sophisticated infrastructure and, notably for Singapore, Japan and Thailand, integration into efficient petroleum refining operations. A notable example is the large-scale refineries in Singapore that provides refinery by-products namely naphtha, gas-oil, C2-C4 olefins and hydrogen, common infrastructure for storage of feedstocks and by-products and distribution. Such integration provides competitive advantage and is very important for its

industries without access to indigenous feedstocks, incur high labour costs and occupy expensive land.

Within ten years since 1990, indigenous natural gas supplies have helped Thailand enter as a key world player and are certain to underpin petrochemical development in Malaysia and perhaps Indonesia. For these three countries, and as evident in other parts of Asia, oil and gas reserves are owned or their distribution controlled by their government so allowing their influence over pricing and supply of important feedstock raw materials for their chemical companies. <<Woodside ethane content issue!!>>>

While labour costs are low in the newer centres, construction costs are higher than for example the US and comparable to capital city construction costs in Australia <<reference>>>. Capital equipment is imported and raw materials are generally at world-prices. Facing competition from Middle East countries, to promote investment their governments all have provided protection at some time to maintain domestic prices above open market levels and reduce risk by schemes to reduce finance costs such as tax concessions and infrastructure incentives and at least in the past, participated in the venture to reduce risk and finance costs. Today equity and even finance provision is increasingly rare with growing preference for more indirect forms of assistance, notably "tax holidays", depreciation allowances and infrastructure funding. All are reducing protection ().

### 7.1.1.1 Scale

Scale, like integration with similar operations, provides substantial operating cost benefits, especially for commodity chemicals produced in capital-intensive manufacturing. <<details and explanation in Appendix on scale effects on operating costs>> and can help offset raw material and operating cost disadvantages.

Investment in Asia commonly involves the biggest chemical manufacturing centres in the world that includes a 600 000 tonne per year ethylene plant at Thailand's Map Ta Phut with plans for an even larger 800 000 tonne unit in Singapore that would rank with the USA as the biggest in the world. Other examples include for the manufacture of commodity aromatic chemicals such as paraxylene at 800 000 tonne per year reflected in the next step product, phthalic anhydride that has doubled in size to lead the world at scales of 900 000 tonnes per year. While increasing scale provides operating cost advantages and offset factor cost disadvantages, as occurring for South Korea, that advantage can be lost with the establishment of even larger operations, notably in Thailand.

### 7.1.1.2 Technology

Generally with the exception of India and China, the competitiveness of Asian commodity chemical producers is helped by using the latest technologies provided by Japan, the US and Europe. Japan in particular has been aggressively pursuing investment in commodity chemical manufacturing in Asian countries to take advantage of their lower production costs. It has been supporting large-scale plants using latest available technology to replace production from their own now modest scale and aging plants. Japan like other investors in commodity chemicals offer the latest technology helped by finance and sophisticated skills. As a result, the newer production centres in Thailand and Singapore are at the forefront of technological advances and a proving ground for the development of commodity consumer chemicals. For example, new technology to produce paraxylene from toluene is being applied by Mobil at the Jurong refinery to reduce capital and operating costs by up to 15 per cent. Polyolefins, the core to Australia's petrochemical industry, are being developed with evolutionary and new technologies to provide a significant competitive advantage. Notable are the metallocene catalysts that produce polyethylene and polypropylene resin polymers with greater clarity and lower costs. Polypropylene, a key engineering grade polymer, will

be produced in syndiotactic form, quite different to the isotactic form produced in Australia <<contact Montell>>. Even the petroleum cracking process, core to Asia's petrochemical feedstock supplies, is being improved with "deep catalytic cracking" to produce low cost propylene feedstock and applied in Thailand and China.

While the latest, if not leading technology is being applied in Asia, it is however largely confined to commodity chemicals notably the high volume consumer product polymers, such as polyethylenes and rubbers while older, second-generation technology is still being used for higher value added chemicals that continue to be produced in Japan and western countries. In apparent recognition of this trend, Asian countries are actively offering incentives related to the technology intensity - a strategy successfully pursued in Japan (16.4) since the 1970s where market access was traded for technology.

It is again worth noting that Australia, like Asia throughout its industry development, used the latest technology through to the early 1980s. Unlike Asia, Australia was then at a more comparable position with technology providing countries. However, Australia then, reflecting foreign ownership of its industry, had its access to overseas markets restrained by their US and European owners, as being reserved for their home base industries. It was also not a threat with production aimed at the highly protected home market. As described (), Australia has not advanced its technology, scale of operations, or products (). It remains competitive using depreciated plant and without the integration and infrastructure facilities of many Asian centres. It remains a significant user of anti-dumping legislation ().

### 7.1.1.3 Commodity chemicals - scale and infrastructure providing competitiveness

Reflecting local demand and limited feedstocks, Asian chemical companies typically produce bulk commodity chemicals, notably ethylene-based such as the polyethylenes ("polythene" plastics), as well as synthetic rubbers, polypropylene and other high volume consumer oriented products. Broadly in terms of value-added or technology intensity, Asia imports two classes of products that are below and above the consumer-oriented commodity chemicals. Below are the low value added commodity chemicals from the Middle East and Western Canada that includes acrylonitrile, ethylene glycol, caustic soda, methanol and the chlorine chemicals EDC/VCM and PVC: above are higher value added and "technology-intensive" chemicals imported from the western world and Japan. With implications for the PPP proposed for Western Australia (), the Asian region is projected to have a shortfall in production of around 3 to 3.5 million tonnes of EDC, VCM and PVC expressed as PVC resin. <<details to explain "as PVC" if necessary>>

### 7.1.1.4 Feedstocks – Asia in perspective

Liquid petroleum refinery liquid by-product, notably naphtha<sup>31</sup> is the predominant and traditional feedstock for the manufacture of petrochemicals in Asia including Singapore, Japan, South Korea and China. Typically, some 5 per cent of refinery production is used for petrochemical production and its close relationship provides significant cost benefits for petrochemical producers (). These refinery liquids can be "cracked" notably into ethylene, propylene and butadienes ("C2", "C3", and "C4" respectively). The new natural gas-based petrochemical centre at Map Ta Phut in Thailand with potential centres in Malaysia and

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<sup>31</sup> *Naphtha* is a refinery by-product similar to diesel fuel that may be *cracked* to C2, C3 and C4 hydrocarbon feedstock. Whereas the C2 feedstock is used to produce ethylene chemicals, the smaller proportion of C3 is used notably for polypropylene plastic and acrylic acid resins and derivatives, the C4 is used for synthetic rubber and some other chemicals such as MTBE. *Gas-oil* is another petroleum fraction that is used like naphtha.

Indonesia may promote the use of naphtha with its valuable C3 and C4 feedstock << implications on products and Australia – but see next>>.

The choice of gas or liquid feedstock influences the products and general long-term competitiveness with implications on the region and Australia. Liquid feedstocks produce C3 and C4 hydrocarbons for polypropylene resin and synthetic rubbers respectively. Natural gas contains in addition to the predominant methane that is used for energy, ethane that is converted to ethylene to produce polyethylene resins. While cheaper, and ideal for producing polyethylene resins, gas does not contain the C3 and C4 hydrocarbons in adequate amounts so helping the competitiveness of liquid feedstock based producers. The balance between liquids and gas use however shifts with changing oil prices and, to a lesser extent, the value of the products.

Petroleum liquids are not only more volatile in price, but are more expensive raw materials than natural gas from the Middle East, Venezuela and Canada where it is often a by-product of petroleum production or extracted from domestic use gas.<sup>32</sup> Gas is expensive to transport requiring special cryogenic vessels and is sometimes even flared-off at oil production centres reflecting its low opportunity value. The low cost of gas has promoted large volume chemical production centres to produce glycol, acrylonitrile, polyethylene resins, methanol, EDC, VCM, and as a co-product, caustic soda. These are increasingly imported from the gas rich centres such as the Middle East. It is also this sector where nearly all investor interest has been in Australia.

Any increase in the price of oil, helps the competitiveness of gas-based producers against liquids users given the limited alternative application for gas and its higher freight costs.<<reference/footnote>>. Helping however is that liquid feedstock is by-product of refinery operations with some 95 per cent of their output being for transport-related purposes. In other words, the petrochemical feedstocks, notably naphtha and gas-oil, can be supplied on more price stable terms than implied by the underlying petroleum price. Nevertheless, with any increases in the cost of oil for most products, liquid users will be disadvantaged compare with those using natural gas.

Increasingly therefore the gas-rich regions of the world are producing primary commodity petrochemicals; feedstock representing a large proportion of the production cost produced in large-scale production plants. Glycols, chloralkali chemicals, VCM and EDC used to produce the important commodity PVC plastic, and caustic soda are accordingly shipped around the world and increasingly to the Asian region. Distance and industry protection policies in Asia, by way of import tariffs and anti-dumping legislation, influence the balance between what is manufactured or imported. Thus while the region is increasingly producing bulk commodity products aimed at their consumer market, increasingly too it is importing primary commodity chemicals made at gas-based regions to use as the inputs for the manufacture of the next step commodity chemicals. It is worth noting that closures in Australia have been in primary commodity and higher value added products placing Australia in direct competition with the new production centres in Asia. Investor interest has been in primary commodity chemicals based on natural gas.

### 7.1.2 The balance of demand and production in Asia

To complicate the impact on Australia of new industry and growing markets in Asia is that regional demand and supply will remain unpredictable. In the newer regions, large-scale plants some operating under conditions of declining import tariffs, avoid capacity under

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<sup>32</sup> In the long-term there are prospects for new regions such as the Former Soviet Union countries using low-cost feedstock to develop their petrochemical industries.

utilisation, notably during downturns in domestic demand, by exporting at discount on home market prices.<sup>33</sup> For example, the 1997-98 downturn in Asia, saw export prices commonly reduced by 30 to 40 per cent below the home market levels testing anti-dumping legislation in many countries, notably in Australia (<<<refer A/D in Australia>>>). With surplus capacity in most countries, with an unpredictable investment and rationalisation process in China, and India, small variations in demand, can be anticipated to reflect in large variations in supply and prices. These two countries, also representing two-thirds of demand in the region, can be anticipated to continue to be influential on demand and supply.

India and China have older and protected industries and retained small high cost production centres. China for example developed regional centres notably in the west of the country that are both small and using old technology (such as producing EDC from acetylene that is made from carbide as in the 1950s in the western world). Declining levels of protection is exposing industry to increasing international competition promoting eventual, but unpredictable closures. While some of the market released will be assumed by new production facilities, new markets will also evolve notably for primary commodity chemicals and some technology intensive, higher value added chemicals such as acrylic esters, engineering resins and polyamides. For reasons of size and potential, China will have a major impact on the region though the extent and timing is not clear. With predictions of China remaining an importer of chemicals, presently meeting one-third of demand, the government has declared its ambition to be self-sufficient by 2010. That aim would be achieved by a doubling of production capacity with eighteen large integrated petrochemical complexes. China's balance of trade will therefore reflect its ability to attract or fund new investment that is very sensitive to perceptions of political stability.

Overall while there will be major shifts between countries, net demand growth is such that South East Asia is projected to require some fifteen new olefin and ten new aromatic chemical complexes in the next decade.<sup>34</sup> These are commodity chemicals.

### 7.2 Asia's relevance to Australia

For Australia's government, Asia provides a useful perspective on the active participation of government in industrial development. For Australia's chemical industry, Asia presents a fast growing market for its products. However, having attracted one-half the world's new investment in the chemical industry with large and latest technology investments, it also presents a threat.

In terms of strategy, the countries in the region are at three stages of development with some making the transition from factor cost sensitive commodity chemicals, to technology-intensive higher value added products. Asia is therefore important for Australia both as a role model for government and for commerce.

Like Australia to the late 1980s, industry protection has been widely used to promote investment, often with direct and indirect forms of assistance. Only Singapore has not used industry protection but then direct and indirect assistance and initially some government equity participation was once employed. Japan on the other hand, primarily used formal and informal intervention in commerce and trade, while the governments in China, Thailand, Malaysia and Indonesia, in addition to providing assistance and protection, influenced feedstock prices and availability by owning or controlling oil and gas distribution. Common

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<sup>33</sup> Naturally with import tariffs protecting the home market, to export requires values to be at least below the tariff inflated price.

<sup>34</sup> Rathvon, W, Managing Director BA Asia Limited. *Petrochemical Industry in Asia: An Overview*. 'Bank of America's Guide to Petrochemicals in Asia'. EFP International (HK) Limited, HK 1998.

to most countries are direct and indirect forms of assistance by way of tax concessions, funding for common user infrastructure and the active promotion of technology-intensive products.

Since the mid 1990s, industry protection is being reduced throughout Asia. Countries such as India and the China, that protected their industries with import duties of up to 60 per cent, with WTO incentives and ASEAN membership requirement, tariff rates are reducing to less than 5 per cent by 2003 - below those ruling in Australia. Thailand, within a decade of creating its chemical industry, is now phasing import tariffs to below the 5 per cent ceiling rate applying in Australia; while and notably since 1998, most Asian countries are liberalising foreign investment rules.

For the duration of each country's chemical industry, some four decades in Japan to one decade in Thailand, there are no particular government initiatives common to all countries that point to a formula for success. Regional and international circumstance, timing and feedstocks have contributed to shape their industries. Common to all however has been the involvement of government.

Government initiatives and policies are converging. Most notable are; the reducing use of protection against foreign competition by import tariffs; on-going government ownership or control over oil and gas resources, government funding for common-user infrastructure, tax "holidays" for new investment, often combined with incentives for high technology activities, and a more liberal attitude to foreign investment. Many countries maintain government agencies, if not to steer investment, then to provide relevant information and guidance. Examples include Japan's well-known MITI (), Singapore's EDB (), China's new State Petroleum and Chemical Industry Bureau () and Thailand's Investment Board (). These are increasingly providing information and policy guidance advice. Australia has a branch within the Department of Industry, Science and Resources, called Chemicals and Minerals Processing.

The national chemical industries are at different stages of development, ranging from the very new commodity chemical based industry in Thailand, older and fragmented production in China and India, to the increasingly higher value added technology-intensive industries in Japan and Taiwan. Japan however stands out in the region for having developed its own technology and becoming a licensor. Japan is also now an investor in Asia in the production of commodity chemicals as its own commodity chemical producing industry is losing its competitiveness. Taiwan is making the transition but without developing indigenous technology aimed at its home industries, notably textiles and computer technology, while South Korea's original competitiveness based on scale, is being eroded without evidence of a transition to the next level of sophistication or technology. South Korea is beginning to lose market share in the region to the new entrants in Asia, notably Thailand.

Asian countries are showing evidence of the importance of ownership or access to technology as key to reducing their lack of comparative advantage in feedstocks and construction costs presently, but long term vulnerable, offset by the economies of scale and integration into petroleum refineries. Many countries are therefore providing forms of subsidies for new investment related to the use of technology. Australia investment incentives has not shown such interest <<<details>>>.

Except for Japan, Taiwan and South Korea as the more mature countries, all have markets projected to grow at rates of around to 10 per cent per year while the whole region is attracting nearly one-half the world's new investment in chemicals. In the context of fast growing markets, India and China while both having long established industries also have fragmented and aged plants with poor infrastructure. Both countries, but notably China, will require extensive new investment to supply the projected fast growing domestic demand.

### 7.2.1 Competitiveness

There is considerable variation between countries in terms of age and scale of operations, ranging from old and small-scale operations in India and China, to large-scale modern plants in Thailand and South Korea. To meet growing demand, and generally without indigenous feedstocks, international competitiveness is achieved by new investment among the largest in the world – often three or more times larger than those in Australia. With a production capacity in excess of immediate domestic demand, the fixed cost recovery penalty of unused capacity is reduced by export sales at prices covering marginal costs to contribute to fixed cost overheads. Consequently downturns in domestic demand, has led Thailand for example to export up to one-half of its production at prices well below home market levels.

Based on factor costs, most Asian countries are not competitive on an international basis. Construction costs are substantially higher than the benchmark US Gulf Coast and comparable to Australia <<ref Chem Systems>>, lower labour costs are generally offset by higher manning levels reflecting lower labour efficiencies and energy costs are high. Most of Asia uses naphtha, a liquid petroleum refinery product that is priced at world levels. Only Thailand has its own oil and gas supplies though Malaysia, and perhaps later Indonesia, will join Thailand with their own indigenous feedstocks presenting a cost advantage, notably with gas. Scale and integration, helped by publicly funded infrastructure is therefore very important for short-term competitiveness.

Thus, another generalisation about Asia is that in the long term, with the possible exception of the late starter countries with their own oil and gas reserves, is that the region will not be a major exporter of commodity chemicals, at least outside of the region. Cheap gas centres such as the Middle East, Canada and Venezuela have become low cost manufacturing centres for base or commodity chemicals (15.1.1.3) and the primary forms are now often imported by Asian countries as inputs to further manufacture.

In the short term with over-capacity in the newer centres and until domestic demand catches up with installed capacity, the countries will supply to foreign markets to cover marginal costs. Australian industry's high use of anti-dumping legislation can be expected to continue until home demand catches up with installed capacity.

### 7.2.2 Comparison with Australia

Unlike Australia, South Korea, Thailand, and Japan have achieved at some time of their development world-scale production centres for commodity chemicals. All have exported more than the one-tenth of their production turnover (as the typical low proportion achieved by Australia's industry ()). This observation is even more notable as unlike Australia, Japan, Singapore, Taiwan and South Korea have not had access to indigenous feedstocks, notably cheap gas as available to the Altona petrochemical complex in Victoria. Unlike most of Asia with the notable exception of India and China, Australia's industry became fragmented with up to three producers operating at scales one-third typical of current world-scale that competed to supply the small Australian market. Unlike most Asian countries, there was no Australian government control on new investment. While increased domestic competition was a consequent outcome, with the high levels of protection, it did not promote the competitive industries that would have eventuated in a less protected economy so firms remained locked into the domestic market with largely undifferentiated products. Thus, key differences with Australia were the absence of mechanisms to control entry and the failure to provide incentives to promote advanced technologies. << Were tariffs too high??>>

Also unlike Australia, Asian governments established specific agencies to steer, control or influence the development of their chemical industries. To influence the price and availability of feedstocks, many countries own or directly control oil, gas, and feedstocks including their distribution. <<<Woodside ethane argument, Bass Strait gas prices and Altona>>>. Equity

positions were also assumed by government to seed major new investments and restricted the entry of competitors to the industry, notably by foreigners. Further, and not evident in Australia until the mid 1990s, and only in a modest level, government has funded extensive common-user infrastructure such as A\$7 billion provided for Singapore's giant Jurong Island petrochemical and refineries complex and the Map Ta Phut complex in Thailand.

While equity participation was common, even early on in Singapore, it is today less common and confined to the formative stages of new industry and generally on a minority basis. Government however remains very active in funding common user infrastructure and incentives, notably tax concessions to new investors. More recently, and increasingly common in most Asian countries, is that assistance favours technology-intense, higher value-added activities. Such emphasis is not evident in Australia.

There are therefore both similarities and differences between the more recent development of the Asian chemical industry and that of Australia through to the 1980s. Australia then too had a home market growing at around 10 per cent per year and import tariffs of up to the equivalent of the highest available in Asia sometimes with other domestic price-inflating controls on foreign competition.<sup>35</sup> Australia however had the benefit of access to cheap feedstocks including since 1966 from Bass Strait, ethane in South Australia and for the last decade, in the northwest of Western Australia. Today unlike Asia, Australia's chemical industry is expressing uncertainty about its future with little new investment in the last three decades.<<ref>>>

Some of the difference in performance between Asia and Australia can be explained by timing. Whereas technological developments still originate from the US and Europe, and more recently Japan, those countries now have slower growing markets, without competitive feedstocks and some with now small-scale production centres. The very latest technologies, and at the very largest scales, can now be supplied for commodity chemicals without disadvantaging their home industries increasingly moving to higher value added products. In other words, those now developed countries are becoming importers of chemicals manufactured from their own, sometimes enhanced technology. For most of Asia, often without access to competitive indigenous feedstocks, the benefit of technology is being helped by an operating environment of world-class infrastructure and sometimes by integration into world-scale petroleum refineries creating very competitive production centres.

In contrast then for Australia during its formative years, the foreign owners of its chemical production centres would not allow their Australian subsidiaries to supply Asia which was then supplied from more competitively located plants in Europe and Asia, and later, from the Middle East and other gas-rich locations. Without that restraint today, Australia is not able to significantly supply Asia for reasons not now of ownership but for its lack of competitiveness from scale and technology.

It is relevant to note that those western countries and Japan that are now supplying the technology to Asia for commodity chemicals, without access to competitive feedstocks and without the scales of production of these newer centres, are increasingly shifting their own chemical industries into specialty and other higher value added chemicals. That technology is expensive and not available on the ready terms of commodity chemicals. Recognising the dearth of investment in higher value added products, Asian investment incentives are increasingly responsive to the level of technology involved. Such emphasis is not evident in Australia and presents a future similar to South Korea (16.7).

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<sup>35</sup> Australia also practiced import licensing, similar in effect to the foreign exchange control practiced in Japan and applied *primage duties* on a broad range of products.

### **7.2.3 Implications of Asian development on Australia**

THIS SECTION IS TO BE DEVELOPED.

For Australia therefore there are three considerations.

A modest domestic market

A nearby fast growing Asian market but sometimes supplied by high cost production centres.

Singapore, () though high cost, increasing their petrochemical industry taking advantage of scale and central location.

Increasing supplies from gas centres in the Middle East.

## 8 GOVERNMENT - INDUSTRY POLICY

For some government is more often seen as a burden than a benefit to business and more of a source of problems than a means of solving them. When government responds, it gives priority to political interests focussing on short term costs and benefit over long-term considerations.

On the other hand, some groups promote government to help their emerging or important industries for being special. <<refer PACIA>>They emphasise the important benefits they provide to the country and would invest too slowly if left to private initiatives. Commonly they asset that more competitive countries will pre-empt the opportunity due to a lack of competitiveness at home that can be addressed by government. In essence, economic growth would suffer without government support for their sector. <<<get quotations>>>

Critics of government involvement on the other hand argue that market forces are better than bureaucrats at “picking winners” as it requires a thorough knowledge of the technologies, an appreciation of market demand and a sense of timing.

Others against government participation view their assessments of consequent spillover benefits if not exaggerated, one-sided and without consideration of national costs and the regions or targeted industries would have developed anyway. Accordingly, ensuring skilled workers, capital and aggressive entrepreneurs are more important to economic growth than any government initiatives.

Proponents of government intervention believe that market forces alone provide inadequate incentives to invest in emerging industries. It is considered that the risk of exploiting new technology may be too large for competitive firms to bear alone or spillovers may be so large the social value of investing in emerging industries may far exceed the profits accruing to the private firm taking the risks. <<references>>>

Porter identified both failings and important roles for government to help develop competitive industry.

### 8.1 Failings of government

Porter was generally unimpressed by the performance of governments notably for; assuming a zero-sum view of international competition<sup>36</sup>; not having a close economic understanding<sup>37</sup>; being biased for election reasons to the short term over slower developing, though more sustainable higher quality determinants of the diamond; and for creating unproductive incentives to promote local firms at the expense of the country.

