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AN ANALYSIS OF THE REGIONAL IMPACT OF THE
KAPUNI AMMONIA/UREA PLANT

A research report constituting two 14.499 Research Reports, in partial fulfilment of the requirements for the degree of Master of Agricultural Business and Administration, Massey University.

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PREFACE.

Successive post war governments in New Zealand have emphasised industrial development as the basis of economic growth. During this period national-level planning has become institutionalised. Central to the choice of planning policy for industrial development is the balance of payments problem. This has tended to mask other considerations which can be identified as pertinent to national and regional level decision making by private and public organisations. A major difficulty for the researcher is establishing which questions are relevant in a New Zealand context. This research exercise pursues the perspectives and questions which might be brought to bear on specific national development projects. The research focuses on the Kapuni Ammonia/urea plant and analyses the regional impact of that project.

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CHAPTER 1

INTRODUCTION

The New Zealand Government, in 1973, reached agreement with the oil industry to buy Maui Gas. This resource was regarded as ideal for electricity generation and decisions were made for its use as a fuel for the New Plymouth power station. Soon after it was found that the Kapuni resource was substantially larger than previously estimated. This and the fact that Maui Gas would not be on-shore by 1975, the year for the New Plymouth power station to come on-line, led instead to untreated Kapuni Gas being earmarked for use at New Plymouth.

The Government believed at that time that Maui Gas could form the basis of a petrochemical industry. In 1974 it set up an Interdepartmental Committee on Petrochemicals to review the situation and to look into the various petrochemical products which could be produced using Maui Gas. The objectives of their study were to determine the potential for petrochemical manufacture in New Zealand with reference to :

- i) the types and sizes of development best suited to meeting domestic demand for key petrochemical products;
- ii) the need for exports to support a petrochemical industry and the identification of potential export markets;
- iii) the potential economic benefit to New Zealand of alternative petrochemical developments;
- iv) the broader social, economic and environmental implications of petrochemical manufacture.

Secondly, to provide sufficient information to enable petrochemicals manufacture to be compared with other uses for Maui natural gas (N.Z. Interdepartmental Committee, 1976) .

The New Zealand Interdepartmental Committee submitted its report to the Government in June 1976. It had considered five options. These were the production of Ammonia/urea, chemical methanol, fuel methanol, olefins based plastics and synthetic gasoline.

Ammonia/urea production was seen as being marginally more attractive than chemical methanol, these being the best options. Fuel methanol was favoured but technical difficulties with the methanol/gasoline blend meant that more research was needed before this option could be considered further. Olefins based plastics would not be suitable until demand and markets within New Zealand had grown. Finally, synthetic gasoline was seen by the Committee as being the least attractive option of all. This the Committee saw as being justified only on non-economic grounds such as a need to reduce oil imports.

In the case of the Ammonia/urea plant two options were considered economical by the Interdepartment Committee : The first was a large plant primarily based on producing products for export and the second was for a small plant producing mainly for the domestic market, but with some product exported. Their conclusion favoured the small plant for New Zealand. At this point the Government invited the Petroleum Corporation of New Zealand Limited to undertake its development.

In 1978 the planned schedule of development was revised by the unexpected availability of a partially completed Ammonia plant. The Government was approached by Capital Plant International Limited (CPI), with information that a United States client, Fish Engineering Constructions Company Inc. of Houston, had partly completed the manufacture of a medium-sized ammonia plant for a client who was unable to complete the purchase. This option appeared attractive because proposals submitted up to this point failed to meet the Government's criteria.

Fish Engineering were offering the Ammonia unit along with the yet to be constructed Urea plant and ancillary off-sites. This plant was considerably larger than those being considered prior to 1978.

The Government carried out a preliminary economic analysis

the details of which are not available, which showed this plant to be economically viable especially if the plant was located next to the Kapuni treatment plant owned by the Natural Gas Corporation. The latter would be able to supply direct the feedstock necessary for the manufacture of Ammonia/Urea fertilizers. At this point the Government decided to proceed with negotiations for the establishment of a medium-scale, export market oriented, Ammonia/urea complex.

Negotiations for the purchase of the ammonia and urea plants were commenced in Houston in November 1978, and a contract signed in March 1979. This contract was for the completion of the project within two years from the date of site acquisition. The completion date is now set for December 1982.

The initial estimates of the capital cost of the plant, including spares, interest during construction and other costs associated with the completion of the project, were estimated at \$70 million (Petrocorp Review, 1980). The plant was purchased on a U.S. dollar fixed price basis. The capital cost of the project has increased since March 1979 to \$98.3m. This is mainly due to a 5 percent devaluation of the New Zealand dollar in June, 1979, and a continuing floating devaluation since that date (Appendix A-1).