Most failings of government were for assuming too simplistic principles on competitiveness or biased by politically motivated short-term agendas that included:

*Emulating policies of other countries.* Foreign policies while having been successful in the early stages of their industries’ development, by effect were shown to be unsuitable to promote sustainable and advanced industries. Common initiatives by government aimed at correcting trade imbalances were often simplistic aimed import replacement and protection and assistance that provided static short-term cost advantages but in reality undermining competitive vitality, wealth creation and innovation.

<sup>36</sup> Government initiatives tend to focus on attracting investment that might be located elsewhere - ie. a gain at the expense of another activity or location so making it necessary to provide incentives.

<sup>37</sup> Porter concluded that direct government-business collaboration undermined the long-term viability of business and did not help appreciation of the forces of business.

*Biased to regions or industries for political reasons.* Government often gave priority to regions or targeted industry simply for being depressed especially those with a large labour force, low wages or import competition (people vote, machines don't). The intensity of the political process deflecting an objective policy process to allow industry restructuring that came at considerable, but less politically visible cost to the country. This bias is particularly relevant in Australia with its very high representation in government, notably in rural regions.<sup>38</sup> The concentration and bias creates a political economy that favours concentrated special interest groups in established industries, over dispersed groups of consumers and new emerging industries.

*Biased to the short term over long-term benefits.* Reflecting political sensitivities, government favoured the immediate over the long term. That included preserving underperforming industries; resisting beneficial deregulation because of adverse short-term effects and supporting corporate mergers for short-term, limited benefits that serves only to reduce domestic competition.<sup>39</sup>

## 8.2 Government - improving competitive advantage

Given therefore the inherent political bias of government while recognising an important role, the implication is that government should promote competitive industry without its express involvement or direction. Only during the development of industry in the early phases, as Stage 1 and Stage 2 (5.1), should it assume a direct and participative role.

On acceptance of the principle of an indirect role, government may influence the industry's competitive advantage through all stages of development by recognising the sources of competitive advantage lie outside the firms but within industry clusters (6.1.1). In other words, competitiveness is based on relationships. On acceptance of this principle, the role for government should be to invest in the collective assets that are public goods which reside within clusters and potential clusters and not within individual firms. Its endeavours therefore, serve to enhance the diamond and not specifically a firm. Porter however requires that the underlying determinants for success must already be evident as a "government can only promote the chances of establishing national advantage but cannot create the advantage itself".<sup>40</sup>

Therefore the attention of government should be the upgrading of the quality and efficiency collective assets or public goods that are of business inputs and infrastructure.

This could be helped by policies and regulations that stimulate innovative development and vigorous domestic market rivalry. This while Porter does not recommend roles for government to develop direct or targeted (9.7) industrial policies or sources of competitive advantages, its role could be to create a business environment supportive of rising productivity through vigorous competition and relevant education and training. By this principle alone, every country according to Porter, could begin to improve their prosperity simply by relaxing the constraints and regulations that work against the upgrading of industry. In other words, macroeconomic benefits could result from removing microeconomic restraints on business.

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<sup>38</sup> There is always the distinct possibility that the special interest groups are caught up in a *prisoners dilemma* each having an incentive to exploit the system but all may benefit from a move to a less exploitable, more efficient system that generates a greater output.

<sup>39</sup> Product and process development and the benefits of pursuing sales in overseas markets soon nullify even a 10 per cent saving through economies of scale (which is considered rare in a domestic merger or cooperative effort).

<sup>40</sup> Porter stresses that this should not involve the classification of the country's industrial base into implicitly better categories such as *high-tech*, *sunrise*, growing, manufacturing or labour-intensive. Examples are provided where many countries have performed well with some of the lesser-classified, even *sunset* industries.

Important roles identified by Porter for government aimed at improving competitive advantage are summarised to:

- Identify factors for creation and enhancement that should be undertaken by industry as it has the clear economic interest to avoid them being insufficient, inappropriate, too generalised or applied at the wrong time.
- Ensure the workforce has developed high levels of broadly based skills
- Promote the entry of new firms into more productive activities.
- Create policies and provide funding for externalities<sup>41</sup> that promote underinvestment by industry, notably in R&D.
- Promote the transition of industry through each stage of development (5.1).
- Stimulate emerging domestic industries at the early stages with some guarantee of a market through government procurement or some formal or informal import barriers.
- Avoid the transition to a wealth-driven economy (Stage 4, (5.1.1.4)) at which time there is reduced innovation that leads to stagnation and economic decline.

### 8.2.1 Taxation

Taxation can influence the direction of investment and business and core supporting influences such as R&D, new facilities and training. It can influence the goals of investors, senior management and corporate governance to promote more sustained capital investment. Taxation measures achieve this by the more favourable treatment of long-term gains, including on capital gains and shares over short-term gains such as salaries, wages and speculative gains. Taxation can therefore promote incentive-based compensation for management with a higher incidence on wages and salaries to encourage commitment<sup>42</sup>, effort, risk-taking, skill-enhancement and unusual effort.

### 8.2.2 Internationalisation – monitoring losses in the country

Government can influence the progress of internationalisation as an important feature to a country's growing competitiveness. Internationalisation involves the use of subsidiaries in other countries to obtain the weaker determinants of an industry's diamond that complement the more competitive determinants in the home base. Involving sometimes politically sensitive losses of weaker industry, government should not oppose the internationalisation of its country's industry to not disadvantage the more competitive firms. While losses are a natural feature of competitive development, where these relate directly or indirectly to other diamonds, the cause and implications should be evaluated as a portent of a trend that could adversely affect the long-term development of the country. An analysis may for example indicate a need for review of measures under influence of government where micro development is a portent of a macro trend.

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<sup>41</sup> *Externalities* or *spillovers* are where the benefits to the country as a whole exceed those accruing to a single firm or individual to the private entities will tend to underinvest from the perspective of the country. Examples include general education, quality of the environment and R&D that boosts productivity in many other industries.

<sup>42</sup> Commitment to the firm can also be promoted by favourable tax treatment of training benefits to discourage labour mobility, but with suitable regard to distressed and declining industries.

### 8.2.3 Education

On the principle that government does not have the close economic interest or market awareness, it should therefore only provide support for broad-based education with the more specific forms of education under influence of industry. Its role therefore should be to ensure the highest quality standards of teaching that it is both valued and effectively related to industry.<sup>43</sup> Another valuable role for government is therefore to facilitate scholarships and awards provided by industry to direct education institutions provided by government.

### 8.2.4 Science and technology policies

National advantage may be enhanced by policies that are coupled with commercial prospects. Like education, these should be evolved with industry that has the market awareness and the close economic interest to orient and determine their timing. Government should therefore promote university research with industry links aimed at developing commercially relevant technologies. Science and technology policies should be combined with innovation and not simply for the development of "science and technology" per se.

### 8.2.5 R&D

Government, in representing the national interest, is justified in providing incentives for R&D activities because of the spillover benefits to the national economy.<sup>44</sup> In other words, publicly funded support is warranted as the firms share the rewards with the country, justifying public support. Again with the importance of market awareness and close economic interest, the direction of research by industry should not be influenced by government. Equally important is that any consequent externalities should be confined to domestic firms and the home country and not spill over to foreign firms. This could be helped by reducing the ease of licensing of technology or of mergers of certain industries and justified if government intervention promotes the transfer of foreign technology to domestic firms. It also assumes of course that the technology represents a significant proportion of industry costs and that assistance will raise entry barriers to foreign firms.

Porter therefore recommends the most effective ways of encouraging industrial R&D includes the partial funding of specialised research institutes that support industry clusters, the partial subsidisation of research contracts between firms and the support for research institutions such as universities and small firms. In recognition of the wider public benefit that underpins the basis for its support, government promote the rapid and wide devolution of the resultant knowledge in return for its support for R&D. Acknowledging also the need for a reward for the firm's R&D outlays, Porter concludes that on balance restricting the flow of information is not in the national interest.<sup>45</sup> <<Australian context of CRC's, SPIRT Grants etc.>>>>.

R&D in one firm has consistently been found to stimulate productivity in other firms.<sup>46</sup>

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<sup>43</sup> Effective education should also be complemented by anti-discrimination policies to help advancement on merit in an open educational system.

<sup>44</sup> However, some countries that are aggressive investors in R&D, such as Sweden and Germany do not provide special government incentives. It may be that stimulating other parts of the *diamond*, such as domestic rivalry, technical information in the country, promoting corporate goals and rewards, may be more effective for the country as a whole to stimulating R&D in industry.

<sup>45</sup> An issue for Australia is whether technologies should be controlled given the experience of foreign-owned companies that operate in cooperation with resource companies and apply the results of their relationships in overseas countries without return to Australia.

<sup>46</sup> Griliches Z. 1994, 'Productivity, R&D and the data constraint', *American Economic Review*, 84 (1), 1

Econometric studies measuring social returns to R&D suggest very high values for spillover benefits with a ratio of social to private returns in the United States of the order of 2 to 1.<<references>>

## 8.2.6 R&D in Australia

Federal R&D support of business R&D is provided through tax concessions (125 per cent) and the discretionary and targeted Industry Innovation program comprising the R&D Start program and the Innovation Investment Fund.

### 8.2.6.1 R&D Start

It aims to *encourage overseas companies to establish R&D facilities in Australia. Where the benefits of R&D are to be retained in Australia, these firms will have access to R&D funding on a competitive basis. This complements the Government's broader strategy to attract foreign investment to Australia.*<sup>47</sup> This was the major component of Investing for Growth with \$190 million being approved in 1998-99 (DISR 1999).

There are three components.

- *R&D Start* - companies with grants of 50 per cent of the project cost.
- *R&D Start-Plus* for companies with average turnover of more than \$50 million with grants of 20 per cent of the project cost.
- *R&D Start-Premium* up to 72 per cent of project cost contingent on successful commercialisation of technologies and for *projects deemed to be of exceptional merit and with outstanding prospects for commercialisation.*

These programs provides for higher returns than the 125 per cent R&D tax concession ranging from 150 per cent to 200 per cent.

The Industries Commission recommended<sup>48</sup> that Government consider replacing the general R&D scheme with one aimed at assisting *additional* R&D; and providing a non-taxable form of incentives which could apply to firms with tax losses or insufficient franking credits. A more targeted scheme would also provide the scope to increase the rate of assistance to R&D.

Many industrialised countries have adopted schemes to favour incremental or additional R&D.<sup>49</sup>

### 8.2.6.2 The Innovation Investment Fund

Provides venture capital funds to small technology firms to assist with the commercialisation of R&D. Assistance is through the creation of investment funds on a 2:1 basis with private sector capital.

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<sup>47</sup> Commonwealth of Australia 1997, *Investing for Growth*, the Howard Government's Plan for Australian Industry, December.

<sup>48</sup> Industries Commission, *Telecommunications Equipment, Systems and Services* Report No. 61, 1998, AGPS Canberra. The recommendation was rejected noting the complexity and uncertainty that would follow from an incremental scheme.

<sup>49</sup> Hall, B. H. 1995. *Effectiveness of Research and Experimentation Tax Credits*, Report for the Office of Technology Assessment, US congress, June.

### 8.2.6.3 Technology Diffusion program

Grants are made available to projects that facilitate the uptake of 'new and appropriate technologies' with grants to a maximum of 50 per cent of the project cost on a 1:1 basis.

### 8.2.7 Cooperative R&D

Cooperative research is often promoted to achieve critical mass and avoid "wasteful" duplication. In reality, Porter found the participating companies were not motivated to fully support them by not providing the best skills and referring resultant information back to their own research centres to gain advantage over their competitors.<sup>50</sup> Porter however concluded that cooperative research could be justified if it:

- Is for basic products and processes, and is not similar to proprietary research.
- Represents only a small portion of overall research on the topic to avoid reducing the incentive for research (ie. reducing the firm's penalty for falling behind).
- Is undertaken through separate and independent entities such as university laboratories to avoid management difficulties that were often evident if controlled by the firms.
- Includes active competitors, rather than a few dominant firms.<sup>51</sup>

The (Mortimer) Review of Business Programs recommended substantial cuts to funding of CRCs. <sup>52</sup> However, on further review<sup>53</sup>, in 1999, Government announced funding for 26 Cooperative Research Centres with \$140 million having been applied in 1998-99. Applicants are required to demonstrate "a well structured, practicable and feasible strategy for the utilisation and commercialisation of the research outputs".<sup>54</sup>

### 8.2.8 Infrastructure and clusters

Fundamental to the upgrading of industry is modern and efficient infrastructure. Porter however found that government funding for that purpose however rarely contributed significantly to competitive advantage unless the infrastructure was specialised, part of a diamond and not particular to a firm.<sup>55</sup> An effective form of support by government is therefore the provision of infrastructure required by existing clusters (14) which might include that required by technical institutes, training centres and data banks to help attract and hold specialised companies.<sup>56</sup>

<sup>50</sup> Cooperative research is promoted by many sectors as it reduces duplication; provide for scale economies; overcomes the problem of under investing by individuals for not being able to appropriate all the benefits; and signals emerging trends and technologies.

<sup>51</sup> Such cooperative projects succeed in Japan because they involve technologies directly related to industry concerns, represents a small part of the firms overall research effort, powerful representatives from the ministries mediate conflicts and intense domestic rivalry ensures little threat to competition.

<sup>52</sup> The 'Review of Business Programs 1997', *Going for Growth – Business Programs for Investment, Innovation and Export*, (Mortimer Report) Canberra, David Mortimer Chair.

<sup>53</sup> Department of Industry, Science and Tourism, 1998, *Review of Greater Commercialisation and Self-funding in the Cooperative Research Centres Program*, Canberra.

<sup>54</sup> Department of Industry, Science and Tourism, 1998, *Cooperative Research Centres Program: Guidelines for Applicants and General Principles of Centre Operations*, Canberra AGPS.

<sup>55</sup> Porter, page 638. An example is provided where industry associations and local government bodies have cooperated to improve or establish *specialised* infrastructure for competitively advantaged industries.

<sup>56</sup> Such specialised infrastructure could also be provided by government without the cluster being in existence if the government is seeking to pursue the development of a region with a political agenda in which case it is more effective than direct forms of industry assistance.

### 8.2.9 Capital

To fund growth and pursue a higher order competitive advantage, emerging firms should have open and fair access to the country's pool of capital that is efficiently distributed and at low real cost. Capital availability helps new investment with best available productivity and helps improve general productivity.

The Innovation Investment Fund (IIF) provides venture capital to small technology firms to assist commercialisation of R&D.<sup>57</sup>

The availability of capital was reviewed by the Industries Commission in 1991 and it concluded that government intervention to expand institutional funds to SMEs would not improve the efficiency of the capital market or the economy generally.<sup>58</sup> It was re-examined in 1995 that confirmed that difficulties in attracting capital are explicable by inherent features of financing risky investments, rather than a systematic bias on the part of the institutional funds.<sup>59</sup>

### 8.2.10 Information

The amount and the quality of information about markets, technology and competitors increasingly influences international competition. Governments can assume an important role of creating awareness about investment opportunities and other information of importance to investors, and success stories for industry as models for upgrading the factors of production.<sup>60</sup>

In 1998, Invest Australia, providing secretarial services for the Strategic Investment Coordinator (9.8), aims to promote investment opportunities and advice on proposals.<sup>61</sup>

Another role for government is for the projection of a national image for an industry that can enhance foreign demand, encourage new suppliers, and stimulate improvement of supply from current industry. Image projection can even stimulate a national passion that stimulates internationally competitive industries.

In 1998, the Australian Government introduced the Investment Ready Program (IRP), with the objective of improving the commercialisation of Australian technology. The support is directed at making information available to small firms about likely information requirements of potential investors and at enhancing small firms' abilities to manage commercialisation. It is funded with \$20 million.

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<sup>57</sup> A Renewable Energy Equity Fund, is modelled on the IIF, provides venture capital to small firms for the development of renewable energy.

<sup>58</sup> Industry Commission, 1991, *Availability of Capital*, report No 18, AGPS, Canberra.

<sup>59</sup> Industry Commission, 1995, *Research and Development*, Report No. 44, AGPS, Canberra.

<sup>60</sup> MITI of Japan conducts and commissions studies on new technologies, trends in competition and future issues. The reports, prepared by experts from industry, academia and government and broadly distributed and firms advised they have been seen by competitors as a motivation for company study and response.

<sup>61</sup> It also assists businesses to establish regional headquarter under the *Regional Headquarters Program* () and provides *Feasibility Study Funds* () to prospective investors.

## 9 INVESTMENT

### 9.1 Reasons for investment

Investment is influenced by incentives that may be classified as; microeconomic –intrinsic to the firm; macroeconomic - exogenous to the firm; and part of the business strategy.

*Microeconomic influences.* Theories on foreign investment suggest that it is motivated by exploiting the inherent advantages in another country including access to patented technology, specific skills, industry protection and assistance.<sup>62</sup> Clearly, these advantages have to outweigh the often intangible assets possessed by indigenous firms, such as better knowledge of local conditions laws and politics, management skills and access to raw materials. The consideration of advantage may result in direct investment, the licensing out of technology, leasing, equity or alliances. The decision then to invest in some form or simply to export to the market is influenced by the ability to overcome the intangible factors, and the more common sources of comparative advantage such as freight costs, market size and growth, input costs, quality of labour and political stability. The choice is also oriented by 'imperfections' relating to the cost of overcoming organisational skills, marketing expertise and management experience. Where these are too significant, a firm may still exploit the inherent advantages by the licensing of technology or leasing of assets. In the end if still too high, the market may be serviced by exports.

Pollution standards relevant to petroleum refining, laterite nickel. <<Has it discouraged investment?>>

*Macroeconomic influences.* Macroeconomic policies in the short term influence policies influence relative rates of return through exchange rates, relative cost of capital and taxation. In the long term, sources of competitive advantage are dominant on investment that changes with time that reflect in changing flows in of foreign investment.<sup>63</sup>

*Business strategy.* A firm chooses a strategy to exploit, protect or enhance their competitive advantages or core competencies.<sup>64</sup> The considerations may be external or internal to the firm. External considerations include the strategies and reactions of rival and allied firms, government regulations, and competencies and bargaining power of suppliers; while internal considerations refer to the firms core competencies and management philosophies. Of course these may change with time, with some identifying three stages.<sup>65</sup> For the first stage these include; saturation of domestic market; movement of domestic customers overseas; sourcing opportunities overseas, entry of foreign competition in home market; desire to keep abreast of technological changes; advances in communications technology and marketing infrastructure; diversification of risk; government incentives. Notable for the chemical industry are; maturing technologies applied at limited scales of manufacture in the home market; new technology diffusion that creates competitors in new markets.

<sup>62</sup> Hymer S.H. 1976, 'The theory of international operations', reproduced in Gomes-Casseres B. and Yoffie d.b. (eds) 1993, *The international political economy of direct foreign investment*, Volume 1, Edward Elgar, Brookfield, Vermont.

<sup>63</sup> For example, Bureau of Industry Economics 1995, *Foreign Direct Investment in APEC: A survey of the issues*, Report 95/21, AGPS, Canberra.

<sup>64</sup>For example Dunning J. H. 1993, *The globalisation of business*. Routledge, London.

<sup>65</sup> Douglas S.P. and C.S. Craig. 1995. 'Global Marketing strategy', McGraw-Hill New York. Also 1989, 'Evolution of global marketing strategy: Scale, scope and synergy', *Columbia journal of world business*, Fall, 47.

## 9.2 Location of investment

<<refer to SCM at Kemerton, Z-Tech at Kwinana etc>>

Preston<sup>66</sup> identified factors that influence location in order of importance: <<find out more about this – what sectors????>>>

1. To preserve and/or expand global market share;
2. Access to raw materials;
3. Access to a low cost skilled workforce;
4. A well-developed local infrastructure;
5. An efficient and honest public sector; and
6. Political stability.

Preston commented that company tax rates and investment and depreciation allowances are “broadly in touch with business taxes” in the (Asian) region and concludes that investors are likely to focus on Australia’s comparative strengths in non-tax factors.

Notable in the Asian region are incentive schemes for major investments that include chemical manufacturing, such as ‘tax holidays’ and lower than open market capital (16). While improving shareholder returns and thus attracting investment to the region and away from competing countries, these incentives impose costs - disadvantaging competing domestic investors not eligible for the incentives; helps bid resources away from other, including more productive, domestic investments and distorts the price of materials, equipment and labour. Such incentives may require generally higher taxes affecting investment in other sectors while reducing the welfare of workers and consumers generally. In such respect, they are like import tariffs – favouring a few with a distributed, and hence politically less visible cost.

## 9.3 Details of investment

There have been more acquisitions than new investment by foreign companies though acquisitions have generally been of foreign owned companies.

<<<Details....

Monsanto to Chemplex to Huntsman with Kerry Packer interest

ICI Soda Ash to MCI via an MBO

Tiwest and Kerr McGhee

ICI to Orica

Plenty River and Chambal

PMA

Gibson to Ecolab

Etc>>>

There is no indication that quality is enhanced.<sup>67</sup> Investment driven by improvement of management and, in the case of Tiwest, access to markets.

<sup>66</sup> Preston A., ‘*Taxation policy and Australia’s competitiveness*’, Address to the Committee for Economic Development of Australia, 22 June, 1994. Reviewed three large scale international studies on factors affecting firms’ location decisions.

Details of greenfield investment.

## 9.4 Impact of foreign investment

Rate since tariff reduction

### Employment effects

Numbers. While in the short term, foreign investment may create jobs, in the long term, it will have no effect as unemployment mainly reflects underlying microeconomic conditions in the labour market (eg. rigidities). Unless foreign investment affects these underlying conditions, it will not affect employment. <<Rio Tinto vs BHP ref. workplace agreements>>>.

Quality. UNCTAD found that jobs associated with foreign investment are generally higher skilled, more productive and are higher paid than jobs on average.<sup>68</sup>

### 9.4.1 Expansions

Displacement of local investment.

### 9.4.2 Productive Capacity

- Does it improve? Production or management techniques by any displacement of Australian investment? << Penrice MBO and MCI>>>
- Improved access to markets than owners of any Australian investment displaced. <<<Tiwest Kerr McGhee>>>

### 9.4.3 Technology

Improving technology improves the capacity of the country to change, adapt and improve productivity. It may be come by way of licensing agreements, reverse engineering <<explain>>, employment and media. It may come by way of large capital equipment or almost imperceptible changes in workplace practices.

For Australia, the main conduit is <,appears? And prove>> by foreign investment. The overseas firms prefer to transfer their technology through to affiliates rather than to less closely related firms. Ownership provides a way for the repatriation of the benefits of technology by royalties and dividends. The issue is, is the reward fully compensated, or are there benefits to Australians. Also the question, is the cost lower to affiliates than to Australian firms? <<Question here of Wesfarmers with market control, freight intensive products where distribution costs are high vs others such as Qenos also commodity but less freight cost intensive. Also Qld Phosphate and HiFert. Anaconda laterite nickel WMC owned Cuba project, Coogee Chems xanthates. Entry barriers – can they be used in Australia to bring in technology??>>>.

<sup>67</sup> The OECD noted for example: 'In Australia's case, while the investment to GDP ratio is quite high by OECD standards, there is scope to improve the quality of investment and the efficiency with which the capital stock is used, especially public infrastructure.' Organisation for Economic Cooperation and Development 1994 *OECD Economic Surveys: Australia*, Paris

<sup>68</sup> United Nations Conference on Trade and Development (UNCTAD), 1994, *Transnational corporations, employment and the workplace*, UN, New York and Geneva. Allen Group study found average earnings in regional headquarters to be twice average earnings. Allen Consulting Group Pty Ltd, 1994, *The benefits of regional headquarters and factors influencing their location in Australia*, Melbourne; and UNCTAD 1994



### 9.5.1 Australia

#### Tax expenditures

In 1999-00, Australian Commonwealth tax expenditure was \$1.6 billion of which one-half or \$800 million was for manufacturing. Including the *special* PMV and TCF sectors (9.6.2) and duty refunds for exports, is a Development Allowance <<??>>(\$35m), Pooled Development Funds (\$3m) and the R&D tax concession (\$180m).

Budgetary outlays for manufacturing for manufacturing were \$700m. Again excluding PMV and TCF related outlays, components were split between Direct Financial Assistance included; SIIT incentive (\$40m – refer 9.8), Pharmaceutical Industry (\$110), Export Market Development Grants scheme (\$55m), IR&D programs (\$170m), Technology Diffusion Program (\$27m), Agri-Food Industry Program <<??>>(\$5m), Austrade (\$65), Cooperative Research Centres (\$40m), CSIRO manufacturing research (\$85m), Enterprise Development Program (\$6m), Invest Australia (\$15m).

## 9.6 The Pilbara Petrochemical Project (or PPP)– an international bargaining chip?

<<BOX THIS, cross reference and expand>>

Since the early 1990s, multinational petrochemical companies have expressed interest to establish a world-scale petrochemical project on the Burrup Peninsula, in the north-west of Western Australia. It is being referred to as the Pilbara Petrochemical Project (PPP). At Dampier on the Burrup Peninsula is where there are world scale liquefied natural gas (LNG) export facilities operated by the Woodside Joint Venturers. While different combinations of chemicals have been proposed, the core is the production of caustic soda (sodium hydroxide) and ethylene dichloride. The interest is driven by the proximity of the key factor inputs and a large market in Australia for the caustic soda.

Australia is the world's largest deep-sea importer of caustic soda, with over one million tonnes per year used by the alumina industry of which some 70 per cent is in Western Australia. Caustic soda is manufactured in a chloralkali process from salt and gas (and energy) that are exported in very large quantities from the Burrup Peninsula. The manufacture of caustic soda co-produces chlorine which is a hazardous chemical and so it is generally converted to another chemical most commonly EDC.<sup>70</sup>

This \$2 billion project has not progressed beyond a pre-feasibility study – in 1999 it was deferred, while Shell, as a partner with Dow Chemical, has threatened to withdraw identifying inadequate Australian government financial support.<sup>71</sup> Although there are large markets – caustic soda in Australia and EDC in Asia, there is inadequate ethane available to support a world scale ethane (C<sub>2</sub>) cracker to produce the *carrier*, EDC, for the co-produced chlorine. Lack of ethane restrains the scale of operation and therefore results in operating cost penalties that implies reduced competitiveness. While the proposed ethane cracker would have a 650 000 tonne capacity - 50 per cent larger than the *combined* output all three

<sup>70</sup> EDC is a common abbreviation for ethylene dichloride used exclusively to produce PVC polymer resin via VCM, vinyl chloride monomer. Its production requires an ethylene source normally produced at scales approaching one million tonnes per year. Due to its hazardous nature, and with no alternative disposal potential, chlorine is not shipped in bulk and transported as EDC or VCM. At times, the value of the chlorine component can actually become negative, offset by the value of the co-produced caustic soda. At such times, the ethylene becomes the *vehicle* to move the co-product chlorine to the market for PVC producers like Australian Vinyls in Victoria.

<sup>71</sup> Asian Chemical News, Vol. 5, No. 220 14/06/1999 P27

ethylene units in Australia, it represents operating cost penalties of around 20 per cent on the variable cost of production.

It is relevant to note that Woodside and its partners established contracts to export LNG gas that is unusually rich in ethane to Japan. The ethane component is now locked out from use as feedstock within Australia.<sup>72</sup> Domestic use gas, or new fields such as Gorgon, is now the only potential supply of feedstock ethane.

It is also relevant to note that propane (C3) and butane (C4) are extracted with 800 000 tonnes sold as LPG. Is there a case for government failing to provide for a clause for the development of W.A.'s *wet*, ethane-rich, LNG and to make the ethane available for the PPP? Is it a case where the ethane could be held as an undeclared *hostage*: keep it locked away and obtain assistance to compensate for lack of consequent scale of the PPP? Compensating for LNG contract renegotiation; using propane to replace ethane; or contingency compensation is more rational than offsetting inadequate scale. Let me explain with two government initiatives.

The Federal Government, through the Office of Strategic Investment Coordinator, has offered \$100 million to encourage an alumina refinery in Queensland. It is a strange offer as it would compete with alumina refineries in Western Australia.<sup>73</sup> It is even more difficult to accept if one recognises that if those W.A. refineries expanded, their production by the amount the new refinery will produce, up to 160 000 tonnes of ethane could be made available in W.A. from domestic gas.<sup>74</sup> Malaysia is also bidding for the alumina project, but should government disadvantage not only the existing alumina producers, but also W.A.' potential ethane supply?

To make the matter more complex, a second offer by government is being made to PPP joint venturers, Dow/Shell<sup>75</sup>. In a sense, Offer Two compensates for the lack competitiveness of scale caused by limited ethane supply. Remember, Offer One, for the Queensland alumina refinery, reduces the availability of ethane in WA and so then undermines the value of Offer Two for the PPP venturers, Dow/Shell. What is the return to us, the providers of the capital, infrastructure and the owners of the resources? Both offers can be bargaining chips against overseas offers for the operators.

Is this auction approach, in response to a corporate strategic game, in our interest? Is it the best Australia can do? I of course acknowledge Queensland's interest in a gas line from PNG that requires a base load helped by the alumina producer. As I will show, Offer Two clearly compensates for inadequate ethane and reflected in inadequate operating scale. Does Government really understand?

Dow's partner Shell, has a one-fifth effective interest in Woodside's LNG production. Why is not the C2 component extracted for beneficial use – after all, Santos did so for two decades in South Australia *and* reinjected it into the ground for future use. What if the PPP is nothing

<sup>72</sup> One tonne of ethane-containing LNG (*wet* gas) has more energy and so, with the ultimate use as an energy source in Japan, will present shipping cost savings and, for the user, reduced distribution and storage costs. *Wet* LNG, as provided by W.A. will attract a premium per tonne over competing *dry* gas suppliers. Tied up in Schedule A-type supply contracts, it is not clear how much of that premium is shared between the Australian suppliers and Japanese customers.

<sup>73</sup> Asian Chemical News, *Australia: a hurdle too far? The Pilbara cracker project faces an even greater problem*, Vol. 5, No. 224 12/07/1999 P30.

<sup>74</sup> The Comalco alumina project will require 27 petajoules of gas per year at stage one, increasing to 80 petajoules by stage three. Given one petajoule is about 20 000 tonnes of gas, the ethane content, assuming 10 per cent gas, would range from 54 000 tonnes to 160 000 tonnes per year at stage 3.

<sup>75</sup> Australian Financial Review, October 1999, "*Deal close on \$2 billion W.A. ethylene plant*". Refers to meeting of Senator Nick Minchin with Dow Chemical in Chicago, USA.

more than a 'bargaining chip' dressed up as a prefeasibility study to get a better deal from the Malaysian government? Are we in Australia being duped? A one million dollar pre-feasibility study by Dow/Shell being levered to a likely subsidy from Australia but then levered against another location. There *will* be a new petrochemical venture in the Asia-Pacific region and while I hope I am wrong, the evidence points to one of two scenarios.

- A leverage to gain Asian government incentives; the venturers spend one million dollars in Australia and get at least hundred of millions from another government; or
- Australian government assistance to compensate for inadequate ethane that results in another underscaled project. While W.A.'s unusually ethane-rich LNG may indeed now be locked away in supply contracts with Japan, that is not to say they may not be released later, or supplied from alternative sources (such as Gorgon in which Shell has an interest). A far better deal might be to link any assistance with the release of the hostage ethane – ie. as compensation for LNG contract renegotiation.

### 9.6.1 Export subsidies

Growing international trade has promoted interest in policies on trade to achieve domestic goals and defend against the "unfair" trade practices of foreign firms and countries. Export subsidies are one form that provides direct assistance to industry by helping expand sales to foreign markets without reducing the sales of other domestic firms. This can be used to offset import tariffs in foreign countries. Export assistance is however subject to the same concerns as other forms of industry assistance in reducing competition and distorting the market and thus undermining their intent. Porter for example observed export subsidies provide an incentive to divert supply from the home market to foreign markets driving up domestic prices and reducing home market consumption and so presenting a community cost. Spencer<sup>76</sup> concluded that export subsidies while reducing the impact of foreign competition, could also provoke a price war that lowered profits and reducing their value.

### 9.6.2 Export subsidies in Australia

In 1999-00, Australia outlaid some \$1.0 billion in export assistance of which 95 per cent was in a direct form (the indirect form comprises of some \$12 million for shipbuilding bounties and \$30 million for the 'Pharmaceutical Industry Development' program).<sup>77</sup>

Direct export assistance (ie. \$0.95 billion) outlays comprises around 40 per cent for the 'special' TCF and PMV industries<sup>78</sup>, 40 per cent for 'export market and promotional services' represented by Austrade, the Export Market Development Grants scheme and the Australian Tourist Commission.<sup>79</sup>

In 1998, wholesales tax exemption was provided for space vehicles and satellites to be launched in Australia aimed at promoting a commercial space industry in Australia.

<sup>76</sup> Spencer Barbara J, *What Should Trade Policy Target?* 'Strategic Trade Policy and the New International Economics', p70. 1993 Paul R Krugman Editor.

<sup>77</sup> Industry Commission, 2000, *Trade and Assistance Review 1998-99*, Annual Report Series, AGPS. Canberra Table 4.2.<<<check later>>>

<sup>78</sup> The Textile Clothing and Footwear (TCF) and Passenger Motor Vehicle (PMV) industries have traditionally being afforded higher levels of assistance and protection; the former benefits from the *Import Credits Scheme*, the latter from the *Export Facilitation Scheme*.

<sup>79</sup> Other outlays were for tariff refunds (\$150m) and an *Export Access* program (\$5m).

## 9.7 Targeting

Industry development policies are often targeted to give priority to particular industries on the premise of achieving greater public benefit and improve the return on government resources. Those targeted include the so-called “sunrise” industries by observing their growth in other countries or simply identified by projections of growth trends.

Targeted policies, aimed at particular industries may be direct or indirect. Direct targeting includes subsidies, selective protection and the channelling of capital. The less directly influential forms are indirect that include government “white papers”, investment in specialised educational institutions and the sponsoring of trade fairs aimed at some industries.

Porter observed targeted policies were even more prone to failure than the more general policies of government (8.1). Targeted policies in particular failed because they were often biased to politically influential industries or regions for non-economic reasons. Reasons for targeting included for the aim of “regional development” that in reality was aimed at electoral support (job creation); being sensitive to job losses; protecting emerging industry though it would reduce the competitiveness of downstream industry; or creating weak and dependent industries because there was no functional support within the economy, notably from the key determinants of the diamond.

By its very nature, targeting measures function by distorting the market signals to which industry responds and by that reallocates resources to selected industries. Even identifying an industry sector for targeting may have that influence serving to attract investment by signalling the government's confidence and implicitly prospects for its support. <<<The PPP.>>> It however also involves resources being bid away, increasing their cost to other firms. In other words, presenting politically visible benefits for some, with the less visible, distributed cost, absorbed by the economy at large. It occurs in the absence of consumer based countervailing political influence to provide balance that recognises the interest of the public at large.

Overall, Porter found governments to have been unsuccessful in targeting business without a net cost to the country. The worst results were when it focussed on price-sensitive segments based on factor costs and scale economies as these often resulted in large underutilised plants that through the political process became the focus for on-going appeals for support and assistance.

In a general sense, governments that undertook targeting and protection measures were observed by Porter to create counterproductive tension, distrust and paternalism as the hidden costs of doing business in the region. Better results than targeting are achievable by using indirect forms of industry assistance aimed at upgrading demand conditions, human resources and scientific expertise, including the upgrading of specific skills or technologies that are important to many, and not just a few industries.

### 9.7.1 Australia

In Australia, state Governments commonly practice targeting for ‘marginal’ projects in order to increase the effectiveness of the assistance provided. This has been criticised by the Productivity Commission as ‘...attempts to buy development with selective assistance can be at the expense of getting the fundamental business climate right, and the provision of

community services.<sup>80</sup> It has delivery costs ranging from 28 to 80 per cent and is often supported by flawed evaluation techniques – a reflection of a *prisoners' dilemma*.

### 9.7.2 Observations and conclusions

The previous measures, in improving competitiveness, will attract investment. These address the fundamentals of the economy helping not only domestic firms, and influence multinational firms. Government may also take steps to address inaccurate perceptions of the country such as by investment promotion and facilitation that informs investors about the countries fundamentals.

Government will also often undertake specific measures to promote investment. One such measure is the SIIP (9.8).

There is no clear evidence to suggest investment incentives are particularly important to locational decisions. <<BIE, UNCTAD<sup>81</sup> the bulk of literature points to the importance e of market factors such as the size and growth of the market as the drivers of investment.

## 9.8 Strategic Investment Incentive Program

The Strategic Investment Incentive Program (SIIP) was established in 1997.<sup>82</sup> An Office of the Strategic Investment Coordinator (OSIC) was established to assess and advise the Government on the merits of providing investment incentives for select projects.

The *Investing for Growth* Statement<sup>83</sup> outlined broad eligibility criteria in determining the provision of incentives. These are in limited and special circumstances if:

1. The investment would not be likely to occur in Australia without the incentive.
2. The investment provides significant net economic benefits through:
  - a. substantial increase in employment;
  - b. substantial business investment;
  - c. significant boost to Australia's R&D capability;
  - d. significant benefits to, or investment by other industries, either users or suppliers (cluster investment); and
  - e. ensuring that it does not involve substitution of existing production capacity which would provide an unfair advantage over other competing projects.
3. The investment complements areas of Australia's competitive advantage.
4. The investment is viable in the long term without the subsidy.
5. The incentives are open to foreign and domestic investors.
6. The quantum of project specific assistance takes into consideration the availability of other assistance from Commonwealth or State or Territory governments.
7. Any incentives are consistent with our international obligations including under the WTO.

<sup>80</sup> Productivity Commission, 1996, 'State, Territory and local Government Assistance to Industry', AGPS, Canberra page xxix.

<sup>81</sup> United Nations Conference on Trade and Development, 1996, *Incentives and Foreign Direct Investment*, Division on Transnational Corporations and Investment, Current Studies Series A, No. 30, UN, New York.

<sup>82</sup> Recommended by the 'Review of Business Programs 1997', *Going for Growth – Business Programs for Investment, Innovation and Export*, (Mortimer Report) Canberra, David Mortimer Chair; and Goldsworthy, A. 1997, *The Global Information Economy: The Way Ahead*, Report of the Information Industry Taskforce (Professor A. Goldsworthy, Chair).

<sup>83</sup> Commonwealth of Australia 1997, *Investing for Growth*, the Howard Government's Plan for Australian Industry, December.

### 9.8.1 Commentary on SIIR

The incentives are intended to apply in limited and special circumstances and can take the form of grants, tax relief and the provision of infrastructure services. High technology projects with 'strategic' characteristics are targeted.<sup>84</sup> To date only two projects have been awarded or received assistance under SIIP - \$40 million for a paper and pulp mill in Tumut and an alumina refinery in Gladstone ().

In September 1999, the Government decided to increase the scope of investment incentives to offset the removal of accelerated depreciation on large capital-intensive projects with long lives. It will consider such projects in context of an expanded strategic investment coordination process, including the consideration of the option of targeted investment allowances.<sup>85</sup>

In 1999, the North West Shelf project<sup>86</sup>, among others was nominated.<sup>87</sup> Only two out of a dozen project proponents have reached Cabinet while rejections, including social cost-benefit analyses, are not made public, the government is concerned not to create a hand out mentality and assistance may be refused if other companies are operating in the industry without help.<sup>88</sup>

The Productivity Commission's Trade and Assistance Review, 1998-99<sup>89</sup> said: *Unless applications for selective assistances are carefully vetted, a proportion of assistance provided under programs such as SIIP (9.8) could entail net costs to the community. Indeed the Commission considered that it is better to fund specific improvements of Australian endowments (such as roads, skills, and R&D) critical to foreign investments than to provide subsidies directly to shareholders, including foreigners.* The Commission recommended, to minimise economic risk, that:

- The program should reflect the extent to which it is *new* to Australia (to avoid simply transferring income to shareholders);
- Subject to rigorous cost benefit analysis, including sources of spillovers;
- The amount be capped to impose a discipline and bargaining power of government; and
- The program should be monitored to increase effectiveness.

OSIC has indicated its considerations include *whether Australia is competing to attract the investment, or whether the proponent is considering its investment in an overseas location.*<sup>90</sup>

Clearly, businesses will engage in strategic behaviour that will mask its intentions and whether it is strictly *new*.

<sup>84</sup> OSIC also provides a Major Projects Facilitation service providing fast tracking for government approvals for investments above \$50 million.

<sup>85</sup> Costello, P (Treasurer) 1999, 'The New Business Tax System', *Press Release*, 21 September.

<sup>86</sup> The North West Shelf project is an offshore natural gas and petroleum liquids process project located in the north west of Western Australia.

<sup>87</sup> Question without Notice: Business Tax Reform: Accelerated Depreciation, House of Representatives, *Hansard*, 22 September, p 7740.

<sup>88</sup> James, D 1999, 'Australia's The Next Step', *Business Review Weekly*, 2 July, pp 84-7.

<sup>89</sup> Industry Commission, 1999, *Trade and Assistance Review 1998-99*, Annual Report Series, AGPS. Canberra.

<sup>90</sup> Industry Commission, 1999, *Trade and Assistance Review 1998-99*, Annual Report Series, AGPS. Canberra

## 9.9 Regulations and product standards

Regulations and standards imposed by government are generally perceived by industry as presenting cost imposts to reduce their competitiveness. These include those on product performance, safety, the environment, energy-efficiency, operating conditions and for product liability.<sup>91</sup> While these impose a compliance cost and influence industry, Porter however observed that when these regulations and standards are more advanced than in competing countries, they also serve to enhance the sophistication of the home market motivating innovation contributing to international competitiveness.<sup>92</sup> Advanced regulations and standards are important incentives to upgrade and the resultant competitiveness overwhelms their cost impact commonly identified by industry. Conversely, regulations that are anachronistic or less advanced, reduce the incentive to innovate and enhance industry competitiveness. <<example environmental equipment>>> By implication therefore, if the government regulatory agencies are too sensitive to claims about their cost impact, they undermine the competitiveness of industries creating opportunities for foreign suppliers with more advanced products.

An important role for the regulatory government agencies therefore is to promote and enforce regulations and standards that enhance buyer sophistication to at least match international standards. With potential by that to stimulate or retard industry, an important function for government is therefore to monitor trends in the development of foreign regulations, standards and attitudes <<< Olympic Games PVC>>>. A system of international review should monitor their development to ensure domestic regulations and standards are at least equal, and by anticipating trends, and perhaps even more advanced. Clearly too there is an important role to promote their early adoption necessarily combined with rigorous enforcement by government.

While adopting standards that are advanced by international standards aimed at promote competitiveness, if too advanced, they serve to create a guaranteed market severely discriminating against foreign suppliers and, by reducing competition, in the end reduce competitiveness undermining the intention.

Government agencies often represent a significant part of the market for many suppliers and require advanced or products with international standards. To help reduce the compliance cost government could provide reduced cost testing services.

Thus while many of the regulatory agencies define their roles in social or public welfare terms, they miss their potential valuable role of stimulating national competitiveness. These agencies can therefore be very instrumental in promoting a sophisticated home market and hence promote a competitive industry.<sup>93</sup>

## 9.10 Regulating competition

While still ensuring their primary role of ensuring social welfare, government agencies can influence competitiveness by regulations influencing domestic and international competition.

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<sup>91</sup> Too extreme however, product liability laws and other regulations can in fact serve to retard innovation and competitiveness.

<sup>92</sup> An obvious conclusion is that reducing the incentive for firms to comply with such regulations only serves to reduce innovation and incentive to upgrade and is therefore counterproductive to international competitiveness.

<sup>93</sup> This is not a principle that applies to distribution channels as regulations only serve to increase costs undermining the competitive advantages of other industries.

### 9.10.1 Regulating diversification, acquisitions and mergers

Diversifications, acquisitions, mergers and alliances (alliances are detailed 9.10.3) consolidate competitors and will influence competitiveness though influence on location, personnel, relationships, markets, strategies and products. They are justified by management to reduce costs and duplication and enable economies of scale. They may also be motivated simply to reduce competition when management has become preoccupied with financial performance and stability.

Porter's key observation is that firms that do not compete in the home market rarely succeed in foreign markets so that intense domestic competition is in fact the essence of national advantage. On accepting this principle, the benefit of consolidations - of reducing wasteful and excessive competition has to be weighed against the outcome of reduced the incentive to develop international competitive advantage that should follow from reduced domestic rivalry. In other words consolidations requires a trade-off of immediate operating cost benefits and scale economies against longer-term penalties of reduced international competitiveness.

### 9.10.2 Regulating competition – some conclusions

Porter observed consolidations to be associated with impending failure and reduced rivalry that detracted from innovation, focus, commitment and sustained investment in core activities and industries. Industry consolidations commonly undermined long-term development. Where it was a diversification, reflecting the original motivation, management generally lacked the vision to drive their new business in the optimal direction to gain competitive advantage and even prone to failure as management underestimated the source or extent of their firm's competitive advantage. Consolidations also promoted a reliance on local factor cost advantages detracting from the incentive to upgrade the factors to gain competitive advantage.

While the justification of consolidations was that they provided for the development of valuable scale economies enabling worldwide sale, the reduced dynamic home base in fact was observed to reduce that capacity. Porter concluded that the sought after economies of scale would instead best be gained by the firms selling globally reflecting their individual competitiveness and not just by their merging to dominate the home market.

Consolidations aimed at achieving a specific advantage, could however become an important contributor to long-term success by being able to take selective advantage of the sources of advantage in national diamonds and being able to supplement the firm's own source of advantage.

Porter therefore recommends a diversification, acquisitions or a merger could be effective for the long term development on compliance with the following considerations.

Involves a large firm acquiring a smaller firm to transfer skills.

Provides for vertical collaboration between suppliers and buyers without unduly excluding other competitors.

Has common buyers, distribution channels, suppliers and technological connections.<sup>94</sup>

The consolidated firm is small in the home market so as not to weaken competition.

<sup>94</sup> Dispersing productive activities may help access to foreign markets and foster commitment to foreign buyers but loyalty to domestic suppliers for its own sake is self-defeating as there should always be aggressive upgrading of quality and productivity with globalised strategies.

For the individual firms, the considerations include:

Even if motivated to access foreign technology, there should be a knowledge base at home with the ultimate aim of self-sufficiency.

The acquisition relates to the home base.

Extends the firm's current clusters.