The decision to build a large plant instead of the small plant recommended by the Interdepartmental Committee is accompanied by a higher degree of risk. The extent to which this aspect has been considered by Petrochem, the subsidiary company of Petrocorp, is not immediately obvious. The acceptability of this increased risk depends on the existence of overseas markets.

Any forecast must be based on facts from which one could conclude that it was highly probable that the forecast would be

realised, and any assumptions underlying the projection must be disclosed. The change from an emphasis on the domestic market to one on an export market brings with it the risk of export instability and uncertainty. Locally induced or multiplier effects are frequently not set into motion by the actually executed export activity, but by expectations and forecasts (Krumme, 1977). The expectation of demand and its realisation does not necessarily follow one after the other.

It is against this background that this study has been undertaken. In part it is an historical account of what has happened during the planning and construction phase, and in part it estimates the final impact of the Ammonia/urea plant when it reaches full production by 1984. The primary objective of this study is to relate theoretical and planning considerations to the actual considerations of the Government in this part of its Growth Strategy. An attempt is made to identify and list the priorities given to the national economy, and the regional and sub-regional economies.

In brief the purpose of this study is to find out -

- i) how the Ammonia/urea plant might be placed into the national economic environment;
- ii) how the Ammonia/urea plant fits into the industrial structure of the region;
- iii) the place of the Ammonia/urea plant in any industrial complex which might emerge in Taranaki based upon Maui Gas.
- iv) what kinds of sub-regional impacts might arise from the establishment of the plant.

Chapter 2 outlines the dominant theoretical considerations as these relate to the Ammonia/urea plant. Chapters 3 and 4 are concerned with the Government's role, the growth strategy and industrial development in New Zealand focusing past and present thinking to future developments. Chapter 5 outlines

the impact of the plant in agriculture and relates nitrogen fertilizer production in New Zealand to domestic and world demand. Chapter 6 defines the area of social influence at the subregional level, while Chapter 7 estimates the income and employment multiplier effects using the Keynesian model. Chapter 8 applies the input-output non-survey method to the Taranaki region. The conclusions are presented in Chapter 9.

CHAPTER 2

THEORETICAL FRAMEWORK

This chapter attempts to outline a theoretical base on which to analyse the Ammonia/urea plant as it relates to the Taranaki region and to the nation. In a development context, characterised by planned development, what questions are appropriate? Those considered relevant to a project, such as the one under study here, are outlined. These are then compared to those used by the Government in its planning approach. Unfortunately no clear statement about this aspect is available from the Government, which leaves to this study the task of suggesting from the evidence available their major considerations.

Two development theories with regional applications are available : Growth-Pole Theory and Growth Centre Theory. Growth Pole theory is "an umbrella term, embracing a large number of more specific theories which are positive and normative; static and dynamic; sociological, economic and geographical. The essence of the idea is that development is selective in its initial incidence (i.e. it is polarised), and that sociological, economic and geographical theories relating respectively, for example, to innovation diffusion, industrial complexes or central places are merely elaborating this idea in their respective disciplines." (Moseley, 1974)

Growth-centre theory is no easier to define. The concept is based on the assumption that "growth-centres" do benefit much wider areas. This is embodied in public policies designed to stimulate extensive development by concentrating upon a few favoured places. An important distinction between growth-pole theory and growth-centre theory is that the former takes a national perspective, while the latter is regional and concerned with effects outwards from the centre to the

hinterland. It is this feature which makes the latter appropriate to this study.

The discussion which follows revolves around two distinct phases. The first is the "cause" or planning phase and is discussed under the headings 'resources', 'location' and 'industrialisation'. The second is concerned with the outcome or effect aspect and looks more closely at growth-centre theory and the lead firm concept.

Resources

The resources in question here are the Maui Gas resource situated off-shore to the west of Mt. Egmont, and the Kapuni Gas resource South of Mt. Egmont (Figure 2-1). Both these resources are linked by a series of pipelines which extend north to Auckland and Tauranga and south to Wellington.