The consolidation contributes to the diamond, by adding to competitive advantage.<sup>95</sup>

In the main, with the exception of the aforementioned, Porter reasons that government should prohibit or at least not encourage joint production and most other forms of direct cooperation and mergers by leading competitors. This clearly has implications on simplistic industry policies that consider immediate impact without regard to the long-term consequence of undermining the vitality that promotes competitiveness.

Porter found the best performing firms were those with the strongest competitors in the home market. As corollary, if a firm relocates because of a consolidation, its headquarters should be to where there are leading international competitors and sophisticated buyers that create important competitive challenges and motivation.

### **9.10.3 Alliances**

Alliances are long-term agreements between firms from different countries that exceed normal market transactions such as joint ventures, licenses and cross licences, and sales or supply agreements. Like mergers, they are particularly common in industries undergoing structural change during intensive competition.

Alliances have become common as they accelerate the globalisation process; provide economies of scale, access to markets and other benefits without loss of corporate independence or incurring the cost and inherent disadvantages of mergers. An important advantage is that alliances enable firms to benefit from factor advantages in other countries.

Porter observed however that alliances involve significant costs in terms of coordination and reconciliation of goals. Often created by a competitor in some related activities or in management, alliances also reduce the incentive to improve their sources of competitive advantages by eliminating an important competitor with a consolidation of management.

Porter therefore concluded that most alliances were only transitional relationships for failing to enhance the true competitive advantage of firms. Only alliances that involve particular parts of the value chain or specific product lines or markets were successful in strengthening the alliance. <<,Role of industry associations - halfway house??>>

### **9.10.4 Regulation of international competition (protection)**

Government has used import tariffs, restrictions on imports and other forms of assistance to protect home industry from foreign competition. The overwhelming evidence points to their failure to stimulate competitive industries. It is therefore only justified for promoting new emerging local industries, or to allow for the adjustment of established industry. Even where, protection was instigated for short-term initiatives, it often became long-term after

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<sup>95</sup> The newly acquired firm should be given responsibility for one item in the product line where it represents a superior determinant of the diamond. Porter however also found that extensive integration might weaken the diamond by withdrawing skills and capacities that help with a sensitive and rapid response to local conditions that is essential for competitive advantage. Therefore, to avoid this weakness, where the new business assumes the nature of a subsidiary, it should ideally be fully integrated into the firm and become part of the corporate culture even though this may be difficult to achieve far from its home or its core research base.

intense lobbying from industry to a politically sensitive government. Protection therefore has only served to delay the process of industry restructuring with little evidence for promoting a basis for competitive industry.

According to Porter, industry protection could be justified if:

There is strong domestic rivalry that substitutes for international competitive pressure.

There is potential for a favourable national diamond (ie. potentially favourable factors and conditions).

During Stage 1 or Stage 2 (5.1) of industry development.

It is assured to be of limited duration.

#### **9.10.4.1 Regulation of foreign firms**

While extensive foreign investment may signal an unhealthy domestic environment for innovation and upgrading, according to Porter, foreign investment should only be opposed if:

It undermines domestic rivalry.

It is retaliatory because market access to the country of the foreign firm is restricted, or firms from that country have practiced unfair trading practices (such as dumping<sup>96</sup>).

Criteria for promoting investment and their relationship with indigenous firms in developing countries are described in **Error! Reference source not found.**

### **9.11 Timing of government policies**

Government has the greatest direct and beneficial influence as decision-maker during factor-driven Stage 1 (5.1.1) and the investment-driven Stage 2 (5.1.1.2) of national development. At these stages, according to Porter, government may direct factor creation, promote the accumulation of capital for investment; upgrade education and infrastructure; and develop a technology base. At that time, government may focus on select industries; promote risk taking through implicit or explicit guarantees of assistance; stimulate and influence the acquisition of foreign technology; and provide temporary protection to promote domestic rivalry and the upgrading of facilities and infrastructure. To the extent practicable given the early stage of industry development, such intervention should be helped by anticipating growing domestic rivalry and an efficient capital market to support new competitors.

As a country progresses to the more advanced innovation-driven Stage 3 (5.1.1.3), its government should assume an indirect role as a facilitator, signaller and promoter to avoid retarding the upgrading of industry that would otherwise occur. As some firms benefit from slowing the transition from Stage 1 to Stage 2, government must be capable of resisting the lobbying from industry to maintain assistance measures. This requires some preparation to anticipate the out come of the shift of its policies in the next stage of development with appropriate public relations measures. During such transitions government should also ensure effective anti-monopoly controls so as not to reduce competition that would result from the mergers and acquisitions of firms that tend to evolve (9.10.1).

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<sup>96</sup> Anti-dumping legislation is aimed at restraining imports supplied at below the variable cost of production. An alternative form of remedy to dumping, without presenting itself as a form of protection, is to restrict firms from offending countries from investing in the country.

## 9.12 Capacity to change – a *public good*

In a dynamic system, competitiveness reflects the capacity to upgrade and improve performance to regenerate the sources of competitive advantage. It requires; planned movements along the learning curve of improving productivity; the address of dislocations of supply, of production and distribution; and reassigning and changing the input factors that influence its organisational structure and performance. Those changes begin with the firm's management that monitors deviations and signals of change, and then interprets the information as relevant to the organisation for amplification and application. The extent to which these changes are identified and responded to depend on the firm's ownership, its relationships, internal structures, and especially for chemicals, the scale and product range. These are issues internal and private to the firm.

How effectively firms and investors become aware and respond however, will also depend on relationships and access to relevant information - their capacity for change. That capacity could be described as providing either a third dimension to Porter's diamond, or that which ensures that the four determinants are related – to enable the required interaction <<<review and expand>>>. Given these are external to the firm, implicitly identifies an important role for government to protect this externality as being in the public interest.

### 9.12.1 Government – guardian of capacity to change

In representing the public interest, government has a role of enabling the capacity to create wealth that in a dynamic system requires an environment supportive of innovation and adaptation. This has been the defined role of government - to promote a competitive environment. The capacity of the business environment to undergo the required changes will depend on how able and willing it can detect, interpret and respond. To create a responsive environment, government would have a more facilitative and more indirect role than previously defined for it. The role of government would then be to focus at the macro-level to ensure the framework and environment of industry is conducive to deal with the necessary changes; to identify the imperfections in the business environment; and ensure the flow and accessibility of relevant information. All these relate to adaptation and change. Premised on the principle then that the capacity for change is key to competitiveness, it could be ascribed as being a public good with government as its facilitator. Simply put, government would become the guardian of change, facilitating the management of the business environment and its capacity for change. Government is now providing the additional facilitatory links to reinforce the diamond, instilling institutional capacities to promote change at a macro level to help productive capacity and competitiveness.

The aim of government is then to promote an environment conducive to qualitative and irreversible change, and not necessarily to promote stability.

With the capacity to create wealth now related to the capacity to change, will now also require a culture and a political tolerance supportive of what could amount to sometimes large-scale reorganisation with often politically visible losers with long-term pay-offs expressed outside of the current re-election cycle. Government does not then operate by implementing any preconceived plan or intervening at the micro-level to pick winners or protect losers. Instead, it has to be independent of secular and political interests and rely on industry with its capacity to identify opportunities and apply resources at the appropriate time. One role for government would therefore be to highlight industries in decline and opportunities for development and new investment. This requires mechanisms for diagnosing structural problems, designing policy responses, developing solutions and managing their implementation on an industry-wide basis. It will also require skills for systematic planning that are different to the micro-oriented skills of business that are for particular corporate objectives and regions. The skills of Government will be to promote

structural change and transformations that are of much higher complexity than required by business.

Acceptance of this implies the development of a relationship of industry <<<problem here given old and foreign industry in Australia!!>>>> and government based on a dynamic approach to manage the required changes to invigorate the chemical industry in Australia.<sup>97</sup>

It requires considerations of structures and relationships. <<models Japan, the Netherlands, Singapore>>>

### 9.12.2 Political framework

This section will consider Federal and State government policies and instruments as they influence current and potential industry.

It will largely be a review by documentation and personal interview with Government agencies, industry and potential investors. Where practical, this will be benchmarked against the competing Asia/Pacific regions. Particular emphasis will be a review of the role of Governments in countries with successful chemical industries. Net public benefit of some initiatives will be assessed.

The mechanisms to share the experience gained from the learning process into other contexts.

Political barriers preventing model/vision for the industry from emerging. Demand influence for secular/state gains.

Necessary steps to promote preferred model

Steps for adoption.

Costings.

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<sup>97</sup> Metcalfe, Les 1993. *The Government's New Role in Managing Competitiveness*. Australian Journal of Public Administration. Vol 52 No 3, September 1993.

## 10 INDUSTRY ASSOCIATIONS

In consolidation of the study, a review of potential initiatives by Governments and industry associations in the context of the Australian system of government. It will include an assessment policies and mechanisms to enhance the competitiveness of the chemicals industry. These will include the promotion of capacity for change, pooling of visions and trends and their promotion, provision of common-use infrastructure and other initiatives with a net public benefit.

Comparison with successful chemical industries in other countries.

<<<clusters>>>>

As illustrated by the very successful Italian ceramics industry (), the enhancement and maintenance of competitive advantage implies a more tangible and pro-active role for industry associations than frequently practised.<sup>98</sup>

Industry associations can:

- Help with communications, logistics, investigating technology, holding trade exhibitions and even working with educational facilities.
- Provide the critical mass, where its membership was individually too small to offer training in the necessary critical skills.
- Promote the funding, and even creating the specialised research institutions.
- Organise trade fairs and other forms of foreign market promotion.

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<sup>98</sup> According to Porter, most associations are primarily concerned with lobbying for quick fixes such as protection, promoting a bias to national goods, regulatory standards, subsidised capital and energy and for seeking permission to merge with competitors.

## **11 IDENTIFICATION OF SHAPING FORCES**

The study will identify the influences of government policies, resources, technologies and demand had on the shaping of today's industry.

This will be undertaken by a strategy-based analysis of the development of company and industry sectors since around 1920 using information maintained by the author. It will examine the products and relationships of raw materials between industry sectors with commentary on industry relationships as these influence competitiveness. This section will contribute to understanding of the form of today's industry.

### **11.1 Case studies.**

Why and how the chemical industry could do better.

Details of some key industry sectors such as polyolefin petrochemicals, titanium minerals, ammonia and ammonia chemicals (sodium cyanide, ammonium nitrate and urea). It will describe the opportunities and impediments to the development of the industries. This will include cost sources, the presence of related industries and other services and other influences on the industry.

### **11.2 Influence of today's industry on new investment.**

The current industry has been substantially shaped by past government policies. There will be an assessment of the two-way influence of current industry on potential new investment.

This will be undertaken by a largely strategic assessment of; available resources; market opportunities; and indications of new investments for potentially manufactured products. These new activities will be exemplified by case studies (eg. titanium minerals, chloralkali and ammonia). Influences will be considered with respect to their strategic two-way relationship on current Australian chemical manufacturing activities. This section will be developed from information provided by the author, industry and relevant government agencies.

#### **11.2.1 Performance**

Sources of comparative advantage and disadvantage of the Australian chemical industry.

Assessments of efficiency - internal and inter-company. Review of potential synergies from developing new industries. Case studies including of industry parks.

The industry's perception - public and of itself. If improved, what could be the benefits.

#### **11.2.2 Potential ("The New") chemical industry**

Available resources, markets, current industry, trade opportunities with international perspectives.

The new chemical industry (referred to by the chemical industry association PACIA for potential industry in Australia). Description of the changes that could occur in terms of products, locations, relationships, competitiveness. Other activities that could be stimulated.

The potential industry compared with current.

Current industry versus potential.

Alternative models for development

The preferred model.

Factors that work for and against the model.

Comparisons with overseas examples.

Case studies. why and how the chemical industry could do better. details of some key industry sectors such as polyolefin petrochemicals, titanium dioxide, ammonia and ammonia chemicals (sodium cyanide, ammonium nitrate and urea) and chloralkali.

### **11.2.3 Benefits of the 'new industry'.**

An economic assessment of benefits of an expanded revitalised industry for Australia. Methodology to be defined.

Qualitative

Quantitative.

### **11.2.4 Industry Structure**

### **11.2.5 Potential industry relationships**

Consideration of effective business, institutional and service provider relationships.

Relationships with related activities as stimulus to new products and services.

## **12 THE FUTURE**

Consideration of some effective industry relationships and structures. Reference to study of industry clusters and their potential influence such as enhancement of external efficiencies and stimulation of other industry.

A quantitative assessment of the benefits of an expanded industry with description of potential industry and quantitative assessments including contributions to GDP.

**13 APPENDICES**

## 14 CLUSTERS

Clusters are concentrations of interconnected companies, institutions and entities representing organised chains comprising the value chain. They are described by linkages of vertical and horizontal relationships of suppliers of specialised inputs, infrastructure, customers, producers of complementary products, companies related by skills, technologies and common inputs. Component elements of clusters include government, universities, training companies and trade associations that provide specialised training, education, information, research and technical support <<<PACIA>>>. Though generally of a regional nature, clusters sometimes stretch across political or geographic boundaries, most however have a home base.

Industry clusters are developed from the interplay of several determinants of the diamond (4.1) which when shared by a group of companies, promotes a sustained competitive advantage. A group of industries can become mutually supporting with interconnections promoting new ways of competing and exploiting opportunities.

A cluster is therefore a system whose competitiveness is greater than the sum of the benefits of the individual determinants from the external economies.<sup>99</sup> As a system of relationships, clusters are therefore difficult to replicate by foreign competitors, a country's industry is more competitive when its firms are related by clusters. The external economies presented by the clusters directly benefit industry and also help related industries so that it is even possible to develop an international firm without a significant home market.<<<Krugman and economic geography>> Also A Marshall<sup>100</sup>>> Factor creation will then increase and the resulting new industries are then commonly promoted as prestigious and as national priorities.

Broadly therefore, clusters tend to:

- Draw attention to the industry.
- Create diversity and incentives to speed the rate of innovation.
- Stimulate new rivals through spin-offs.
- Create and attract factors of production.
- Upgrade and expand demand in the home market.
- Encourage and upgrade related and supporting industries.
- Guide government into developing more effective policies.

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<sup>99</sup> *Economies of scale* allow fewer resources being used per unit of output as represented by a downward sloping average production cost curve with increased production, clearly important for commodity, raw material-intensive products such as petrochemicals. Economies that are internal to the firm including through its subsidiaries in overseas countries, are largely related to the scale of its operation. External economies from its relations with other firms, as recognised by the *clusters* (14) concept, are longer lasting and can provide more significant long term advantages. This raises an important implication for policies that where the economies of scale are external to the firm, but internal to the industry, the firms marginal cost of production exceeds the industry's marginal cost. The competitive industry will produce less than the socially optimally level of output. This would imply a reason to assist production by the firm (eg. by a production or export subsidy) to correct for the distortion created by external economies.

<sup>100</sup> Marshall, A. *Principles of Economics*, London Macmillan, 1920. Marshall identified:

- Pooled markets for workers with specialised skills
- Non-traded inputs specific to an industry in greater variety and at lower cost (eg. subsidiary trades and services).
- Technological spillovers.

There are many examples, early on noted by Marshall in the UK, with the steel manufacturing centres of Sheffield, and textiles in Manchester in the UK. In Europe and the USA, manufacturing belts have developed that persisted well beyond the reason for their establishment as for example the great bulk of the U.S. manufacturing was concentrated in a small part of the northeast of the country. One hundred years after its establishment, it still represented two-thirds of US manufacturing employment even though the great bulk of raw materials were by them imported from other regions and it was no longer near the centre of markets. During that time, the key advantage was transport related though it was slowly being replaced by economies of scale taking advantage of new technologies. For three-quarters of the time, the pull of established manufacturing was strong enough to resist the appeal of new developing markets in the west and new sources of raw materials that would have suited the establishment of new centres in the resource endowed state of California.

## 14.1 Cluster advantages

Clusters offer many advantages including flexibility, the cost and quality benefits from competition, competitive supplies, lower entry barriers, enhanced information, synergy benefits and increased innovation and productivity.

### 14.1.1 Flexibility

Clusters promote competition and cooperation without formal networks, alliances or partnerships. As shown later, through motivation and effective relationships, clusters stimulate efficiency, effectiveness and flexibility. Without the inflexibility of more formal relationships, they provide mutual or synergistic benefits that help their growth, reinforcing their fundamental comparative advantages.

### 14.1.2 Competition benefits

Broadly, clusters comprise entities that help each other as even competing companies and institutions often cooperate at some levels of their operation <<<Dow and Chemplex – though not quite a cluster!!>>>. Through competition, clusters therefore tend to:

- Increase productivity as local rivalry motivates executives to compete to outdo each other and promote a favourable image.
- Promote direction and motivation for innovation, as it is easier to measure and compare performance.
- Stimulate new business (which strengthens the cluster) as opportunities are generally more apparent.

### 14.1.3 Competitive supplies (Pooling economies - see Krugman)

Clusters present more flexible and efficient supply chains without the traditional vertical integration and alliances. In other words, clusters tend to promote more outsourcing of suppliers and specialists that encourages the selection of the best for the purpose. Further, as opportunities are more visible in clusters, they tend to attract more suppliers presenting alternatives and keener competition.

In terms of goods and services, clusters therefore promote:

- Lower transaction costs with reduced inventories, import costs and delays.
- More responsive relations with greater flexibility and responsibility. Ancillary services are more commonly provided such as backup and support.

- As reputation is important, there is more competitive pricing and commitment rewarded by efficiency gains in marketing and services.
- Generally improved communications.

#### **14.1.4 Lower entry barriers**

Barriers to entry are lower in clusters because there may be:

- Lower operating costs representing a more competitive environment.
- Readily available assets, skills and personnel.
- More venture capital with lower risk premiums because; investors are more familiar with the business; more information about the nature of the industry helps signals opportunities; and enhanced Information
- With a more open structure, there are more personal relationships that promotes trust and information flows. [Very important - see Krugman (and Alfred Marshall writing in the 1890s!)]
- Opportunities are therefore more visible with an increased accumulation of business information.

#### **14.1.5 Synergy benefits**

Synergy is the mutual gains derived from business relations that are expressed within and outside of the cluster. Synergy benefits are expressed variously including in marketing, education and innovation.

#### **14.1.6 Marketing gains**

Clusters often enhance the collective reputation of the businesses and provide for joint marketing campaigns.

#### **14.1.7 Shared education, training and infrastructure**

Education, training and infrastructure help reduce costs and improve the skills base so that governments will therefore often provide special grants and other assistance for common user facilities and services such as roads, utilities, ports, and education. Equally, industry including competitors, may contribute to common user facilities such as quality centres, testing laboratories and educational facilities.

#### **14.1.8 Improved innovation**

Three factors promote greater and faster innovation in a cluster.

- Constant comparison with greater visibility and internal transparency, promote insights that are more rapid and the identification of opportunities in the market and in applied technology.
- In a more flexible environment, there is often faster response to the opportunities.
- With access to common shared facilities, experimentation often occurs at lower costs.

The interface of clusters provides particularly productive and dynamic sources of competitive activities and innovation.

## 14.2 Cluster beginnings

Clusters develop naturally though they may be reinforced by governments at later stages of development. There may be special conditions such as geography, regulations, environmental that have an influence, as does the existence of other clusters. Even historical circumstance can impact.

Cluster growth is self-reinforcing by signalling success they attract skills, entrepreneurs and people with ideas, suppliers, trainers, institutions, information, relevant infrastructure and research. With more visibility, they present lower relocation risks for employees and so extend the available skills base.

### 14.2.1 Clusters location

Clusters are more likely to develop near businesses in their home base though influenced by government policies (including by taxes and regulations<sup>101</sup>), legal rules, capital market conditions, factors costs as well as social and political values that may favour one location over another. (See also Location (6.1.3)). Clusters often develop with vigorous competition that is often reinforced by supporting institutions and government that provides funding for shared facilities and public goods.

Their localisation is driven by many influences such as workers convenience, flexibility for alternative employment, by avoiding monopsony employment, and employers with competitive alternative labour. Localisation will tend to occur unless the cost of transporting intermediates are particularly low compare with the cost of transporting final goods. Krugman<sup>102</sup> showed that a general reduction in transport costs, of both intermediates and final goods, will ordinarily encourage localisation rather than discourage it. <<<details of MIC Tiwest>>>>

In the absence of innovation, economies of scale, new technologies and shifting raw material, labour and factor costs can significantly erode clusters. In the US, standardised tyre production enabled large-scale manufacturing closer to markets leading to the cessation of Akron as the tyre capital of the world. In Australia it promoted to the decline of Rhodes, New South Wales as a manufacturing centre that began with the closure of Timbrol. Further, Porter found the worldwide declining cost of communication and transportation, combined with reductions in trade barriers increased, and not reduced, the importance of location and proximity. Personal contacts were found to be increasingly important and a good location helped improve the prospects for success in more distant markets. Even reducing the time to imitate with increasing mobility of technology, does not diminish the importance of proximity as in the end the competitive advantage is helped by the ability to respond to markets and employ and improve technology. Proximity therefore, provides an important source of competitive advantage. The implications are that locations become more sensitive to change in policies and other influences with falling transport and communications costs with significant impact on regional development.

## 14.3 Cluster decline

Clusters may decline for a variety of factors - external and internal.

<sup>101</sup> Being regional phenomena, clusters are therefore more sensitive to state and local government policies and initiatives.

<sup>102</sup> Krugman, Paul, *Geography and Trade*, The MIT Press, USA, 1991.

### **14.3.1 External factors**

Factors external to the cluster that may promote their decline are:

- Changes in technology.
- Changes in buyer needs.
- Inadequate information.
- Inadequate employees skills.
- Imposed influences such as regulations, restrictive union practices, reduced qualities of educational institutions and government measures to protect industry.
- Inadequate supporting services, firms and institutions.

### **14.3.2 Internal factors**

Factors internal to the cluster that contribute to a decline of a cluster include:

- Corporate rigidities such as extensive vertical integration.
- Relationship rigidities such as mutual understandings, cartels and relationships that reduce competition and rivalry.
- Failure to anticipate and accommodate new technologies.

## **14.4 Clusters and role for government**

Government policies should aim to help the basic foundations of clusters including those that help improve the education, skill levels, technology, access to capital and the general improvement of the institutions. Porter found policies could be both helpful and unhelpful to cluster development.

### **14.4.1 Policies that help cluster development**

Government policies that help cluster include those that promote:

- Competition between states and regions (as stepping stones to promoting international trade).
- Arrays of clusters, rather than just a few.
- The consolidation of linked activities in a region.
- On-going relationships with components of clusters.
- Industry associations that provide a forum for the exchange of ideas and action to overcoming obstacles to productivity and growth. (These activities include training, management, environmental, trade fairs and purchasing consortia). Governments should promote regionally focussed institutions, as national associations are often too broadly focussed to be effective for clusters.
- High quality inputs such as education, skilled workforce and physical infrastructure.
- Rules for competition by protecting intellectual property and anti-trust laws.
- Shared public goods and facilities that are valuable to many linked businesses.

- The building, rather than the creation, of clusters. A cluster should already have been tested in the market and built on local sources of uniqueness before being helped by publicly funded resources.

#### **14.4.2 Policies that disadvantage the development of clusters**

Government policies that undermine the competitive development of clusters include those that:

- Influence location (with restrictions and subsidies).
- Protect industry from competition, notably those that promote rigidities (such as vertical integration) and reduce incentives for innovation.
- Biased to particular clusters.
- Create, to contrast with helping, new clusters.

##### **14.4.2.1 Clusters – Australia**

A review of current and potential clusters - linked businesses and institutions.

Clusters have been identified (Porter et al)

The extent to which clusters exist in Australia, evidence of their success, the extent to which they interface with other successful clusters, overseas success stories, the extent to which they are a model for Australia, and the role for government and industry.

One of the successful sources of innovation and vibrant activity has been at the interface of clusters. Some case studies provided of successful Australian clusters for resource developing industries. Are there prospects for promoting an interface with chemical industry clusters? To what extent can cluster be adopted against the need for integration of chemical operations.

How could these clusters be developed and what could be the benefits? Is there any conflict with Australia's competition theory?

## 15 OVERVIEW – CHEMICALS GROWTH

The growth in the world demand for chemicals, notably petrochemicals that includes polymer resins (plastics), exceeds the growth in gross domestic product (GDP) driven by new chemical-derived products such as plastics replacing traditional materials such as metals and wood, and by increasing consumption with growing affluence.<sup>103</sup> Whereas in developed countries, such growth, and most notably in commodity chemicals (Group 2 Chemicals (15.1.1.3)), has slowed to around that of growth of GDP, in Asian countries it is still 1.5 to 2.0-times faster. Growth has been around 10 per cent per year and projected to continue in most of Asia so that demand in the region that represented just 4 per cent of world demand in the early 1980s, has tripled to 14 per cent by 1996 <<update>>.<sup>104</sup> Accordingly with per capita consumption of chemicals and plastics in the region less than one-tenth that of developed countries, growth will continue for at least two decades before catching up to the levels of the developed world.<sup>105</sup> The growing Asian market therefore represents potential for Australia's industry.

With the opportunity presented by fast growing demand, during the last decade Asia has attracted one-half the world's new investment in chemical manufacturing. Not only at very large-scales of production – an important source of cost advantage.<<details of scale benefits>>>, for commodity chemical production it involved the latest technology.<<reference source of investment >> As detailed (7.2.3), it presents both an opportunity and a threat. An analysis requires an understanding of the development phasis evident for “chemicals” that presents as groups.

Though most of Asia uses liquid feedstocks without any feedstock cost advantage, the large scale of operation has enabled the supply of very competitive chemicals. Further, countries such as Thailand and South Korea have experienced substantial variations in domestic demand and avoided cost penalties of operating at underutilised installed capacity, during downturns in home demand with export sales “at any price”. Prices have been close to marginal cost levels to cover their variable costs of production avoiding operating with extensive under-utilised production capacity. Such sales have sometimes promoted the use of anti-dumping legislation () in vulnerable markets like Australia. Australia is particularly vulnerable in the region as recent Asian investment and most of their exports have been in commodity chemicals such as consumer plastics that form the core of Australia's chemical industry. Australia's industry with its small scale of production, is particularly vulnerable to sales from Asia and it is often only fully depreciated plant which avoids the need for fixed cost recovery and sometimes the application of anti-dumping protection, that has avoided the impact of the “Asian Meltdown” on its industry.

### 15.1.1.1 Industry origins – Chemical Groups

Chemical industries begin in stages reflecting local demand, comparative advantage, differences between local and international regulations, extent of industrial development, and industry protection policies. Most countries begin with Group 1 industries using simple technology, commonly by mixing or simply reacting chemicals at batch level to produce

<sup>103</sup> Some 80 per cent of is used by key economic segments such as building, automotive and industrial segments so the demand faced by the chemical industry is more volatile than changes in GDP.

<sup>104</sup> Pickover, B.H., Swanson, A.B. *The Dynamics of Global Interplay of Petrochemical Markets*, 'Bank of America's Guide to Petrochemicals in Asia', EFP International (HK) Limited, 1998.

<sup>105</sup> Annual Asian Petrochemical Summit '97.

products sold on price. Sometimes, industries begin with Group 2, but like observed in development of countries (5), not all proceed to Group3 or beyond.

### 15.1.1.2 Group 1 – Basic Chemicals

Chemical manufacturing begins in response to local demand for basic products as fertilisers, adhesives, paints, detergents, and inputs to other industries such as for the paper, textile and resource processing industries. The satisfaction of demand by local manufacture or imports is for this group very sensitive comparative costs including distribution cost savings, industry protection and regulations presenting a compliance hurdle for foreign competition.

Many Group 1 products, notably paints, adhesives and formulated<sup>106</sup> pesticides may be manufactured by mixing or simple reaction of often imported chemicals with locally available materials, such as water, solvents and base chemicals. The process therefore presents a very large saving on international transport costs so this group of chemicals is often the first to be manufactured.<sup>107</sup> These can be produced from largely imported key ingredients using limited technical expertise and low cost plant by batch processing.<sup>108</sup> Entry barriers are low for most products with readily available technology, know-how and low cost fixed capital.

Where the products are for household markets, image is more influential than information about their function including detergents, cosmetics and toiletries, high advertising outlays aimed to persuade by emotion presents a major barrier to entry. Accordingly, their manufacture is increasingly by multinational US and European-owned companies reflecting their expertise in advertising and the high volumes required to recover high advertising outlays. For that reason, this group of consumer-oriented products could be assigned to a subdivision as Group 1(b) for being less sensitive to factor costs than implied by the simplicity of the products. In other words, Group 1b products owe their success more to packaging and advertising than their manufacture.

Another sub-group of Group 1 chemicals are those simply produced from natural resource endowments. These may be produced by simple processing such as the roasting of limestone to produce lime and superphosphate fertiliser by reacting sulfuric acid with rock phosphate. This group is normally a more stable manufacturing core, though like most of this Group, proximity to markets and access to raw material are very important.

### 15.1.1.3 Group 2 – Building block or commodity chemicals

This group also referred to as base or commodity chemicals represent the basic component raw materials for the bulk of the chemical and other manufacturing industries. They include the petroleum refinery by-products BTX (benzene, toluene and xylene), ethylene, ethylene oxide and glycol, propylene, EDC, VCM and soda ash. While important as inputs to other chemical industries, their production is very sensitive to factor costs, notably raw materials and scale. For example, VCM may be imported and then polymerised into PVC plastic so

<sup>106</sup> *Formulated* refers to the mixing of chemicals with solvents, water or other media to formula in contrast with the chemical reaction of chemicals to produce other chemical entities.

<sup>107</sup> Sulfuric acid for example is made by reacting cheaply transported sulfur with air and water increasing its mass three-fold and also its hazard. Local manufacture therefore provides for substantial freight related cost savings. The acid in turn can be applied to cheaply transported phosphate rock to produce 'superphosphate' fertiliser.

<sup>108</sup> Batch manufacturing, involves manufacturing goods in production lots that uses mixing or reaction vessels to produce products in fixed amounts. This process presents lower capital costs but higher manning costs compared with continuous manufacture that characterises the large-scale manufacture of most petrochemical and other Group Two manufacturing (15.1.1.3). Batch manufacturers therefore cannot only produce at much smaller scale, they are more flexible in terms of quantities and products manufactured. For many Group 1 chemicals such as cleaners and paints, they are the only practical way for their production – simply mixing chemicals with solvents and carriers to produce the product.

that the balance between manufacturing or importing is very sensitive to the scale of production and import protection.

Using mature and readily available technology and common product specifications, this group competes on price more than on the uniform performance.

The products comprising this Group could be divided into Group 2a high volume, scale-intensive products to include those produced in the gas-rich centres; and Group 2b products that are with the character of basic chemicals (15.1.1.2) but competitive at low production volumes in the home market for freight cost savings.

Groups 2a and 2b chemicals are therefore often produced where there is cheap gas, energy and mineral endowments or other related industries notably petroleum refineries. Accordingly, the Middle East and Canada are key suppliers while many countries import these products as raw material inputs to produce more advanced product industries.

Group 2b includes sulfuric acid and caustic soda/chlorine that are often produced at small scales given the high cost of freight that enables competitive production even at small scales for home market consumption.

### **15.1.1.4 Group 3 – Specialty Chemicals and Engineering Plastics**

This group of chemicals is manufactured from Group 2 chemicals. It includes isocyanates (used for polyurethane), acrylic esters, pesticide chemicals, catalysts and sophisticated polymer resins such as ABS, SAN and polyamides (nylons). They are often produced with new, often tightly held and sophisticated technologies, typically with a high value added. Many are produced for sophisticated applications for which there is only limited alternative supply. While many of the products are made in highly integrated chemical plants, access to raw materials is less important than access to technology. With this group having a standardised character, price more than performance determines competition.

### **15.1.1.5 Group 4 – Advanced Materials and Noble Chemicals**

These are more specialised products than groups 1, 2 or 3 and include specialty polymers, fine ceramics and biotechnology products. It also includes membrane chemicals, photographic chemicals and reprographic chemicals. Similar to Group 3 products, these are more specific in application, often with fewer customers and higher value added reflecting extensive research and sophisticated technology. Producers obtain substantial premiums over the cost of input raw materials as they have varying performance characteristics and with limited suppliers, sometimes protected by patents, if only knowledge, compete more on performance than on price.

## 16 ASIA - COUNTRY REVIEWS

Refer also overview discussion (7).

### 16.1 China

The chemical industry in China contributes 4 per cent to GDP – about three times that of Australia. The petrochemical industry, as the core of the country's chemical industry, is petroleum liquids-based, predominantly naphtha as are most other Asian countries. The feedstock is supplied by some of the fourteen petroleum-refining centres that contribute to China being the fourth largest petroleum refiner in the world. Unlike Singapore where the petrochemical industry is integrated with its world-scale efficient refineries and underpinning competitiveness, China's refineries are underscaled and dispersed to hinder development of a competitive commodity petrochemical industry.<sup>109</sup> Thus while by year 2010 China is projected to become the world's largest economy, its industry could still be operating at small scale, fragmented, operationally inefficient and without the infrastructure that underpins most Asian chemical centres. The fragmented nature and poor transport system is a major impediment to industry expansion.

With a fast domestic growing demand exceeding 10 per cent per year forecast for the next two decades, the balance of trade is subject to the realisation of investment plans. <<China's political stability??>> While imports currently represent one-third of consumption of chemicals, and the country only produces about one-half of the key feedstock ethylene, China has declared its ambition to be self-sufficient by 2010 by a doubling of production capacity with eighteen large integrated petrochemical complexes. That projected investment will be sensitive to investors' perceptions of the country's political stability. Also presenting some uncertainty for investors are that tariffs, which were second highest to India in the Asian region at up to 30 per cent in the mid 1990s, are scheduled to phase down to between 10 and 5 per cent by 2003. China is partly opening up its economy and allowing foreign investment with ownership depending on "notable economic benefits". Significantly and unlike other Asian countries and signalling the urgency for new investment, China does not emphasise technology requirements for investment assistance.<sup>110</sup>

The government's State Petroleum and Chemical Industry Bureau aims to macro-control manage the country's refining and petrochemical companies, formulating policies, development plans, and setting targets for imports and exports.<sup>111</sup>

### 16.2 India

India has a fast growing chemical industry that represents a very large 9 per cent of GDP but like China is fragmented and small scale.<sup>112</sup> It relies on import tariffs to sustain small-

<sup>109</sup> China is also a net importer of crude oil with 20 per cent of its feedstock imported and projected to increase.

<sup>110</sup> 'Notable economic benefits' include where:

- It uses advanced technology and equipment, develop net products, save energy and raw materials and upgrade and replace existing products for import substitution; or
- The value of products exported annually must account for over 50 per cent of the total value of all products produced and a surplus of foreign exchange achieved.

<sup>111</sup> The State Petroleum and Chemical Industry Bureau was formed in 1999 by transferring the government functions of Ministry of Chemical Industry, Sinopec, and China National Petroleum Company, and is administered by the State Economic and Trade Commission. It now separates the functions of government from industry so that it can no longer directly set the price of feedstock, notably for chemical fertilisers to be well-below world levels.

scale high-cost manufacturing centres often with poor infrastructure, notably port facilities. Helped by protection from foreign competition, even with domestic demand growing at 10 per cent per year, India is almost self-sufficient in polymers and most chemicals. However, with on-going reductions in import tariffs, India's high cost centres are being exposed to international competition anticipated to promote rationalisation and closures.<sup>113</sup> For example, while PVC is the only polymer produced in India with installed capacity significantly exceeding demand, the precursors VCM and EDC are imported and reduction in protection for the basic conversion to PVC resin, could promote increasing importation in favour of those precursor chemicals.

Its chemical industry uses predominantly naphtha as the feedstock complemented by indigenous natural gas. Though also a large exporter of naphtha, two-thirds of its petroleum is imported and projected to increase; and while there is enough gas for forty years supply at projected demand, it remains in short supply.

Foreign investment with equity to 51 per cent is allowed without special approval.

### **16.3 Indonesia**

Indonesia has a large population, growing demand and abundant oil and gas production to provide competitive feedstocks for a petrochemical and chemical industry. There are many projects planned or under implementation held back by uncertainties about its political stability.

Like some other Asian countries, a government owned agency, Pertamina, controls its oil and gas reserves and its distribution.

A "Foreign Investment Law", allows foreign companies to invest and operate if the products are either exported or sold into the local market to other companies for further manufacturing.

### **16.4 Japan**

Japan's economic growth has been greater than any other OECD country. In a relatively short period, the profile of its manufacturing sector and its foreign trade has changed from labour-intensive to commodity products to higher value added technology-intensive products. In chemicals, its development followed a similar trend to Australia - beginning with commodity chemicals and using imported technology. Japan however without Australia's raw material endowments, increased its scale of production to match world trends and is now much less reliant on imported technologies, even developing its own. While Australia too protected industry from foreign competition, unlike Japan it did not manage domestic competition resulting in excessive fragmentation. Later, unlike Japan, Australia did not establish mechanisms to promote industry rationalisation and the import, development and adaptation of relevant technology.

Japan is now transforming its manufacturing industries to produce higher value added chemicals. Whereas Australia's chemical industry is almost entirely owned by foreign companies, which are in contraction and using older technologies, Japan's chemical industry

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<sup>112</sup> The significance of the Indian chemical industry is influenced by the level of import tariffs that in increasing domestic prices, also increases the value added. Reductions in tariffs, in addition to promoting closures and rationalisation of the less competitive operations, reduce the value added, and a reduction in the significance of the chemical industry as measured in relation to GDP.

<sup>113</sup> Import tariffs that in the early 1990s were the highest in the world at up to 65 per cent are being reduced to 25 per cent. Feedstocks and intermediates are dutiable at around 10-15 per cent.

is expanding into other countries, investing and forming alliances. Unlike Australia, the government has actively promoted industrial development with positive measures to promote technological expertise.

Today, Japan has a high level of consumption of chemicals that is supplied by a large sophisticated chemical industry. Without indigenous feedstocks, it is investing or providing services integrated with commodity chemical production centres in Asia while emphasising higher value added chemical and polymer production centres at home. Though it still has many small high cost production centres protected by its industrial and distribution system, it is increasingly replacing its commodity chemicals with imports, including those supplied by affiliates in other countries. <<link to Stages of development>>

#### 16.4.1 Origins

Japan's post-war industrialisation began with heavy industry and consumer goods that became increasingly capital-intensive such as in steel, chemicals and automobiles. With mounting competition from low wage countries, notably from the early 1970s, the government's Ministry of International Trade and Industry (MITI) defined its role to stimulate domestic R&D, investment and production. Targeted industries received subsidies for R&D, and promoted loans on low interest or repaid on becoming profitable. To control foreign competition, MITI controlled foreign exchange for select imports and restricted investment by foreign companies by regulations on ownership.

With low wage countries beginning to undermine Japanese exports, from the mid 1970s and while still protecting its industry, the government promoted an investment climate conducive to change. Industry rationalisation was stimulated by facilitating capital and labour flows from declining industries into emerging industries that was complemented by the importation and adaptation of technology and expertise. Up to that time and like Australia today, production was largely based on licensed technology, notably from the USA.

Around that time, entry to the Japanese market was restrained by government controls over foreign exchange giving it monopsonist control from the perspective of US and European chemical firms seeking access to Japan's large and rapidly growing market. The government took advantage of its influence on the market and the informal collaborative arrangements of industrial and financial enterprises by offering market access in exchange for foreign technology. Foreign firms notably from the US were allowed to sell into the Japanese market in return for the licensing of advanced technologies and expertise. MITI, through the Ministry of Finance that controlled foreign exchange, linked the import of a particular technology to the firm's ability to export products that used that technology. It sometimes even required the technology to be diffused through other Japanese firms.

While foreign firms gained substantial royalties and access to the Japanese market, it was often lost when the technology and expertise was imitated by Japanese firms. This trend was helped by co-operation between firms, including suppliers and distributors, to the exclusion of foreign firms foregoing profits to ensure local purchase. Such intervention and co-operation not only enabled development of technology, but also promoting production at world-scale.

The government went further than controlling trade and progressively took an active role in shifting its manufacturing base to higher value added and more technology-intense production. Collaborative R&D was promoted by government aimed at developing generic technologies that were not product-specific, especially for mass production processes. Government even offered concessional loans to develop their application after having been collaboratively produced and refined in-house. While facilitating the diffusion of the resultant technologies among local firms reduced the cost of the riskiest processes. As a result, the chemical industry has been successfully shifted from its emphasis on bulk

commodity chemicals (Group 2), such as polyethylene, caustic soda, PVC, that still dominate Australia's chemical industry, to more sophisticated chemicals, such as acrylics, polyesters, and other specialised chemicals.

### 16.4.2 Current status

With a focus on technology, Japan's comparative advantage has successfully shifted from capital-intensive heavy industries, to knowledge-intensive industries to now be among world leaders. Since the mid 1980s, while MITI has reduced its direct influence, it still provides administrative guidance on specific merger and investment decisions. While having been subject to criticism for backing losers, its industrial policy is claimed to have been more effective than implied by considering the components of its actions; so that even the promise of a subsidy, rather than specific guarantee, has been influential.<sup>114</sup> MITI still attempts to select specific industries for encouragement with the help of a council of experts from leading corporations, banks, universities newspapers and trade unions.<sup>115</sup> It gathers information on world developments to help form a consensus on policies between the public and government sectors while avoiding the exclusive opinion of industry experts. While thereby identifying targets for industry, these are voluntary and do not commit government to provide assistance.

Efforts to rationalise production in the commodity chemical sector, to achieve economies of scale and avoid unproductive competition care, needs explanation. Having criticised the ACCC with JV on Orica/Kemcor, however appears to have had only limited success reflecting the reduced influence of MITI and government since the mid 1980s. The Japanese antitrust regulations have been liberalised allowing mergers with production representing nearly one-half market share. There has been extensive dismantling of regulations that precluded foreign investment and in 1998 Montell became the first foreign firm to assume a major interest in a large chemical business. A designated inward investor program provides for loan guarantees and tax incentives; and a more generally available low interest loan program has been established through financial institutions. That advantaged loan is aimed at shifting the industry to higher technology activities that promote an "international exchange of technology and knowledge".<sup>116</sup>

The chemical industry is today highly integrated providing substantial operating cost benefits. That advantage is however reduced by being based on imported raw materials, notably naphtha; its ports are remote and shallow and thus cannot handle large ships, and it operates in one of the highest costs structures in the world. Until the mid 1980s, it successfully exported a large proportion of production, since then exports have reduced as domestic demand caught up with installed production capacity. The scale of plant is now much less than that being installed in SE Asia but remains competitive against imports for

<sup>114</sup> Denison, Edward, and W.K. Chung. *How Japan's Economy Grew so Fast*. Brookings. 1976.

<sup>115</sup> The chemical industry falls under the primary jurisdiction of the Basic Industries Bureau of MITI. The Bureau is comprised of administrative divisions including:

- The Basic Chemicals Division, which administers general affairs related to petrochemicals and other basic chemicals
- The Chemical Products Division which administers general affairs related to petrochemicals and other basic chemicals
- The Chemical Products Safety Division which oversees regulations and in particular, attempts to harmonise Japan's chemical industry regulatory regime with internationally accepted standards.

<sup>116</sup> It takes two forms:

- Designated inward investor programme for branch or subsidiary of a foreign firm engaged in manufacturing and other services may qualify for tax incentives and loan guarantees
- Low interest loans are available to firms with more than 50 per cent foreign capital. Loans covering 95 per cent of a company's required working capital may be granted for high-tech fields or that which promotes international exchange of technology and expertise.

being technically efficient and well integrated. However with its traditional markets, notably Taiwan, Thailand, and Malaysia now more than self-sufficient, it has been projected that two out of eleven olefin complexes required to be closed to achieve a one-third reduction in ethylene production. << Japan: At a Turning Point Hunter, David Feb. 03, 1999 pS4ref Chemical Week>>

With its developed technology and expertise, Japanese chemical companies have become the most active in the Asian region and moving into China and India to participate in their industrial development to manufacture of commodity chemicals. They offer strong links with Japanese finance sources and accept low-levels of equity in return for related roles such as the provision of raw materials, related procurement, financing and contracted buyers. In transferring to manufacturing commodity chemicals offshore, Japan is increasingly emphasising the manufacture of more sophisticated chemicals in which it has become a dominant world supplier. Included are electronic chemicals, filtration membranes and health care products.

<<<<Alcoa and Ciba and Nalco. Trading comparative advantage and technology

Australia's Office of Strategic Investment

Invest Australia. . >>>>

## 16.5 Malaysia

Malaysia has abundant low cost state-owned gas reserves controlled by the national oil company Petronas. The government offers inducements including tax exemptions on 70 per cent of income for first five years of production while Petronas has undertaken joint ventures with multinational companies. The country has a Ministry of International Trade and Industry (MITI) with similar functions as its better-known namesake in Japan.

## 16.6 Singapore

The chemical industry began in 1983, two-decades after Japan when the Singapore government and the Japan-Singapore Petrochemical Company as equity partners commissioned a naphtha cracker on one of the islands now part of large Jurong Island complex. As the Petrochemical Corporation of Singapore, it had a capacity of 450 000 tonnes, or twice the size of the ICI plant commissioned about that time at Botany, New South Wales. Several other plants were built by European and US companies including polyethylenes (LDPE and HDPE), ethylene oxide and ethylene glycol. A second cracker was completed in 1998 with a 520 000 tonne capacity which is fully integrated to produce other ethylene-based chemicals. Other commodity chemicals produced include polypropylene and synthetic rubber.

Despite high cost land and labour and with no natural resources, the chemical industries are competitive from the large and efficient petroleum refinery complexes that provide the lowest cost naphtha in Asia and into which the chemical industry is highly integrated and supported by very efficient infrastructure. Large, efficient and using the latest available technology to produce a range of commodity chemicals and polymers, more than one-half of its production exported. Singapore is however now beginning to compete in the region with countries with indigenous oil and gas supplies and new efficient industries notably Thailand and Malaysia that have been its traditional markets.

Reflecting its young age, its chemical industry has not advanced beyond producing commodity chemicals manufactured in large volumes using technology under license from foreign companies. In this respect, Singapore is similar to South Korea so as most other Asian countries, the government is encouraging a shift to higher value added activities including high-tech industries and R&D with contingent assistance. <<details >>>

### *Business climate*

Singapore's sovereign risk is low being at or near the top of most country's ratings for business and investment climate, ranking high on transparency of government and commercial dealings, government planning and sophistication of financial and labour markets. In contrast to most of Asia, it does not require foreign-owned companies to offer equity to local partners and it has never employed import duties or anti-dumping legislation. The corporate tax rate is 4 per cent lower than the 30 per cent rates ruling in most of Asia including Indonesia, Malaysia, and Thailand.