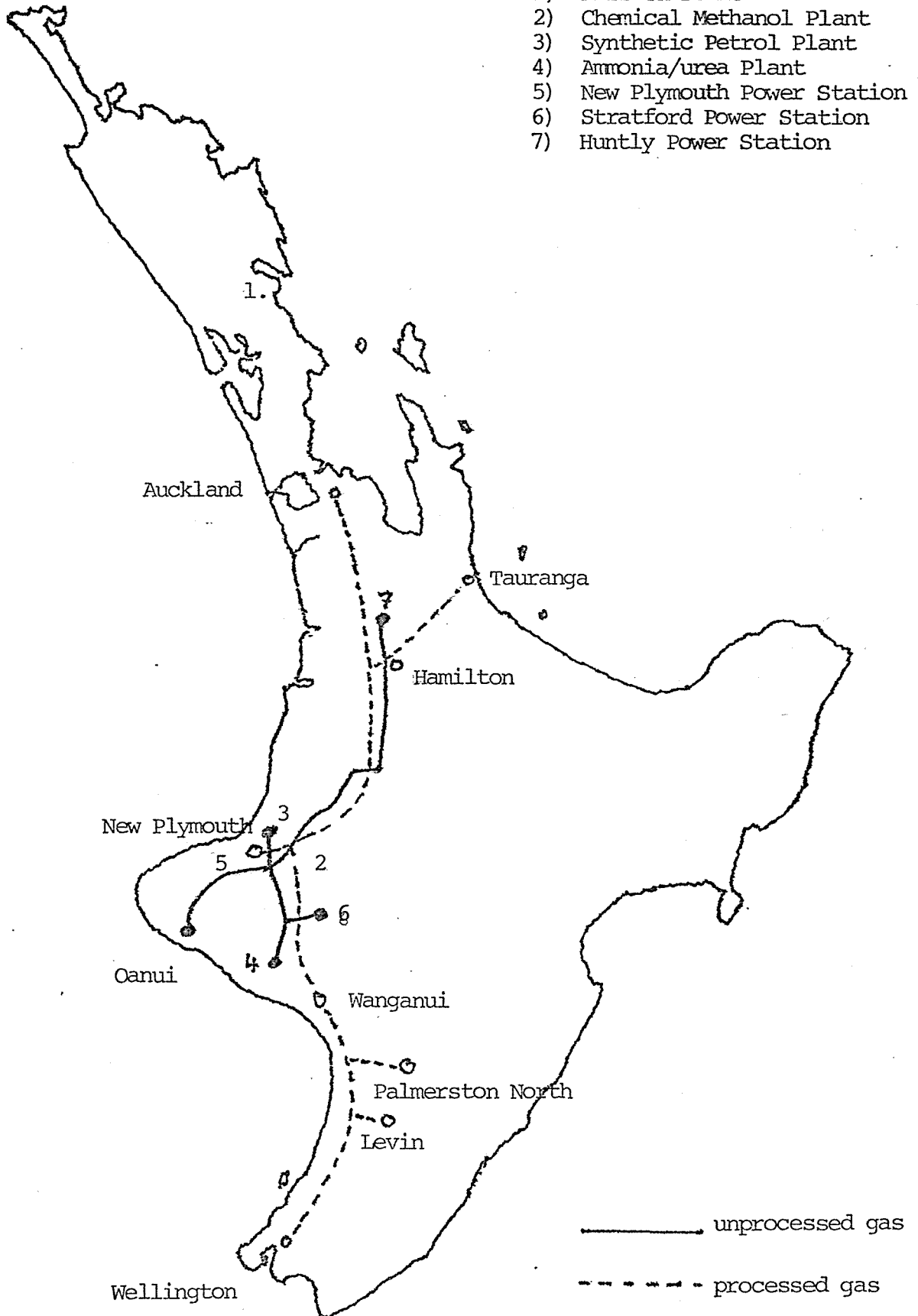
Successful exploitation and development of New Zealand's gas resource depends on market demand, resource availability (long term), labour and capital. These are preconditions without which regional growth in the areas affected cannot be sustained.

Two types of market exist - the domestic (interregional) and the export (international). The ability to export induces a flow of income into a region, which through the multiplier effect, tends to expand the internal markets of the region for goods and services produced locally and non-locally (Perloff and Wingo, 1961). At the national level trade with other countries results in income which filters directly, but mainly indirectly into the economy. International trade is less complicated than regional trade because regional trade benefits not only from exports overseas but also among regions.

FIGURE 2-1

Location of Major Energy-based Projects
and Gas Distribution

- 1) Marsden Point
- 2) Chemical Methanol Plant
- 3) Synthetic Petrol Plant
- 4) Ammonia/urea Plant
- 5) New Plymouth Power Station
- 6) Stratford Power Station
- 7) Huntly Power Station



In considering the trade factor it will need to be determined at which levels - national, regional or sub-regional - and in what ways the Ammonia/urea plant has an impact? This will depend on the development of a much larger domestic market and the acquisition of overseas markets. These points are taken-up in Chapters 5, 7 and 8. Here the issue is resource development.

Perloff and Wingo make several observations about a regions resource endowment. This they see as 'good' - which is taken here to mean favourable enough to justify further action - when rated high on the following criteria :

- i) demand for the resource must be derived from final and intermediate demand sectors of the national economy with a high elasticity of demand.
- ii) Production of the resource must be characterised by extensive locationally associated forward and backward linkages.
- iii) The resource must be characterised by a high regional multiplier. This means that some portion of export returns must influence demand for regionally produced goods and services.