As practiced in other parts of Asia, the government will contribute financially to common user infrastructure such as the A\$7billion provided for the Jurong Island petrochemical complex. Except for 1983, when it assumed equity to initiate a petrochemical complex, it does not assume equity or otherwise participate in commercial ventures.

The government's Economic Development Board (EDB) is identified as a key industry influence coordinating and encouraging investment in Singapore that includes the granting of "pioneer" status that provides for provision of direct subsidies and assistance.<sup>117</sup>

## **16.7 South Korea**

South Korea established its chemical industry after Japan and Taiwan. By pursuing scale, it has become the largest exporter of commodity (Group 2 see 15.1.1.1) chemicals, exporting one-quarter of its production. Like most of Asia, it uses naphtha feedstock and imports primary commodity (Group 1) chemicals such as ethylene glycol and acrylonitrile from the gas-rich centres like the Middle East. South Korea gains competitiveness from large-scale integrated production. During the 1990s however, it was overtaken as the biggest exporter in Asia by Thailand with its larger scales of production and access to indigenous oil and gas.

Unlike Japan and Taiwan, that are increasingly moving to higher value added chemicals, South Korea remains a producer of commodity chemicals and polymers lagging in the production of specialty high value added chemicals. Significant for the outlook for the country, while technology is comparable to advanced countries, it is licensed from US, European and Japanese sources. Unlike Japan that invests some 6 per cent of sales on R&D, South Korea invests just 1.6 per cent raising doubts about its ability to make the transition away from commodity chemicals like Japan and Taiwan. As a user of naphtha feedstock to produce low value added commodity chemicals and polymers, it is sensitive to any world oil price increase that would further disadvantage it against gas-based producers in Thailand and the Middle East.

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<sup>117</sup> The investment incentives are for activities that *enhance the economic or technological development of the nation* by exemption or reduction of tax liability. For capital-intensive investment a company can negotiate with the EDB for either a:

Pioneer Enterprise classification – a tax holiday for five to ten years depending on the merits of the project, including investment level, value added, innovative high-tech content and spin-off investments. Qualified companies with Pioneer Enterprise status may be considered for Post Pioneer status, providing reduced tax rates as low as 10 per cent for 10 years.

Investment Allowance being a percentage of qualified capital investment normally up to 50 per cent as an offset to earnings before interest and taxes.

Investment is now largely unregulated and open with five-year tax holidays if made in important technology-based enterprises or “important invested enterprises” (that includes by definition, petrochemical companies).

## 16.8 Thailand

In just one decade since 1990, Thailand has become one of the top ten petrochemical producing countries in the world and the largest exporter of commodity chemicals in Asia. It began in 1990 with a petrochemical complex owned and operated by the Thai Petrochemical Industry (TPI) at Map Ta Phut based on a large ethylene cracker using natural gas from the Gulf of Thailand. Its competitiveness was further helped by government funding for world-class infrastructure. Five years later in 1995, the complex was extended with feedstock from a petroleum refinery and condensate from the Gulf. With further natural gas discoveries in the Gulf, there are plans for upgrading existing plants and the building of NPC-III complex extension.

Like all Asian countries at their formative stages of the chemical industry, Thailand is a producer of consumer commodity chemicals using licensed technology. It has the advantage of scale, modern infrastructure, integration with petroleum refining and some government participation to reduce the cost of capital.

As in India, China, Malaysia and Indonesia, the oil and gas reserves are controlled by the government company Petroleum Authority of Thailand that buys the gas from the concessionaires and a minority shareholder in a range of petrochemical companies including TPI.

Since 1995, import tariffs have been reduced to around 5 per cent declining to 2 per cent by 2003.

A “Board of Investment” may assign a company as being a “promoted company” with a range of privileges and concessions.<sup>118</sup> Another body is the Petroleum Institute of Thailand (PTIT) that functions as an independent body to develop and strengthen organisations, personnel and facilities to optimise the benefits of the development of the petroleum and petrochemical industries in Thailand.

## 16.9 Taiwan

Taiwan’s chemical industry began like Japan as an early starter in Asia producing commodity chemicals. (Group 2) Since the early 1990s, it has been increasing importing and producing more sophisticated chemicals, notably for its textile and computer industries. The transition to higher value added, technology-intensive chemicals is offsetting growing imports of commodity chemicals so that during the recent “Asian Meltdown”, its trade performance was less affected than other Asian countries.

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<sup>118</sup> A ‘Board of Investment’ may assign a company as being a ‘promoted company’ depending on; capital investment, Thai equity, the use of using local raw materials, nationality, number of employees, training, distribution, designation and quality of products. Such status provides for; protection from imports; no competition from government agency; exemption from paying company income tax for three to eight years; and dividends being exempted from taxation. If the project is in an ‘investment promotion zone’ as most petrochemical projects are, it may qualify for a reduction of income taxation for the income derived after the tax-exempt period. It may then provides for deductions on transportation, electricity and water supplies and up to 25 per cent of the capital investment in infrastructure; and a deduction of 25 per cent on in the investment made in infrastructure facilities over 10 years. To promote exports, the BOI may grant additional incentives such as exemption from import duty on raw materials imported to manufacture petrochemicals for export.

As with other Asian countries, investment incentives are available including exemption from import duties on heavy machinery, raw materials and corporate income tax for eight years.

This shift reflects that Taiwan has some of the highest feedstock costs in Asia reflecting it imports two-thirds of the key raw material ethylene to complement its manufacture from naphtha produced at its petroleum refineries. Placing further pressure on its industry is that land is in short supply with increasing public concerns about environmental harm.<sup>119</sup> The outlook is for more contraction in commodity chemical production and increasing emphasis on products required for its industries. Unlike Japan, Taiwan does not possess technology so investments are now underpinned by relationships with existing operations, good infrastructure and a large domestic market for plastics including for its textile industries.

Government is active in promoting industry with an emphasis on higher value technology-intensive chemicals and polymers. Five-year tax holidays are available if the investments are made in important technology-based enterprises.<sup>120</sup>

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<sup>119</sup> The environmental lobby have led to the cancellation of a toluene diisocyanate by Bayer and Tuntex, a Taiwanese firm threatening the relocation of a proposed naphtha cracker to Western Australia Chemical Week December 24/31, 1997, p. 3

<sup>120</sup> A 'Statute for Upgrading Industries' provides for accelerated depreciation on equipment and machinery used for research and development, or energy saving purposes. Tax credits from 5 per cent to 20 per cent are provided to control pollution, the reuse of industrial water and to mechanise production systems.

## 17 THE USA

The USA has been the leader in many industries notably those which are knowledge-intensive with the role of stimulating an environment conducive for private firms and workers to develop high-tech industries. Government participation in industry development is variable.

At the Federal level, government does not target specific industries rejecting the concept of favouring specific sectors or discourage others. It does practice some bias for some activities and products such as tax credits for R&D; assistance for select exports; and accelerated depreciation for certain types of investment. Subsidies have rarely been coordinated or targeted to favour specific industries - most commonly for high-tech industries.<sup>121</sup>

At the State level however, substantial outlays by ways of subsidies, land and infrastructure continue to be offered to industry, notably the larger employers of labour to entice location in the respective state or city.

Helping general competitiveness and promoting investment are the well developed American equity capital markets and labour that is more mobile than in many countries. has been instrumental in setting up many businesses. Military and space spending has helped to stimulate many industries.

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<sup>121</sup> The US Department of Energy is offering US\$4 million to fill chemicals research needs identified through the industry's Vision 2020 report. The funds targets cooperative projects involving several chemical companies in computational chemistry, catalysis, separations, and other research for which detailed road maps have been completed (Chemical Week, Oct. 7, 1998, p. 26). The concept is being adopted in Japan.

## 18 AUSTRALIAN CHEMICAL INDUSTRY DEVELOPMENT

### 18.1 Beginnings

Australia's chemical industry began in the 1860s with the manufacture of superphosphate fertiliser required by the fast growing agricultural sector.<sup>122</sup> It was produced by several companies using imported rock phosphate reacted with sulfuric acid. As this acid is expensive and hazardous to transport, it was manufactured from imported sulfur - a process in effect involving catalytically controlled burning and reaction with water.<sup>123</sup> Having sulfuric acid enabled the production of other chemicals notably nitric acid used in other manufacturing.

Small and inefficient, the manufacturers were competitive against imports as the production of the fertiliser (and acid) increased the bulk to represent freight savings. The fertiliser was priced by import parity but at a premium against the long-term cost of production - at oligopoly prices.

With a stake to reduce the cost of a factor input, a cooperative of farmers established the Pivot Superphosphate company at Yarraville, Victoria producing fertiliser at below import parity and in so doing, promoted industry rationalisation. 1929, Pivot's four principal competitors combined to form the Commonwealth Fertilizers and Chemicals Limited.

### 18.2 By-products driven

The second driver to the development of the chemical industry was the availability of by-products. The early fertiliser manufacturers extended their market with a crude phosphate fertiliser made from bone material from abattoirs reacted with their sulfuric acid. Having dealings with abattoirs for bone material stimulated the use of animal-fat that could be simply reacted with caustic soda to produce soap as well as glycerine and crude fatty acids (stearin and olein) that could be used in another chemical industry in pharmaceuticals and toiletries.

Later in the 1920s, and before the advent of natural gas, the manufacture of town gas from coal and later oil, produced waste containing phenols and aniline. These by-products became the key raw materials for the Timbrol <<ref>> company.

Later again in the 1950s, the iron and steel industry required coke made from coal. Produced by the coking process, a range of useful (aromatic) substances, including coal tars, benzene, toluene, xylene (BTX) and naphthalene provided raw materials for not only the Timbrol company, but also Monsanto and later naphthalene for CSR Chemicals (later ICI Rhodes). Of course, at that time, Australia had adopted industry protection to enable these three high cost industries, though for all three, the raw material came from a by-product.

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<sup>122</sup> Though it could be said that the chemical industry began in 1841 in Sydney with the production of gas from coal that co-produce ammonia and aromatic solvents.

<sup>123</sup> The first fertiliser plants were established by the Mount Lyell mining company in New South Wales, Victoria and South Australia, by the Cumming Smith and Company at Yarraville, Victoria, the Adelaide Chemical Works Company near Adelaide, South Australia, the Colonial Sugar Refinery (CSR) operations at Balmain near Sydney, New South Wales and by Cresco Fertilisers at Geelong, Victoria.

### 18.3 Pharmaceuticals

During the nineteenth century, a rapidly growing local market encouraged the manufacture of pharmaceuticals using eucalyptus oil and other local vegetable products. Phenol, produced at gas works enabled the production of antiseptics while vitamin A, extracted from fish, contributed to the seeding of another sector of the chemical industry – the pharmaceutical industry. FH Faulding and Drug Houses of Australia were established to manufacture of distillates and extracts made from eucalyptus trees as a respiratory treatment, odoriferants and liniments. The pharmaceutical industry drew its competitiveness from naturally occurring products used in such simple processes as distillation, extraction and mixing.

From the 1920s, Australia adopted a policy of industry protection () but it was not until World War 2, that it stimulated the pharmaceutical industry, and indirectly thereby a plastics industry. Required for military action and with a worldwide shortage, new antibiotic and antiseptic chemicals were produced helped by tariffs and import licensing. The US subsidiary, Monsanto Australia (18.7) began their manufacture at West Footscray Victoria. Starting with benzene and phenol, the company progressively diversified the site to become a substantial manufacturer of commodity chemicals.

### 18.4 Mining initiated

The mining industry was a strong component of the early Australian economy other early stimulus for chemical manufactures, and later providing an entry point for the UK company ICI as ICIANZ<<>>. Mining required explosives that as dangerous goods were expensive to transport. Freight cost savings promoted an explosives industry that began with the Australian Explosive and Chemical Co. Ltd (AEC) in 1874 producing black powder until dynamite was discovered a few years later. In 1897 AEC was purchased by the Nobel company that in 1928 became part of the Imperial Chemical Company of the UK (ICI). The explosives plant was owned by the ICI subsidiary ICIANZ marking it as the Australian launch pad for its progressive domination of Australia's chemicals industry. Seven decades later, and now as Orica, it is reverting to its original nucleus in explosives but now as an Australian multinational.

In 1918, the Mount Lyell mining company required caustic soda and set up an electrolytic chloralkali plant at Yarraville, Victoria. Co-producing chlorine<sup>124</sup>, it was purchased by ICIANZ and chlorine formed the nucleus of a chlorine-based organic chemical industry notably pesticide chemicals required for the agricultural industry.

### 18.5 Adding value to rural products

Ethanol (ethyl alcohol) was produced from 1901 by the Colonial Sugar Refining Company (CSR) by fermenting molasses. Forty years later in 1940, ethanol was for a short time to be the starting material for their organic chemical plant at Rhodes, New South Wales. Instead, CSR Chemicals (18.8) became a sophisticated chemical manufacturer of diverse chemicals and polymers required by other industries, including by manufacturers of plastics, paints, pharmaceuticals and adhesives. Enabled by industry protection, reductions from the mid 1970s promoted its closure in 1997 have by then contracted to the partial manufacture of plasticisers using naphthalene - a raw material produced at the BHP Newcastle steelworks.

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<sup>124</sup> Caustic soda (sodium hydroxide) is always co-produced with chlorine gas in an electrolytic cell using common salt as the raw material. The chlorine, as a hazardous gas, is used where it is produced such as today in the manufacture of titanium dioxide pigment ( ).

## 18.6 Timbrol

In 1930, Timbrol Ltd established a plant at Rhodes, New South Wales to process coal tar and residues produced at coking plants that provided benzene, phenol, naphthalene, toluene, creosote and pyridine. Ten years later, it shared the industrial estate on Homebush Bay with CSR Chemicals though they operated independently but shared the status of the only two significant chemical companies that started Australian-owned.<sup>125</sup>

Timbrol, like other manufacturers over the next four decades to the mid 1970s, was enabled by industry protection by way of import licensing<sup>126</sup> and import tariffs. By reducing import competition, the prices of Australian chemicals were typically 60 to 100 per cent above those of competing countries and so enabling a broad range of high-cost activities. The elimination of import licensing in 1960, and the progressive reductions of import tariffs beginning 1974, began to expose Australia's protected manufacturing sector to international competition. Falling prices led to closures of many small and high-cost activities and businesses.

It was during that protectionist era that Timbrol, from 1955 as Union Carbide of Australia Ltd, became a diversified chemical industry. Original and diverse technology was applied by this Australian chemical company. From 1937, it manufactured nitric acid made from ammonia from the gas works, for reaction with phenol and other coal tar products, to produce anilines and nitrobenzene. A decade later, it used chlorine from its chloralkali plant to produce pesticide chemicals including DDT, HCB and 2,4-T. Declining levels of assistance and increasing competition from technology backed multinational ICI and Monsanto now located in Australia, saw its closure in 1987.

## 18.7 Monsanto

Phenol, a key basic raw material used by Timbrol, also seeded the Monsanto Australia plant at West Footscray, Victoria as the first of many US and European companies to establish in Australia. With phenol as its starting material, in 1939 Monsanto began to manufacture pharmaceuticals, including aspirin and antibiotics, as well as phenol-formaldehyde resins and rubber chemicals. Later, it synthesised the phenol, using crude benzene from BHP steelworks, to produce pesticide chemicals produced in competition with Timbrol and ICI and later the expertise of its US parent Monsanto in aromatic chemicals, applied to the manufacture styrene-polymers resins.

Today, as Huntsman Chemical Corporation, it no longer produces pharmaceutical chemicals. It still starts with benzene and its derivative phenol that seeded its business in Australia but now uses to produce styrene polymer resins. Benzene, the key raw material that underpinned the complex for three decades, is now essentially imported. The West Footscray operation, functions without a raw material advantage but helped by import tariffs, anti-dumping legislation, depreciated fixed capital and local advantage through distribution savings.<sup>127</sup>

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<sup>125</sup> The purchase in 1989 of Monsanto Australia by Kerry Packer's Consolidated Press Holdings could claim for four years to be Australian owned as can today Orica, the former ICI Australia on being sold by its parent ICI Plc in 1998. WMC's Queensland Phosphate, manufacturing fertiliser can now also claim to be Australian owned.

<sup>126</sup> Import licensing required importers to obtain a permit issued by government aimed at reducing the quantity of foreign competition, whereas import duties (including *primage duties*) enabled prices to rise to the increased import parity level. Australian prices were recorded as being up to 100 per cent above those in the UK and USA <<<ref>>>.

<sup>127</sup> Shell Australia implicitly made a judgment about the company when quoted in as having considered a benzene extraction plant at one of its refineries but is 'uncertain whether a local and *dependent* market can be found'. European Chemical News (17 May, 1993, page 18)

## **18.8 CSR Chemicals**

The 1940s marked the beginning of a boom period for the world's chemical industry with new polymers and chemicals for new applications and for replacing traditional materials such as metals, leather and wood. Utilising this newly introduced technology, the chemical industry in Australia could grow at twice the rate of the economy. At the beginning of that cycle, a sugar grower and producer of ethanol entered Australia's chemical industry to add value to its key product. Ethanol, made from sugar refinery products, could be oxidised to acetic acid and dehydrated to ethylene as two important chemical inputs. In 1939 CSR Chemicals (CSRC) established at Rhodes, New South Wales next to Timbrol the only other significant Australian-owned company.

Initially cellulose acetate resins and vinyl acetate were produced, part derived from ethanol – produced by its parent, Colonial Sugar Refineries (CSR). For 15 years it even produced polystyrene using imported styrene competing in Australia's small market with the US-based Monsanto company operating in Victoria.

A quarter century later in 1966, CSRC abandoned its sugar-origin (ethanol) strategy and began to produce phthalate-based esters used as plasticisers for PVC resin and paints. The required alcohols were produced using newly developed oxo alcohol technology. Not only was the plant small, it was increasingly overshadowed by ICI (18.9). It used feedstocks and raw materials supplied by ICI, and produced chemicals for the paint and PVC resin markets increasingly dominated by ICI. Not surprisingly therefore from 1968, ICI began to acquire equity in CSRC. Without ever obtaining a industry average rate of return, CSRC began to close in 1992. Before closing five year later, it produced phthalic anhydride made from naphthalene produced at BHP steelworks, reacted with imported alcohols to produce the phthalate esters. These esters are used principally as plasticisers for PVC resin and for paints –key products of ICI.

The closures of Timbrol and CSR Chemicals ended Australian-owned chemical manufacturing and industrial activity on Homebush Bay.

## **18.9 ICI**

World War II led to shortages reinforcing concerns about Australia's self-sufficiency justifying increased import tariffs and import licensing. The potential for high prices attracted Imperial Chemical Industries of the United Kingdom (ICI UK later to become ICIANZ) to invest in Australia with four plants. In 1940, a chloralkali plant was built at Botany, New South Wales to supply caustic soda and chlorine and a soda ash (sodium carbonate) plant built at Osborne, South Australia. Other ICI investments included a naphthalene plant at Newcastle, New South Wales, an explosives plant at Deer Park, Victoria (the Nobel plant (18.4)) and a chlorohydrocarbon chemical plant at Yarraville, Victoria based on the chloralkali plant started by Mount Lyell (18.4).

Botany however formed the core of ICI's domination of Australia's chemical industry for the next half century. Their chlorine was initially used to produce halocarbons including carbon tetrachloride and perchlorethylene and later pesticide chemicals. In 1957, ICI began to manufacture PVC polymer using acetylene gas made from calcium carbide produced in Tasmania. Polyethylene resin too was introduced, initially from ethylene made by dehydrating ethanol. Not only operating at small scale, the raw materials were expensive in a world that was now using petroleum and natural gas as feedstock.

A then substantial scale naphtha cracker was commissioned in 1960 with a production capacity of 60 000 tonnes of ethylene per year. Naphtha was available from nearby oil refineries. Also co-producing the required butenes, six years later ICI formed a joint venture company as Phillips Imperial Chemicals to manufacture synthetic rubber at nearby Kurnell.

The venture ceased in 1983 leaving the Australian Synthetic Rubber company (now part of Qenos Australia) as the only Australian producer of rubber.

<<<<Details of 1979, JV etc>>>>

There would however be one other major thrust into Australia's chemical industry during its protectionist era that was initiated by two US companies operating a Victorian oil refinery.

### 18.10 The Altona petrochemical complex

Two decades into an investment surge that saw two polystyrene polymer manufacturers establish; Monsanto at West Footscray, Victoria and CSR Chemicals at Rhodes, New South Wales and with ICI producing polyethylene and polyvinyl chloride resins at Botany New South Wales, a petrochemical complex established in 1961 to compete against all three.

Two companies (now known Mobil and Exxon<sup>128</sup>) operating the petroleum refinery at Altona, Victoria, promoted the establishment of a nearby petrochemical complex at which they would operate as the Altona Petrochemical Company (APC). APC would produce the key feedstocks ethylene, propylene and butadiene from refinery by-product "gas-oil".<sup>129</sup> The feedstocks would be sold three US companies; Dow Chemicals, Union Carbide, BFGoodrich and Goodyear<sup>130</sup>, and later two German companies, BASF and Hoechst to produce of synthetic resins, rubber and chemicals. Import tariffs ranged from 40 to 50 per cent.

In 1965, four years after the Altona complex commenced, Australia's largest oil and gas reserves were discovered offshore in Bass Strait.<sup>131</sup> While the complex expanded using "cheap"<sup>132</sup> ethane gas, over the next three decades, it failed to export more than one-tenth of its turnover. APC (and now part of Qenos previously Kemcor) has been one of Australia's most profitable major manufacturing companies. In 1989, "The Top 1000 Companies" produced by the Business Review Weekly<<<ref >>>, ranked APC as the fifth ranking profitable company and the most profitable manufacturer with a return of 116 per cent on shareholders' equity (in 1983 it was the most profitable company<sup>133</sup>). Kemcor has declared that all its projects over \$15 million will be deferred expecting no significant expansion over the next 5 years<sup>134</sup> and is reducing employment by some 20 per cent. In 1993, "The Top 1000 Companies" listed the consolidated APC as Kemcor, with a loss of \$9.7 million.<sup>135</sup>

The scale of production at Altona was typically no more than one-third that of competing plants in North America and Europe and exports substantially discounted below domestic

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<sup>128</sup> Originally Standard Vacuum Australia, in 1990 Exxon sold its share in the PRA oil refinery to Mobil although retaining its share in the petrochemical plants. It is now known as the Mobil Altona Refinery

<sup>129</sup> Gas-oil produces a similar range of feedstock co-products to naphtha but less ethylene and more aromatic hydrocarbons.

<sup>130</sup> Goodyear Tyre and Rubber Company, as technology licensor, was a 30 per cent partner with APC in Australian Synthetic Rubber Company (ASR) to produce the synthetic rubber.

<sup>131</sup>In 1960, Dr Weeks a consultant geologist established a royalty agreement with BHP in the event of discovering oil in Bass Strait. He was assisted by Dr Temple an Exxon lawyer (Australian Financial Review, 6 March 1992, page 14). The existence of Bass Strait reserves was at best conjectural and planning for the complex had already begun in the late 1950s.

<sup>132</sup> The price of gas was kept confidential though reliable advice received <<<hmmmm?>>>>indicated prices of around A\$0.39 per gigajoule was negotiated. That low rate applied for over two decades before the introduction of the Federal *Resource Rent Tax*.

<sup>133</sup>Business Review Weekly, April 23-29, 1983 page 53.

<sup>134</sup>European Chemical News, 17 May 1993, page 20.

<sup>135</sup>Net revenue was \$263m on assets of \$237m.

levels. In 1979 and 1989 APC retracted announcements for expansion pre-empted by expansions at ICI's Botany complex (**Error! Reference source not found.**).

Activities began to rationalise from the 1970s through 90s including the closure of a chloralkali plant operated by BFGoodrich used to produce VCM for PVC, styrene by Dow and specialty chemicals including by Dow and BASF.

From 1991, with import tariffs declining to 5 per cent, the Altona complex began to consolidate ownership. First as Kemcor Australia that included APC and the assets of the other companies at the complex<sup>136</sup> then in 1999, its joint venture with Orica in polyethylenes () became Qenos. The managing director of the joint venture was also the managing director of Kemcor Australia. <<<discussion about the ACCC>>>

It will manufacture PE products, PP, synthetic rubber and engineering plastics. It will also import the new *metallocene-catalysed polyolefins* – the newer higher performance polymers.<sup>137</sup>

This joint venture will have capacities of: 470,000 tonnes/y ethylene; 130,000 tonnes/y low density and linear low density polyethylene; and 165,000 tonnes/y high density polyethylene. The use of Kemcor technology at Orica's unit in Botany Bay could increase high density polyethylene capacity to 100,000 tonnes per year<<<note benefit of jv in addition to op cost!!>>>.138

### 18.11 Orica in 1983 to present

In 1966, the Tariff Board<sup>139</sup> (later the Industries Assistance Commission) reviewed the assistance arrangements for goods produced by the chemicals and plastics industries in Australia reducing most tariff rates. The Board also recommended a review for 1975 but the new<sup>140</sup> Liberal Coalition Government decided for a deferment until 1979. In 1979 ICI offered to invest in an A\$400 million naphtha cracker at Botany, New South Wales if the scheduled review would again be deferred.<sup>141</sup> Orica was then the largest and most diversified chemical manufacturer in Australia. It owned, or had substantial interests in manufacturing operations in all states of Australia and so given nearly all tariff rate reviews resulted in rate reductions<sup>142</sup>, a deferred review would be valuable. At that time, the Botany petrochemical site was three decades old and their naphtha cracker, that produced the key feedstock for the complex, was operating at a significant scale disadvantage. Feedstock prices were

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<sup>136</sup> Dow Chemical (Australia) continues to operate two technically simple operations - styrene polymerisation to produce polystyrene and polyols made from imported propylene oxide for production of polyurethane foams.

<sup>137</sup> European Chemical News, 'Australia: Orica Joint Venture Under Way' Vol. 70, No. 1868 05/07/1999 P5

<sup>138</sup> Asian Chemical News, Australia: 'Orica - Counting On The Economics Of Mergers'. Vol. 5, No. 206 01/03/1999 P17

<sup>139</sup> The Tariff Board, later to become the Industries Assistance Commission, was a Government agency with the responsibility to review industry assistance arrangements at the direction of Government. The Government normally accepted the recommendations with nearly all since 1966 being for a reduction in tariff rates.

<sup>140</sup> In 1974, the Whitlam Labor Government, that in the previous year reduced all tariffs by 25 per cent of the previous rate to the Fraser led Liberal Coalition party.

<sup>141</sup> Unpublished. The author became aware of the terms of the deferment through being employed by the Industries Assistance Commission.

<sup>142</sup>The Tariff Board and Industries Assistance Commission also reviewed rates on individual and groups of activities, in addition to broad industry reviews such as in 1966.

substantially higher than at Altona that had access to Bass Strait gas.<sup>143</sup> ICI could either progressively phase out Botany given the small scale of operations there, and as it progressively did in the late 1990s, or upgrade its ethylene source that supplied the core of the complex. The feedstock was not only more expensive at Botany, but unlike at Altona, it could not utilise the C4 feedstock stream from the cracker which has an important bearing on competitiveness.<sup>144</sup> The proposed cracker, would operate at substantially higher costs than at Altona but a deferred review of tariff rates impacting on a range of ICI activities provided internal cross-subsidisation.<sup>145</sup> The government deferred the tariff review. In 1984 a \$400 million ethylene cracker, with a nominal capacity of 250,000 tonnes of ethylene and 100 000 tonnes of propylene per year was commissioned.

At Altona Victoria, APC (later to become part of Kemcor) was only extracting around 60 per cent<sup>146</sup> of the ethane available to it, and being very cheap feedstock, it became very profitable (106 per cent return on shareholders funds while tariffs remained between 30 and 40 per cent) (18.10). Exports were at substantial discount to the Australian market price where tariffs and freight, allowed prices to be at least 30 to 40 per cent above world levels.

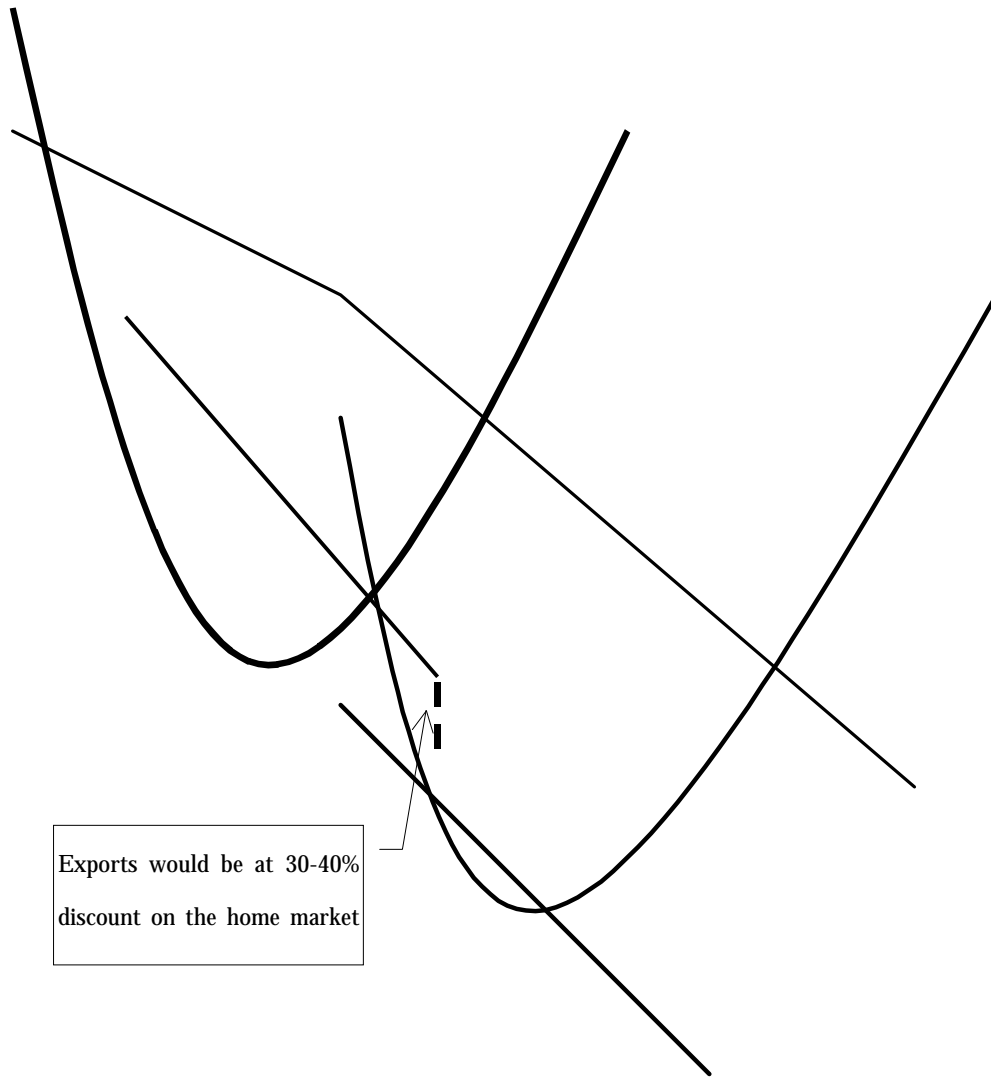
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<sup>143</sup>For example, in the late 1980s, ICI advised the Industries Assistance Commission that it incurred a feedstock disadvantage of about \$100 per tonne - about a 30 per cent compared with Altona. Further, as a naphtha user, ICI did not obtain maximum credit for the C4 co-product feedstock that is sold to Altona after processing in Japan or reformed to lower value feedstock. In either case, the operation represents an inefficient use of naphtha in a world where naphtha crackers are competitive if the co-produced feedstocks (C3 and C4) are utilised. ICI, though less profitable, could operate at such disadvantage by operating at larger scale. Industries Assistance Commission, *The Chemicals and Plastics Industries*, Report No. 390 Vol 2 page 213. 30 May 1986, Canberra. As shown later, ICI may even have operated the cracker and some downstream polymers at very low returns (<<<details of 1979 'deal'.....>>>).

<sup>144</sup> A typical naphtha-using cracker, as then used at Botany, produces a range of hydrocarbon feedstocks, predominantly ethylene (about 60 per cent), C3 - propylenes (about 30 per cent) and a C4 stream - butane and butene isomer mixture (about 10 per cent of usable products). The competitiveness of naphtha-using petrochemical plants is dependent on the value of these three co-product feedstocks For example, in 1986, the value of these co-products from naphtha exceeded the cost of the feedstock (ie. making naphtha crackers cheaper than gas-based units). Chem Systems as reported in *European Chemical News*, February 23, 1987 page 9.

<sup>145</sup> The Managing Director of ICI said '...if implemented (the tariff reductions) would kill the industry, not cure it, and prevent its part in the economic development of Australia'. <<<title>>> *Chemical Engineering in Australia*, Vol ChE11 No 3 September 1986,

<sup>146</sup> IAC Report 1986 Vol 2 page 212. Also Eco Systems study report prepared for the Victorian government August 1990 indicated only 10 petajoules of ethane out of 18 petajoules available is extracted for use as feedstock petrochemicals. Up to 25 petajoules could be available by the year 2000 (One petajoule of ethane is equivalent to about 20 000 tonnes). <<<Referred to in the Coode Island Report study>>>



During the IAC review, a polyethylene manufacturer at Altona sent a telex to government saying that it would still invest "regardless" of the tariff review. A tariff reduction, would actually have helped Altona in discouraging the investment. <<<<analysis of MC curves and kinked demand>>>>

In 1983, Liberal Coalition Government lost office to the Hawke Labor government and the IAC was given the go ahead in 1984 to commence the review of tariffs.

In 1987, a recommendation from the Industries Assistance Commission for tariffs for the chemicals and plastics industries to be phased down to a ceiling of 15 per cent was accepted by Government. ICI began to divest operations at the Botany complex. PVC resin would no longer be manufactured followed a year later by its precursor EDC. Polypropylene

*Figure 4 Part drawn - Concept only!! Altona ethylene cracker operated the LH MC cost curve and faced a kinked demand/MC line (exports at discount. A doubling of capacity would enable it to move to a lower cost curve but only if it could supply the whole Australian market.*

manufacture was closed and the ethoxylate and surfactant business was sold to Huntsman Corporation. In 1997, ICI outbid Kemcor for the ethane that South Australia Altona \$300 million was invested in a pipeline to ethane from South Australia <<reference and explanation IAC vol 2 page 212>>> and the naphtha cracker was converted to an ethane cracker. <<ICI could outbid Kemcor sunk cost argument>>

In 1997, ICI Plc divested its shareholding in ICI Australia and it was renamed Orica. Two years later it formed a joint venture company with its former competitor Kemcor in the manufacture and sales of polyethylene resins. Between the Altona and Botany complexes, LDPE, LLDPE, HDPE and PE are produced at scales of production one-third or less of competing plants in Asia. The joint venture, promoted as reducing annual costs by \$40 million was approved by the ACCC as there was substantial competition from imports. <<ACCC analysis. Discussion with officer>>

Significantly too, it will also import metallocene-catalysed polyolefins (polyethylenes) which are more sophisticated forms of polymers, like those produced in Asia.<sup>147</sup> The joint venture will therefore command three production centres in New South Wales and Victoria with an aggregate production of 450 000 tonnes of ethylene, or about two-thirds the capacity of one ethylene production unit at Thailand's Map Ta Phut

### 18.12 Summary of development <<<analysis wrt Porter...>>

Australia's chemical industry began during the nineteenth century with basic products driven by two influences:

International transport cost savings on basic chemicals required by the fast growing mining and agricultural sectors.

By-products of livestock and agriculture activities could be used to produce crude fertilisers, soap and simple toiletries industry. Later, sugar enabled the production of alcohol, in 1939 alcohol seeded CSR Chemicals to ultimately produce complex chemicals unrelated to alcohol.

Industry protection from the 1920s by tariffs and restrictions, allowed domestic prices to rise enabling high cost activities. There were many outcomes that worked against long-term competitiveness.

#### *Fragmented small-scale production lines*

Activities promoted or enabled to expand, included Timbrol and CSR Chemicals. While located within a kilometre at Rhodes, New South Wales, there were no links. Production was driven by the application of new technology to produce goods for fast growing markets. A diverse range of specialty chemicals were produced at prices that were at least 40 per cent above those in the UK or the US.

In 1990, ICI had reserve ethylene production capacity. Instead of decommissioning its thirty-three years old LDPE polyethylene unit and building one substantial internationally competitive plant, it was refurbished and a second ethylene-using LLDPE polyethylene unit. Tariffs promoted two plants that are each well below world scale.

#### *Multiple competing producers*

There were no restrictions on new investments resulting in multiple competing producers while individual firms implicitly encouraged foregoing scale for fragmented production. For example: a 1959 Tariff Board review of the PVC industry noted the small scale of ICI's Botany plant with consequent high production costs<sup>148</sup>. Two years later, BFGoodrich established a plant at Altona, Victoria to divide the comparatively small Australia market soon followed by a third at Laverton, Victoria operated by ICI. Manufacturers in Japan were then already producing PVC in plants twice the size of the whole of Australia's PVC industry.<sup>149</sup>

#### *Disincentive to export*

### 18.13 Today – industry structure and outlook

A largely descriptive chapter.

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<sup>147</sup> European Chemical News, Vol. 70, No. 1868 European Chemical News 5 July 1999P5

<sup>148</sup>Tariff Board, *Polyvinyl Chloride Resin* f.3620/59 of 30 April 1959.

<sup>149</sup>Tariff Board Report, *Vinyl Chloride Polymers and Copolymers*, 1963

Industry- structure. Anzsic-based description.

Industry performance. Trade profile (import/export ratio by product), production, profitability and employment.

Relationship with government agencies.

Review of available resources (gas, petroleum, coal, refineries, minerals)

Details of the roles of industry associations (State and national).

Outlook by sector. A strategic assessment reflecting scale, age, technology, relationships and general trends.

## 19 FEDERAL GOVERNMENT AND INDUSTRY

### 19.1 Industry protection principles

Porter supports the general contention that industry protection retards the development of industry by reducing flexibility. Krugman however considers that subsidies and protection can be used to increase a country's share of rent in a way that raises national income at other countries' expense.<sup>150</sup> This happens where it provides for external economy<sup>151</sup> with high returns to society because in addition to the benefits to the protected industry, it benefits capital and labour employed outside of the industry. Such targeting could be justified if the domestic industry has a fundamental cost advantage relative to foreign competition and there are substantial economies from scale or learning from increased production including in particular in related industries with fundamental competitiveness.

Because of the increase role of technological competition, Krugman reasons that since certain sectors yield important external economies, producers are not rewarded with the full social value of their production. However, if there were indeed imperfect competition there would also be hidden forms of competition that would dissipate the benefit of protection. In theory, a protected home market allows a domestic firm to produce more in its home market than it otherwise would and therefore learn more quickly than its foreign rivals. This would allow the firm to compete more successfully and earn higher profits in export markets than it otherwise would. Krugman refers to this policy as protection as export promotion.

Experience shows however that protection is susceptible to the political pressures of special interest groups, and outcomes often fail to take adequate account of the cost to consumers. Import protection is often awarded not on demonstrated benefits but in response to particularly intense lobbying. Even administrative mechanisms that were designed to deal with particular identifiable foreign practices or domestic market failures have been manipulated to serve a more general protectionist function.<sup>152</sup> The introduced measures, could ensure the even less visible influence of the political market would replace the less visible influence of the economic market.

In seeking to stimulate industry, government has traditionally focussed on the quantity of demand including by subsidies and export-incentives (0) rather than its quality. Using a variety of performance indicators, Porter found government in the end generally failed to achieve more than a limited stimulus and benefit to the economy by any of its direct measures.<sup>153</sup> A longer lasting beneficial stimulus to industry was evident to Porter by promoting more advanced and sophisticated demand such as by improving buyer awareness (eg. of energy efficiency and product reliability helped by supporting consumer complaint systems). This might include an environment conducive to innovation and entrepreneurship and the support of education and industrial R&D and other measures to promote an efficient redeployment of resources released from declining activities.

<sup>150</sup> An alternative expression is that if there is a foreign firm earning profits in the domestic market, it should be in the domestic interest to extract some of those profits or rents by using an import tariff. The tariff is in effect a tax on a foreign firm.

<sup>151</sup> An external economy means a benefit from some activity that accrues to other individuals or firms than those engaging in the activity.

<sup>152</sup> Finger, J. Michael, Hall H. Keith, and Nelson, Douglas R. 1982. 'The Political Economy of Administered Protection.' American Economic Review 72, 452-466.

<sup>153</sup> Foreign aid is often tied to ensuring captive markets in less developed countries with less sophisticated buyers. Like export drives, only providing a short-term stimulus, such market serve to undermine the pressure to upgrade and should never be used as a means to promote industry.

### 19.1.1 Preamble to protection in Australia

The Federal Government influenced the early development of Australia's chemical industry with industry protection, notably import tariffs and import licensing.<sup>154</sup> These in a sense transferred part of the natural advantage of Australia's mining and agricultural sectors. <loose, explanation?>> Import tariffs (and primage duties<sup>155</sup>), import licensing and anti-dumping measures was used.

From the 1930's, government adopted Keynesian-type management of demand. This generally had a short-term focus with outcomes within the political cycle. To a large degree, these were aimed at stimulating the utilisation of existing or readily available productive capacity. It was a policy of promoting investment in reaction to industry input. (In a sense therefore, this role has today been partly assumed by State governments - see later<<<>>>). The government simply used protectionist tools to manipulate national and international competition varied in response to economic fluctuations. It was applied to attract investment to Australia as a high-cost region. <<<details>>> It was also used to correct departures from the norm of full employment, high capacity utilisation, high output growth and a more favourable external trade balance <<references>>.

Its actions were unilateral without apparent considerations of national impact on costs. It used policy instruments in response to its own decision-making process. Those initiatives often only created shifts that were later reversed and influenced by regional political interests (eg. ICI Botany) aimed at "jobs" without considering the full long-term and national cost<<<refer APC>>>. As such it extended its control from the national, macro level, to the micro level. The government was reactive using quick fixes for the politically sensitive creation of jobs through new investment though the demand for chemicals and plastics was growing rapidly – around 10 per cent per years. It was politically expedient to offset the high cost of doing business in Australia, often influenced by inherent structural inefficiencies related to a highly unionised workforce, by protection whose cost was absorbed by an affluent society.

These protective offsets in the end, became the focus by the protected industry to seek the retention of the tariffs and other protection measures. <<<ACIC publication>>. The government was repeatedly approached with negative signals for which the government was asked to provide enforcements to reverse a shift in the market or in competitiveness. In the end, these represented successive approximations to a moving target with on-going appeals by industry for tariff variations, import licensing, primage duties and anti-dumping. These measures provided short-term shifts between temporary production equilibriums that were

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<sup>154</sup> Tariffs, also referred to as "customs duties" or "import duties", are consumer taxes applied to imported goods valued at FOB (free on board - the cost of goods delivered to the ship at the country of origin). These taxes are applied to goods that are similar or can substitute for locally manufactured goods (ie. produced by the protected industries) and passed onto consumers and users by way of higher prices. For most goods, the Australian price is set by competition from imports. Exceptions include high volume - low value goods such as detergents, paints and pesticides where the incidence of freight is proportionately so high that local competition determines the market price.

<sup>155</sup> Primage duties was a revenue raising surcharge of up to 10 per cent on imports but which, like import duties, implicitly provided additional assistance to Australia's manufacturers.

accepted and justified by industry with secular multiplier benefits.<sup>156</sup> The underlying economy-wide sources of the costs were not addressed.<sup>157</sup>

Since the 1990s with the substantial removal of import tariffs, the focus of industry interest has shifted to 'anti-dumping' protection and maintenance of a 5 per cent residual import tariff.

### 19.1.2 Detailed history of Australian industry protection

Commonwealth tariffs were first levied in 1902 to replace State customs and excise duties that operated before Federation. Then, tariffs were primarily a source of revenue for State governments. In 1908, tariffs were increased on woollen goods, agricultural goods, and iron and steel to allow industry to pay a fair and reasonable wage. Concerns about Australia's isolationism and dependence on outside sources of supply, led to the Greene Tariff in 1921 as it, "will protect industries born during the war, will encourage others that are desirable and extend existing industries".<sup>158</sup> This decision signalled the beginning of tariffs changing from being used primarily for revenue raising to one being primarily for protection, (ie. to promote one activity in favour of another, or to reallocate resources).<sup>159</sup>

The Depression of 1929, a very negative balance of payments and concerns about high unemployment, led the Scullin Government to introduce import restrictions, primage duties and a substantial increase in import duties. Four years later, and through to 1939, tariffs were for a short time reduced to the pre-Scullin levels that had operated until 1929.<sup>160</sup> During World War 2, there was little competition, as imports were dominated by goods required for the war effort but seeking revenue to support the war, the government again increased tariffs.<sup>161</sup> In 1936, import licensing was introduced to conserve currency reserves, it also conferred a substantial measure of additional protection and affected 98 per cent by value of all imports. This quantitative control measure remained in place until 1960.

Anticipated and actual shortages reduced competition encouraging several enterprises to invest in Australian-based chemical businesses including the two multinational companies, ICI and Monsanto. These two manufacturers faced little international competition (except some goods from North America - and even these were subject to severe quantitative restrictions to protect the sterling currency bloc which extended through to 1950), and in Australia from the two small Australian companies, Timbrol and Commonwealth Fertilizer and Chemicals.

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<sup>156</sup> *Multipliers* show the flow on effect of an activity to other sectors of the economy and supported by protected industry to justify their contribution to the local economy normally omitting the wider (and negative impact) of their higher cost products and presence to the nation (*the other side of the equation*).

<sup>157</sup> An extreme example of costs can be made from offshore shipping. Although international freight costs provide a substantial measure of protection from import competition, shipping between Australian ports added to costs. In 1960 it was cheaper to ship salt from South Australia across the equator via Japan to Sydney, New South Wales than to ship it direct around the coast. It was a result of the Navigation Act of 1904 aimed at promoting a local shipping industry. D.W. Findley, *The Chemical Industry in the Australian Economy: Problems and Prospects*, Proceedings, Royal Australian Chemical Institute, Vol 33, No. 2, Feb. 1966, page 25.