Petroleum products have proved good resources for economic growth, but in terms of their multiplier effect and their forward and backward linkages they rate very poorly. This is because they are very capital intensive while requiring very small numbers of employees. Returns to production in the form of returns to capital are high despite the limited linkages.

Sustained regional growth depends on resource availability. Thus, the discovery - depletion cycle is very important. A region which remains narrowly specialised is disadvantaged because its continual economic growth depends on discoveries of the resource occurring at a higher rate than its use. This means that continued 'exploration', which would also mean research and development, must be undertaken. This point

is especially important because the Taranaki region is rapidly developing an industrial base centred on the Maui and Kapuni gas resources. The traditional Dairy industry, the only major alternative, serves as a useful example of the problems associated with narrow specialisation while it goes through its present recession.

The gas resource is likely to be exhausted by 2010. This is enough time for the planned industrial facilities to have reached the end of their operating lives and this is not seen as the immediate problem. First, sizeable domestic markets have to be developed, as does the export market. But when these obstacles are overcome then the problem of continuing growth will come to the fore.

Government plans go far beyond one Ammonia/urea processing facility. There are also the Motanui Synthetic Petrol Plant and the Waitara Valley Methanol Plant, both based on the same Maui and Kapuni gas resources. The question of what comes after this, and how will the local economy continue to develop beyond the year 2010 is yet unanswered.

Location

Plant location is one of the most important questions in investment appraisal. This is because it implies the creation of new economic activity, which in turn, involves interrelations with other economic activities. The availability of natural resources, transportation, communication, general services, the availability of an efficient trained workforce and a social infrastructure to cater for their needs should be considerations.

Applying these considerations to the Ammonia/urea plant each is adequate in terms of the plant functioning and the workforce accommodated. Other options were considered, the major areas being New Plymouth and Wanganui and other less suitable ones, all within the Taranaki region. The one benefit of the Kapuni

site was the existence of a gas treatment plant, an essential part of the nitrogen fertilizer production process, which would have to be replicated at any of the other options. Another important consideration used in this case was the isolation which was important from an environmental point of view. This unavoidable isolation leads us to consider both growth-pole theory and growth-centre theory later.

The question of a trained or trainable workforce is not as critical a problem as it used to be. The availability of new technology has reduced or deskilled many jobs, and the Ammonia/urea plant is no exception.

The Ammonia/urea plant rates well on the location considerations outlined above. This is helped by a social infrastructure already in existence and a small permanent workforce. Raw materials are readily available from the Kapuni well and via pipeline from the Maui gas field (figure 2-1).

Growth-Centre theory

Whether or not the "Growth-centre" idea features in the published records of the Government's growth strategy it is still an important analytical concept here. The Ammonia/urea plant is in many respects 'billed' as a growth centre, although it is more appropriate to use this concept to describe the gas resource, which is explained below. Growth-pole theory is inappropriate for use here. The distinction is that the plant exists in isolation, with few forward or backward linkages. The product is ready for final demand which limits the number of opportunities for the development of dependent industries based on ammonia/urea production. The major local impact is thus limited to "direct" employment, while the main purpose of the plant appears to be related to the balance of payments problem.

Luttrell (1972) recommends a list of questions which define the what and where of a "growth-centre". This argument will be given a general outline as not all of it is applicable in the case of the Ammonia/urea plant. The basic questions are :

- i) What industries are best suited for inclusion?
- ii) What will be the nature of further economic growth induced by these industries?
- iii) At what stage will growth-centres become self-sustaining?
- iv) What forms of social investment will be required to ensure success?

Factors which provide the basis for economic growth are the 'propulsive' unit with forward and backward linkages. This inter-relatedness underlies another concept, that of the industrial complex. In this there are two basic elements, the linkage of economic activity concentrated at one location.

In the first, industries are related to each other by direct interfirm transactions, the joint demand for the products or services of other industrial establishments, or joint supply to one or more shared clients, and joint use of common resources and facilities such as labour and the regional infrastructure. In the second, geographical limitations are important. Transactions take place within a relatively confined area. This second point could describe the relationships between the oil industry (Shell, B.P. and Todd) and the end users (the Department of Electricity, Petrochem and Petrocorp).

Adding to a complete regional infrastructure a developed local market and common labour supply, it is clear that such an area provides considerable attraction for further expansion. A poor market, both regional and domestic for ammonia/urea fertiliser, exists at present so on this point the argument is weakened for an industrial complex. No evidence exists which suggests that the Government is attempting to build a planned industrial complex with its energy related projects.

However, for the success of a "growth-centre" a full appreciation of the market both at home and abroad must be

gained, and this should also include stability or instability. Any market study involves elements such as technological developments, production levels, and changes in demand.

A successful industrial complex shows the promise of longterm growth when it develops a network of sub units or dependent (but common) industries. These tend to be closely located in a geographic sense also (Luttrell, 1972). The Ammonia/urea plant will not stimulate this type of growth because it is limited in its potential to generate forward and backward linkages.

At a local level (sub-regional) if there is a lack of confidence, then investment in related industries and service industries is likely to be reluctant for reasons other than profitability. A 'spot-check' of the local communities adjacent to the ammonia/urea plant revealed a great confidence in the future of the region, although no clear understanding of how and in what form was demonstrated. Contrary to this a spot check in New Plymouth revealed that if the Ammonia/urea plant was anything like the New Plymouth power station then expectations would exceed actual benefits derived.

Spatial Impact

In the previous section the idea of the industrial complex was discussed and it was concluded that the Ammonia/urea plant did not constitute part of this. This section examines the theory behind spatial impact and serves as an introduction to the field work outlined in Chapter 7.

Three questions are central to spatial impact :

Where have the "direct" workers come from?
Where is the "indirect" employment located?
Where is the "induced" employment located?

It is assumed that the Ammonia/urea plant is a growth centre for the sake of argument (Moseley, 1974).

The Ammonia/urea plant is located in an isolated area away from any established urban area. This results in a workforce which must come from "outside" either as a commuter or an immigrant. This is important to the first question. If the "direct" labour comes from within the region then this could have a favourable impact on unemployment. If it comes from another region then this too is a gain, even if it might be at the expense of another region which loses this source of income.

The "direct" labour has important implications for the "indirect" labour. The important element here is the proximity of such employment to the growth centre, and following this how much of the multiplier leaks away from the immediate regions, and why?

"Induced" employment is concerned with the flows of income and expenditure generated by the growth centre. There is concern also with the amount of leakage away from the region and with the spatial pattern within the region of the locations where induced employment is generated.

Another way in which a growth centre might stimulate further development is through a branch plant establishment. The degree to which growth centre firms subsequently throw out branches into the periphery also needs attention. Applying this idea to the Ammonia/urea plant it is more appropriate to view it as the "branch plant" as are the other energy projects: New Plymouth power station; Stratford power station; Motanui Synthetic Petrol Plant; and the Methanol Plant at Waitara. They all have a common element, the Maui and Kapuni Gas fields. (Figure 2-1). Thus the spatial impact must concentrate on the effects in the surrounding area - the area of social influence (Figure 6-1) - and in this case it involves the workforce.

Spending patterns will indicate which areas (and their distance from the plant) benefit directly. To what extent do

these purchases create multiplier effects within the region and which parts of the region are likely to be most affected? Does income expenditure gravitate to the major centres or down to the smaller settlements?

Purchase of goods and services accounts for part of the total expenditure of employees. Housing and recreation are other forms of expenditure, within the region. Leakage is accounted for by holidays outside the region or peripheral economic activity. Thus there are three possible destinations for employment income : to larger urban centres (New Plymouth) to the local area (Hawera, Stratford); or out of the region. The proportion of each determines the spatial affect of the growth centre. The relative benefit to villages (Manaia, Kaponga, Midhurst) and small towns (Eltham, Opunake) in the hinterland tends to be small when the alternative is a larger service centre nearby. The implication of this for the hinterland is no growth in the service sector. This aspect is covered in Chapter 6.

The Ammonia/urea plant does not present a very good example of a "growth-centre" because it has a small domestic market and few forward and backward linkages. This reduces the possible impact to employee spending and export earnings overseas. No evidence exists of sustained economic growth resulting without discoveries of more natural gas in the future. Thus the Ammonia/urea plant provides an example of an investment proposition which functions in isolation with limited objectives. These limited objections are discussed in Chapter 4.

CHAPTER 3

INDUSTRIAL DEVELOPMENT TO 1975

The issue of industrial development has been current since the depression of the thirties. Since the 1950s it has centred on three main elements ; the maintainence of full employment; national development; and the balance of payments question. The latter was tied to import substitution and production for export. (Rose, 1969).

At this time New Zealand industry lacked a wide and diverse base for industries to build on. So any progress in this area would first need to overcome this deficiency.

W.B. Sutch first articulated an argument for manufacturing development as it affected full employment (Sutch, 1957). This related the expected increase in the total labour force by 1975 to employment in the non-manufacturing sectors. The remainder would be provided for through industrial expansion.

Sutch's prediction was based on the assumption that some considerable numerical increase would occur, primarily through a net migration gain of 10,000 people. In this he was wrong. However, he was correct in his prediction of a fall in primary employment. (Rose, 1969).

The policies which were suggested on the basis of these projections were by-in-large adopted by the Government.

The concept of "gap" forecasting is doubtful. The reason is simple. Any extrapolation of statistics has a base period. The figures arrived at simply reflect the trends present at the base period. In the figures produced by Sutch the base period was one reflecting stimulated industrial growth. (Rose, 1969).