<sup>158</sup> *Hansard*, House of Representatives, 24 March 1920, page 700.

<sup>159</sup> The tariff rates appear arbitrary with wide variations for sometimes similar activities. Anecdotal evidence implies rates could then be negotiated on non-economic terms.

<sup>160</sup> For example, the Tariff Board of 22 December 1937 reduced the General Tariff on amyl acetate etc. from 65 per cent to 55 per cent.

<sup>161</sup> *Industry Assistance: The Inside Story*, C A Rattigan, Melbourne University Press, 1986, page 4.

During and after the War, Australia's manufacturers had been very profitable and, with considerable political strength, sought the maintenance of assistance.<sup>162</sup> Helped by the serious balance of payments crisis of 1951, manufacturers successfully lobbied for the reinstatement of import licensing. Licensing again covered 98 per cent of imports offsetting increasing import competition despite high levels of import tariffs.

By 1960 however, the very high cost of manufactured goods in Australia led government to withdraw import licensing for some 90 per cent of imports (excluding motor vehicles, textiles, clothing and footwear to protect politically sensitive industrial regions). Freeing up trade with the consequent reductions in market prices resulted in the inevitable closure of many high cost uncompetitive enterprises.

In the mid 1970s, the average "effective rate"<sup>163</sup> of assistance to manufacturing industry was around 40 per cent, inflation was increasing and there was a major surplus of trade. To encourage more imports, to reduce prices and reduce the value of the currency, the Whitlam Government in 1973 instigated a once-off one-quarter reduction in the level of tariffs. This tariff reduction coincided with a peak in its growth () and a decline from representing 3 per cent of GDP to one-half at 1.5 per cent within two decades.

In 1987, tariffs for the chemicals and plastics industries were phased down to a ceiling of 15 per cent resulting by accepting a recommendation by the Industries Assistance Commission.<sup>164</sup> A 5 per cent concession for all imports from Developing Countries<sup>165</sup> applied. In March 1991, the government announced a progressive tariff reduction program for all goods with a ceiling target of 5 per cent by July 1996 and Developing Country concessions would be phased out for four countries.<sup>166</sup> Presently goods that were once subject to tariffs, but free (under Tariff Concession Order) could be imported at a rate of 3 per cent – subsequently identified as a nuisance tariff. In other words, three rates apply, 0, 3 or 5 per cent for all manufactured goods except textiles, clothing and footwear and passenger motor vehicles.

### 19.1.3 Outcomes

Often without a fundamental competitive advantage, in the end, these attempts failed to promote competitive industry and remedy problems that were created by changes in demand and supply, technology and international productivity. Closures marked the end of protectionism beginning the mid-1970s. There are many indications of weakness, but management quality too suffered as indicated by Penrice Soda Products. This company had been operating as part of ICI Australia since 1940 producing sodium carbonate (soda ash) with import tariffs ranging to 40 per cent and substantial use of anti-dumping legislation.

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<sup>162</sup>This position contrasted to the primary industry group, who as free traders, had become less significant. Alf Rattigan, op. cit.

<sup>163</sup>The *effective rate of assistance* was used by the Industries Assistance Commission to assess the practical value of tariffs taking into account the value added by the assisted activity and the higher cost of inputs resulting from assistance provided to upstream industries (which supply the input materials).

<sup>164</sup> *The Chemicals and Plastics Industries*, Volumes 1 and 2, Industries Assistance Commission May 1986, AGPS cat no. 86 1097 X.

<sup>165</sup>A *Developing Country* - a term used to describe countries such as Singapore, Hong Kong, the Philippines etc. which were previously giving preferential status for cottage industry products but which has been extended to include all their manufactured goods, are afforded a 5 per cent concession. The concession is a reduction from the normally applicable rate thereby rendering imports, (without distinction and even sophisticated chemicals), more competitive against other imports from (developed) countries.

<sup>166</sup> This means that by 1996, imports from Developing Countries, (other than from Hong Kong, Republic of South Korea, Singapore and Taiwan) will be duty free.

With the tariff phasing down to 5 per cent by 1992, the operation was sold and for the next six years it was returning 60 <<confirm>> per cent returns to its new shareholders.

By far the greatest influence was to promote manufacturing oriented to the domestic market dividing markets at the expense of scale that is very important for the competitiveness of the capital-intensive chemical industry. <<<detail VCM/PVC comments by tariff board>>>. Manipulation by government at the micro-level, without addressing the whole industry, the inefficiencies of the operating economy and without regard to the long-term effects, often led fragmentation of many activities. Where the government had direct influence, it chose to ignore or was unaware of the long-term implications <<<<VCM, APC/ICI>>>>.

The failure to address structural problems lead to cost control initiatives from the price reductions notably from 1987 when import tariffs were phased down in two stages from 40 per cent to 5 per cent. Divestments and closures, market the beginning of this stage.

### 19.1.4 Status

While the nominal rate of tariffs on chemicals is less than 0.5per cent, the effective rate is 3 per cent compared with all manufacturing of 5 per cent.<sup>167</sup>

The plastics processing industry is a major user of chemicals as synthetic resins, and although its growth has been high compared to other sectors, it has largely occurred by displacing traditional materials, simply reflecting a world-wide trend. On average, Australia's plastics industry has been paying at least 20 per cent more for Australian made plastics resins than competing countries.<sup>168</sup> Not surprisingly helped by the high costs of raw materials, the value of exported plastic goods is very small (about 2 per cent of industry turnover). The political argument is the balance of the consequence of price inflating assistance for the petrochemical sector employing about five thousand, against the impact on the thirty thousand employees in the plastics sector using their higher priced petrochemicals.

### 19.1.5 Influence of protection on the chemical industry

Tariffs were designed to help foster an infant industry but in 1961 it was predicted that the Australian chemical industry would remain in a "state of permanent infancy".<sup>169</sup>

Import tariffs could be defended as compensation for Australia's unattractiveness for manufacturing. Australia would have been perceived by investors as having high costs for construction, labour and transport, few raw materials and high-energy prices. Tariffs, by raising the local market price, offset Australia's uncompetitive investment climate. Import tariffs and restrictions widened the margin between the cost of raw materials and the finished products. By that they compensated for the then high cost basis to Australia, enabling small scale manufacture or of otherwise non-viable products. However, widening margins increased costs and impacted on the shape of the industry.

#### 19.1.5.1 Prices

In 1960 for example, the Australian price of key organic chemicals such as acetone, acetic acid, aniline, and phenol ranged from 60 to 120 per cent above the price of major chemical

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<sup>167</sup> *Trade and Assistance Review*, 1999, Productivity Commission, 1999. AGPS Canberra 1999, page 58 ff.

<sup>168</sup> For example, Kelvin Fahey *An Island of Plastics* Published by Plastic New International 1989 page 87. Plastic resins are identified as being 20-35 per cent above USA prices. The more recent reduction in tariffs is reducing this margin.

<sup>169</sup>W.P. Hogan, *Economic Aspects of the Chemical Industry*, Proceedings, Royal Australian Chemical Institute, November 1961, page 431.

manufacturing countries.<sup>170</sup> Inorganic chemicals such as soda ash and caustic soda were about 100 per cent and 50 per cent respectively more expensive than in the United Kingdom while the price of the raw materials such as benzene, ethanol and toluene were comparable, even cheaper than competitor countries.<sup>171</sup>

Import tariffs inflate prices to users and consumers reducing disposable incomes (ie. reducing living standards) and the competitiveness of user industries. They have persisted as tariffs visibly stimulate a region or an investment at the less visible (and political) expense to the wider community. In that sense they are ideally defended within Australia's system of over-government where regional minorities can assume political significance over national interests. Tariffs are easily defended by arguments of stimulation to the target and related

### 19.1.5.2 Disturbing competitive positions

The Botany petrochemical complex is a good example (). Protection enabled the 1983 commissioned cracker without which the complex would have declined along with its chloralkali business. Instead, it has become a polyolefin producer using shipped feedstocks. Its initiative has impeded the development of the better-located Altona complex and ICI outlaid \$300 million for a 1 380 kilometre pipeline from South Australia.<sup>172</sup>

### 19.1.5.3 Discouraging exports

Tariffs raise the price of goods in the home market - the higher the tariff, the greater is the disincentive for the Australian manufacturer to export into markets where prices are below those of the home country. <<needs MC MR analysis>>>

### 19.1.5.4 Fragmented activity

Tariffs encouraged the diversification of activities.

Such diversified competition was not confined to finished products as it also involved feedstocks. For example in 1972, Hoechst established at the Altona complex to manufacture high density polyethylene using ethylene as also used by Union Carbide for low density polyethylene. Without a tariff of 60 per cent on high density polyethylene, Hoechst would not have commenced its manufacture. Tariffs fostered two plants competing for limited ethylene, instead of a single, large export-oriented polyethylene plant.<sup>173</sup>

## 19.2 Government post tariffs

During the early 1990s, following its initiatives to reduce tariffs, Government moved to lower public expectations, arguably in view of its perceived failure to achieve credible industry policies. There has been an apparent preoccupation to reduce the expectation of a role for government and allow for the free operation of the market. In 1992, it produced .....<<<petrochemical cost issues. Details of intent. Liaison with ACIC >>>. Overall, industry sector policies and initiatives until 1999 have been in a hiatus as reflected in major reductions of personnel in the manufacturing industry policy areas of Federal Government and generally also at corresponding State Government agencies.

<sup>170</sup>Tariff Board, Annual Report 1960-61, Commonwealth Government.

<sup>171</sup>Alex Hunter and L. R. Webb, *The Chemical Industry* in *The Economics of the Australian Industry*, page 321.

<sup>172</sup>ICI plans \$300 million gas pipeline, *Australian* 8 June 1993

<sup>173</sup>An argument could be made to suggest the reverse, ie. to manufacture the high density form in favour of imports of the low density form. The relative size of the Australian market would favour the former scenario.

Government has reverted to orthodox fiscal management with reduced responsibility for steering the economy and maintaining full employment. This is also reflected in tighter controls on public expenditure, deregulation, privatisation and the contracting out of services with emphasis on increased competition in both the public and private sectors.

By implication, the Federal Government has reverted to a neoclassical role of relying on competition in the marketplace to restore competitiveness and economic performance. (What is the affect of the ACCC with its concerns about domestic monopoly eg. the JV of Kemcor and Orica?). It is relying on a laissez fair doctrine in default of evidence of another role for itself.

### 19.3 Dumping protection

The General Agreement on Tariffs and Trade allows member countries to apply anti-dumping measures on dumped imports if they cause, or threaten to cause, material injury to domestic industry. Governments may impose anti-dumping measures to provide relief to domestic industries injured<sup>174</sup> by competition from imports sold at prices lower than the selling price in the exporting country. Such goods are referred to as being "dumped," and their importation described as "injurious dumping" if industry in the country of destination is "injured". The injurious effects of the dumped goods may be offset by means of anti-dumping duties levied at the time of import, or a formal undertaking to export future goods to the importing market at a normal price. The benefit of losing access to cheaper goods (i.e. by users as their raw materials and inputs to industry or the consequent cost to consumers) is not formally addressed in its application.<sup>175</sup>

#### 19.3.1 Application

Antidumping duties may be applied to the imported goods if found to have been dumped.<sup>176</sup>

Dumping is defined to have occurred if the imported goods are:

- Sold at a price below the country of export, and;
- The Australian (manufacturing) industry has suffered material injury, and
- There is a causal link between the material injury suffered and the exports of dumped goods.<sup>177</sup>

A WTO Agreement<sup>178</sup> allows members to apply countervailing duties where imports, benefiting from certain forms of subsidies in the country of origin, cause or threaten to cause material injury to a domestic industry.

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<sup>174</sup> Injury is signalled by a change in market share, an effect on prices, production, forward orders, profits, employment, cash flow and investment. These signals must be significant and greater than that likely to occur in the course of normal business.

<sup>175</sup> For example, *ICI goes to court against refusal to stop dumping*, Australian Financial Review, July 18, 1991. The Anti-Dumping Authority found that dumping had occurred and dumping duties were imposed. The consequent increases in prices of products (sodium cyanide used by the gold mining industry), prompted a response by their association calling the court appeal a blatant bid to shore up its own interests ('Miners unite to rap ICI', Australian Financial Review, 25 July, 1991).

<sup>176</sup> Normally a claim is made by a manufacturer of like goods that have closely resembling characteristics but not necessarily identical to the imported goods.

<sup>177</sup> Anti-dumping legislation also applies to where government subsidies have been used to promote exports (e.g.. loans and export incentives). Anti-dumping protection rules do not consider the fundamental competitiveness of the manufacturer seeking protection (or the cost impact on users).

<sup>178</sup> World Trade Organization Agreement on Subsidies and Countervailing Measures (1995).

The discount margin on the selling price is redressed by either a dumping duty of equal value or an undertaking by the importer to desist in future. The benefit to the protected manufacturer can be substantial, 20 per cent or more of the imported price and in just one claim can involve imports from many countries. Such legislation provides a substantial measure of protection to industry. Even the presence of the legislation acts as a deterrent, so that the number of claims by industry can understate its impact in inflating the price of imported goods in the home market.

### 19.3.2 Economics of Dumping

There are two components to the manufacturer's cost - a variable cost and a fixed cost.

- The variable cost includes the cost of raw materials, energy and direct labour, packaging and distribution which increases approximately in proportion to each additional unit of production.
- The fixed cost (or overhead cost) includes capital cost recovery, management, research and development and other costs that are incurred broadly independent of the volume of production.

There is therefore an incentive to sell if the price realised is above the variable cost so that there is a contribution to the fixed cost (or the overheads). Manufacturers commonly maximise profits by selling at one price in the home market (fully covering their fixed and variable costs of production) and at lower prices in overseas markets to (at least) cover their variable costs. The nominal profit margin per unit sold in the overseas market is lower but it contributes to the gross operating surplus (of course providing anti-dumping legislation is not incurred in the overseas market).

The chemical industry is a capital-intensive industry (i.e. the variable cost is low when compared to the fixed cost) providing scope for significant variation in the prices of goods between markets. Therefore, while there is unused production capacity, manufacturers may create a variety of prices according to the market or region to minimise the penalty of operating at less than full capacity.

Arguments used to justify anti-dumping protection includes that unregulated dumping can hinder industry development as surplus production from one industry could be (dumped) sold into a smaller market where a new industry is being established. The new industry, without the resources, the breadth and depth of longer established firms may be unable to tolerate a price reduction causing its collapse.

#### 19.3.2.1 Argument against anti-dumping legislation

- Australian industry forewent scale in favour of diversified manufacture to be smaller and less competitive. While declining tariffs has promoted industry rationalisation, antidumping legislation discourages that trend to achieve scale economies.
- Anti-dumping legislation reduces access to cheaper goods increasing costs. In so doing it reduces the international competitiveness of users and disposable incomes and living standards of consumers.
- Antidumping measures may be difficult if possible to enforce when a dumped price material is incorporated as a component of imported goods. Enforcement discriminates between single component product and compound goods.
- Dumping is a feature of the normal competitive environment that should have been discounted into the original investment assessment. It is used after by industry well after the "nursery stage" of development that is used to justify its use.

- Tariff-protected industry in Australia often exports at discounted prices that, if it causes injury, would be dumped prices.

### 19.3.2.2 Significance of dumping in Australia

In 1997, Australia was the world's second largest initiator of anti-dumping action against imports. Over a ten-year period through to the early 1990s, Australia sought more remedial action from dumping than the European Economic Union.

Over a ten-year period to 1997, Australia was the third most intensive user of anti-dumping measures on a trade-weighted basis after New Zealand and Argentina<sup>179</sup>

Over the six-year period to 1998-99, 40 per cent of complaints initiated by industry were for "Chemicals and petroleum products" (ANZIC classification 27).<sup>180</sup> Of the chemicals expandable polystyrene, low density polyethylene and PVC resin accounted for the majority of initiations.

Chemicals - largely petrochemicals, have represented nearly one-half the number of claims in Australia (one-third world-wide) though they were only one-tenth the value of imports. For comparison, China, Indonesia, Taiwan and Thailand do not have anti-dumping systems, Japan has only recently used it for the first time, and Singapore rarely uses the system.

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<sup>179</sup> Miranda, J., Torres, R.A. and Ruiz, M. 1998. 'The International Use of Anti-dumping - 1987-97', *Journal of World Trade*, vol 32, no. 5, pp 5-73.

<sup>180</sup> Information provided by the Australian Customs Service to the Productivity Commission, published *Trade and Assistance Review 1998-99*. Canberra. 1999. pp 64- 69.

## 20 GOVERNMENT AND THE CHEMICAL INDUSTRY TODAY

In the main, the Federal Government has adopted the underlying principle that the private sector is better equipped to read and respond to the signals from the marketplace and assume responsibility for the actual course of development and trade. It will provide a supportive role for private sector activity.<sup>181</sup> In consequence, it has being largely unresponsive to requests for assistance, <<<<though PPP>>> (). Some state governments however have provided other forms of targeted assistance by way of non-common user infrastructure (eg. Qld Phosphate), power concessions (Crest Magnesium in Tasmania) and port facilities (Kingstream Steel in W.A.).

While seeking to avoid direct intervention that risks a net community cost, Government has declared it may respond where there is failure in the market or for some other institutional impediments preventing the development of a particular industry.<sup>182</sup> Since the mid 1990s as affirmed in *Investing for Growth*, it may consider incentives such as grants, tax relief or the provision of infrastructure services based on eligibility criteria.<sup>183</sup>

<<The question is what types of policies are most effective for developing chemical industries and does support for the industry improve economic performance in contrast with reallocation of resources that occurs with the use of import tariffs that was the crux of its industry policies until the late 1980s?>>

### 20.1.1 Government Policies - Theory and Purpose

Justification for industry policies to promote industry and public externalities.

Relevance of policies to:

Industry - economies of scale, support frameworks, R&D, cluster development.

Competitiveness (reference to ACCC).

Service sectors (R&D, engineering,

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<sup>181</sup> Shotgren, Rod 1993. *The Role of the Public Sector in Economic Development and Trade: Eunuch or Saviour*. Vol 52 No 3, September 1993. <<<<MAY NEED UPDATE>>>>.

<sup>182</sup> Broadly, the Government states that it seeks to promote:

- Integration into the world economy to provides access to markets and capital to increase capacity for economic growth.
- Flexible, productive and dynamic workforce.
- Socially productive use of capital.
- Efficient public sector infrastructure services.

<sup>183</sup> The investment incentives are defined in *Investing for Growth* <<<details>>>>that 'will be considered in limited and special circumstances' based on the following indicative criteria:

The investment would not be likely to occur in Australia without the Incentive. The investment provides significant net economic benefits through:

- Substantial increase in employment;
- Substantial business investment;
- Significant boost to Australia's R&D capability;
- Significant benefit to, or investment by other industries, either users or suppliers (cluster investment); and
- Ensuring that it does not involve substitution of existing production capacity which would provide an unfair advantage over other competing projects.
- The investment complements areas of Australia's competitive advantage. The investment is viable in the long term without subsidy. The incentives are open to foreign and domestic investors.
- The quantum of project specific assistance takes into consideration the availability of other assistance from the Commonwealth or State and Territory governments.

Public - ie. education, attitudes, environmental and public safety, etc.

Influence on the chemical industry. Description of the public and industry benefits that could be derived from the adoption of these policies and supporting measures.

Quantification of potential including externality benefits. Flow on benefits including stimulation of other industries.

### **20.1.2 Policies - Australian policy framework**

Australian industry policies - past and present - by Federal and State.

Common user infrastructure assistance

Tariffs

Anti-dumping

Taxation

Indirect influences (NICNAS, NRA etc.).

Which policies were successful and why?

Policies suitable for the chemical industry?

Comparative advantage and sensitivity to policies.

#### **20.1.2.1 Action Agenda on Chemicals**

##### **20.1.2.1.1 ACCC**

JV of Kemcor and Orica in polyethylenes

## **20.2 State governments**

With contraction in industrial policy development at the federal level, state government agencies with responsibility for industrial development have become more interventionist assisting industry by way of concessions and common user infrastructure assistance <<details>>> with a variable success rate. (eg. PICL in W.A., Comalco in Qld, WMC in Qld Z-Tech). So while the Federal Government has largely assumed a role to focus at the macro level, the States are operating at the micro level (with variable success <<analysis/commentary .PNG gas line and Moura ammonium nitrate project (initially BHP coal-bed methane) vs. ammonia at Yarwun as proposed by Orica). Also evidence of sensitivity to public opinion as expressed at Coode Island/Point Lillias hazardous storage facility.>>>

### **20.2.1 Incentive auctions between states**

Erodes the measures provided by the Commonwealth.

Budgetary assistance is selective and discretionary which promotes secrecy<sup>184</sup> and potential for conflict of interest.

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<sup>184</sup>For example, Productivity Commission, 1996, 'State, Territory and local Government Assistance to Industry', AGPS, Canberra page xxviii. "The Commission found a confusion within States regarding the need to maintain confidentiality during the negotiation process and the practice of keeping confidential the nature and value of assistance provided."

Bidding because of perception of employment and income gains often supported by misuse of evaluation techniques. There is a political cost in losing out to other states. Rivalry at best shuffles jobs between regions and at worst reduces overall activity.

Need for greater transparency.

Industry commission, 1996, 'State, Territory and local Government Assistance to Industry', *Report No 55* AGPS, Canberra.

In 1994, State and Territory governments' industry assistance involved; \$2.5 billion in budgetary costs; and \$3.2 billion in payroll taxes forgone – a total of \$5.7 billion.

Compared with the Commonwealth at \$9.9 billion mainly by border and domestic market protection.

## 21 PUBLICATIONS

There is very limited published information available about Australia's chemical industry. It is probably the least documented key manufacturing activity in Australia. Four references of note are:

The Industries Assistance Commission (IAC Report 390), The Chemicals and Plastics Industries, AGPS, 30 May 1986

This provides some generic descriptive information as applied to the Orani Model.

Kolm J.E., 'The Chemical Industry - Australian Contributions to Chemical Technology' in 'Technology in Australia - 1788 to 1988', Melbourne 1988.

Some historical information from point of view of industry.

The Australian Petrochemicals and Polymers Industry Status and Outlook - Study Report, The Department of Industry Technology and Commerce, Canberra. 1992

Limited capacity and descriptive information about petrochemical activities.

The Australian Encyclopedia. Article written by Ron Van Santen on development and status of Australia's chemical industry.

Brennan, David. Process Industry Economics. An Australian Perspective. Longman Cheshire 1990.

Access Economics. Chemical Industry Investment Study. Canberra 1998.

PACIA 1998. The Chemical Industry's Facts and Figures Book 1998 <<<Performance>>>>. The Plastics and Chemicals Industries Association Inc. Melbourne July.

Current information.

In-house information - industry, trade and international.

Published material - Industry Commission, Productivity Commission, University reports, PACIA/ACCESS Economics study. Academic journals and books.

Qualitative interviews: Industry, association, government agency and educational.

Spreadsheet based modelling

Interaction with Australian state and federal policy makers.

Communication with international industry associations, government representatives and key companies.

Extensive integration with new document theories and international observations and experiences.