Philpott (1957) advocated another approach. This attacked the concept of employment promoting industrial development. He observed that the increment to net output that resulted from alternative employment was the most appropriate guide in considering employment of additional labour. This alternative argument was based on the assumption that agricultural production was internationally competitive and as a corollary to this so too was employment in agriculture.

The second argument fell down on a basic point which was related to the fact that farming was predominantly a self-employed owner occupation. Thus a labour force increasing beyond that which could be used either directly or indirectly proved the stumbling block. Manufacturing development, on the other hand, was an effective alternative to this and emigration or decreased immigration.

In the event the approach adopted was a defensive and protective industrialisation (Rose, 1969). The second stage in the argument was national development, and as with the first stage W.B. Sutch was the major advocate.

The concept of maturity which Sutch spoke of was based on Rostow's (1960) stages of economic growth. This in simple terms was when the country reached the point where primary or original industries were joined by other industries formed and able to use the latest technology to best advantage. The idea was that given technological and entrepreneurial skills the country could produce virtually anything it wished.

The major difficulty with both Sutch's and Rostow's argument is that it is not advanced in any depth. Even today similar statements are quite common, but hard to define.

Sutch's general conclusion, that manufacturing development was integral to national development and that the farmer depended upon positive encouragement, is not disputed. The point being made here is that there was no

developed theory upon which to base a course of "action" towards industrial development. This remained the short-fall because the debate was centred at the sectoral level when it should have been at the national level. Had the debate concentrated on industrial development at the national level a theory of development could have included provision for the necessary institutions and administration which would have supported it.

Thirdly, import substitution. To the layman this could simply mean where once we imported a certain item, now we make it ourselves. However, this is not quite what it meant in the context it was used in the 50s and 60s. Then it meant to reduce the propensity to import in the aggregate. Measurement is usually by reference to the ratio of imports to G.N.P. (Ichikawa, 1971).

Rose, (1969) identifies three problems with this method of assessment. First, "...if the marginal propensity to import is greater than the average propensity, then with rising real incomes, the demand for imports would tend to increase more rapidly than output or demand." This would cause the ratio of imports to output to increase, thus defeating the initial gain from substitution. Secondly, "... the determinants of the ratio of imports to total output or outlay, are numerous including, in addition to the changing technical relationships between imports and output, changes in the ability to finance imports from borrowing, and changes in the technical relationships between other primary inputs and outputs". Rose stresses that the fruits of import substitution may be new expenditures on imports so that in the long-run the essential determinant of the level of imports remains the level of exports. Thirdly, "... a simple comparison of imports and total output relates to the observed fall in the proportion of labour inputs applied to primary productions and an assumption that the proportion of total factor inputs so supplied declined also."

The hope of import substitution was then that it would reduce New Zealand's vulnerability to fluctuations overseas. This overlooked our unavoidable dependence on external trade which was even more pronounced because of our size relative to other countries. Following on from this is an inbuilt exchange problem which results because we could not achieve our potential growth if our capital was accumulated. The main element which Rose (1969) sees as insulating this country from external fluctuations in the future more than anything else will be the diversification of exports.

The Import Reliance Argument

Economic growth may reduce or increase demand for imports. Imports are a determinant of the country's growth. Industrial development may increase imports. If world demand for our exports does not increase also, then a balance of payments problem exists. An elastic demand for imports will ensure this does not occur.

The economic structure of a country such as New Zealand tends to be less diversified than in larger countries. This is reflected in the large concentration of industrial production in fewer sectors. Demand by consumers on the other hand tends to be broad reflecting similar patterns in larger countries. This apparent conflict between a limited production base and a broad final demand is resolved through overseas trade.

In theory the demand for imports to make-up the shortfall can be financed through the export of excess production of the few things we do produce. Thus given the above one would expect foreign trade to have a more prominent place in small countries rather than large countries.

Any industry which expands its output to substitute for imports elsewhere is likely to increase the proportion of its imports of materials for earlier stages of production.

Ichikawa explains the relationship very well. The relevance of this to the present study will become apparent in due course. He identified 16 industry categories which were anti-import on the production side. Of these 6 were pro-import on the consumption side and that for these the net effect was pro-import. These were mainly basic manufacturing industries, rubber products, chemical fertilisers, other chemicals, metal products, electrical goods and miscellaneous goods.

Industries are interdependent on both the input and output sides. Input-output analysis explains this interdependence using the forward and backward linkages.

Four classifications of industry type linkages are identified. Category I comprises industries with small backward linkages and large forward linkages; Category II industries have large linkages in both directions; Category III industries have large backward linkages and small forward linkages; Category IV comprises industries with small linkages in both directions. (Chenery and Watanabe, 1958).

Manufacturing industries with small backward linkages (Category I) include chemical fertilisers, mining and quarrying and rail transport.

Industries whose backward linkages comprises wholly of purchases from farming is one reason why New Zealand is viewed as an agricultural country without industry.

Ichikawa's (1971) conclusion on the New Zealand economy of the 1960s was that it was based on import substitution. One of the implications of a policy of industrial growth based on import substitution is that the simple and relatively easy phase of substitution is soon over. When this happens the need arises for more difficult import substitution activities which require high capital-intensities and large markets to achieve reasonable economic efficiency. However, the extension of import substitution to a wide range of goods may generate

and increase demand for other imports in the form of either raw materials and intermediate goods or of new types of capital goods.

Considering the relative smallness of the New Zealand market, it is conceivable that the size of the market made industrialisation expensive and may have necessitated recourse to excessive protection. This insulates the national market from external competition, weakens and even destroys the incentive to improve the quality of output and lower costs. The result of this is the creation of an industrial structure with small uneconomical plants, the weakening of incentives to introduce new technology, and the slowing down of productivity growth. Clearly these problems exist in the industrial structure of New Zealand. (Industries Development Commission, 1982).

The net result for our exports is an increasing difficulty in penetrating overseas markets. This occurs because high overheads resulting from low productivity and our distance from major overseas markets make New Zealand products uncompetitive.

Three main threads have emerged so far from the discussion of industrialisation. They are the balance of payments problem, import substitution and since 1974 energy and exporting. The last, energy and exporting is taken-up in the next chapter.

CHAPTER 4

THE GOVERNMENT'S GROWTH STRATEGY

In this chapter Government's Growth Strategy is analysed. This task is not made easy by the absence of a clear policy statement which defines how growth strategy works and what form it takes. The views of the Government and its advisors are outlined and where gaps exist assumptions have been made. It is clearly a case of stating what has been said and what has not been said. The first part of this chapter deals with the growth strategy and the petrochemicals developments as they relate to it. The second part of this chapter deals with the economic reasoning behind the Government's development projects.

The Government Perspective

The enormous increases in the price of oil have meant that New Zealand has been drained of the overseas funds, earned by agriculture, necessary to buy imports and to promote growth in the economy. The Government's solution is the growth strategy. This aims at placing the economy into a "growth phase". This requires heavy government borrowing, to finance a series of diversified industrial projects, from overseas. These projects will be partly owned by private interests. (1981 Election Campaign).

Three points can be made about this statement. First, growth strategy is linked to the need for overseas funds. Secondly, this will be created through a series of industrial projects. Thirdly, these projects will be diversified in nature.

"Growth strategy works in three ways:

- i) Directly in our export industries, both traditional and new;
- ii) through earning or saving overseas exchange, thus stimulating economic growth;
- iii) indirectly through stimulating demand for goods and services". (1981 Election Campaign).

High priority is given to the development of New Zealand's energy resources - by adding a new dimension to reduce our dependence on imported oil, opportunities will emerge for new industries which will be able to earn overseas income. Thus the Government is suggesting that new industries will emerge based on the development projects and that these will be export oriented.

The Government envisages approximately 410,000 jobs being created as a result of the growth strategy. Many of these are likely to be in the small-business sector. However, there is no empirical or theoretical support for this claim, and it seems more than likely that it is based more on a guess of the multiplier effects resulting from permanent employment when the projects are completed. (Appendix F.)

In the short-term it is unlikely that much expansion in the small-business sector will occur. This area like many others, the Motor vehicle industry for example, will remain depressed until first, the world economy picks-up and secondly, the New Zealand economy improves, and the growth rate increases.

Statements made by Government spokesmen express in general terms the expectations held for the growth strategy. These statements are limited in their use because they tend to avoid any detailed discussion. For example:

"Growth is not about promoting either the big or the small industries. The two are inter-dependent, they go together."

(R.D. Muldoon, 1981).

"Our aim is to ensure an orderly transition from an economy dependent on imported oil to an economy relying on our own diversified energy resources. The long-term goal is for New Zealand to be totally self-sufficient in energy by the turn of the century."

(W.F. Birch, 1981).

These statements are typical of those made in Parliament and recorded in Hansard. From these statements it is possible to make assumptions. The priority for the energy related projects is the reduction of our dependence on imported oil. However, this would not include the Ammonia/urea plant because its product is not energy related.

In the same vein Mr. Birch goes on to explain that energy is related to the growth strategy through the Maui and Kapuni gas fields, McKee oil, coal and geothermal energy and of course hydro resources. There are, in fact, two types of resource mentioned by the Minister. One relates to import substitution while the other relates to cost reduction. The Ammonia/urea plant would appear on the face of it to serve its purpose as an earner of overseas funds at the national level.

Criteria for assessment - Petrochemicals industry

"Alternative petrochemical developments have been identified on the basis of technical feasibility of production from natural gas and the existence of some domestic market. These alternatives have been compared, using a range of economic criteria and with the assistance of a linear programming computer model. Initial choices were modified to include consideration of size and availability of markets and the degree of export dependence."

(New Zealand Interdepartmental Committee on Petrochemicals, 1976).

Beyond the above statement, which represents the character of the report, little more detail is available. The feasibility mentioned is not explained, nor are the methods used to arrive at conclusions described. The linear programming computer model could take a number of forms.

Conclusions reached in the above report indicated that developments for synthesis gas based products, particularly

ammonia/urea for nitrogenous fertilisers "show the greatest national benefit." The petrochemical industry now occupies a key position in the world's industrial economy, providing raw materials to agriculture, secondary and tertiary manufacturing industries. Similar expectations could be held here. Since the petrochemical industry is not a large employer compared to its capital earnings, it is assumed that the latter expectation is held for the industry here also.

Table 4-1 sets out New Zealand's estimated recoverable fossil fuel resource, including the redetermination by Shell, B.P. and Todd Oil Services Ltd in December 1977 of the reserves of the Kapuni Gas/condensate field. As can be seen, the major resource deficiency is in liquid petroleum fuel, and the country will continue to be a net petroleum importer. It will, however, become relatively less dependent on imports for a decade or so as natural gas is brought into greater use.

Any petrochemicals development in New Zealand will require the importation of technology and technical skills. This is not a new occurrence in New Zealand.

The Taranaki projects were assessed on the basis of "net national benefit". In economic terms this means the impact will be in the form of an increased diversification of the industrial base of New Zealand. This interpretation of net national benefit is somewhat limited, but was the way it was used in this context by the Committee. The petrochemical development would compare to other developments and existing major industries such as Steel, and Forest Products.

The points of comparison relate especially to the use of high technology which is a trend in both steel and Forest Products. This is a direct result of industries ensuring that they remain internationally competitive. One implication is the reduction of labour. (Rosenberg, 1969). Another point of comparison is the net saving of overseas exchange in the long-term. The manufacture of methanol, nitrogenous

Table 4-1. Estimated Fossil Fuel Resource of New Zealand

Fuel	Production			Reserves
	78	79	80	
Coal	496 PJ	45	51	Measured 4881 PJ (220m tonnes) Indicated 17210 PJ Inferred 19767 PJ <hr/> 41858 PJ <hr/>
Oil	256	17	15	Proven & Probable (65% Prob) 549 PJ
Gas	595	47	38	Proven & Probable (65% Prob) 5916 PJ (257700mm ³)

Source : New Zealand Yearbook, 1981

fertilisers or olefins based plastics would create a considerable increase in the size and breadth of New Zealand's manufacturing sector.

Developing along with the petrochemicals industry will be the service industry. This industry would most likely be located adjacent to or near the sites. As was explained in Chapter 2 existing settlements would be expected to provide most services with the existing infrastructure, expanding where necessary. To just what extent the Ammonia/urea plant will cause growth in this area is examined in Chapters 6,7, and 8.

To summarise this section the main theme relates to import substitution, an improved balance of payments situation and export oriented industries. The growth strategy is not concerned solely with these issues, but it would appear that the energy related projects, including the Ammonia/urea plant, are (Appendix F-2).

National Planning

The New Zealand Planning Council provides the Government with the social and economic advice it needs to base its decisions on, such as national development. By examining their contribution the picture of the Government's growth strategy might be completed. It is this source and associated bodies such as the New Zealand Institute Economic Research which provide the material discussed in the following section.

The present Government's strategy has emphasised the development of the New Zealand economy through continuing industrialisation. This strategy is long-term and dated from 1975. It aims at diversification and includes projects aimed at reducing New Zealand's dependence on imports of energy and industrial raw materials. This would appear to be the argument so far based on the discussion above.

The major projects are oriented toward national development and are based on assumptions relating to New Zealand's poor rate of growth. The average annual growth rate over the 23 year period ended March 1978 was 3.4 per cent. Up to March 1980 it was 2.3 per cent. This low growth rate in the nation's output has been accompanied by little increase in employment. (Economic Monitoring Group, 1979).

Forecasts for the first half of this decade show an economic growth rate averaging just under 2.0 per cent per annum. During the second half of the decade the growth rate is expected to increase because of an improving trade balance. This will result from export growth and benefits in the form of both import savings and exports when the large-scale projects come on stream.

Major policy objectives involve :

- i) Increased production and sales of agricultural exports.
- ii) An ever increasing orientation of the manufacturing industry to the export sector.
- iii) Import substitution resulting from large scale developments during this decade.

These developments should gradually reduce the balance of payments constraint which should lead to full employment, improved living standards, and a sustainable balance of payments.

In the short-term the capital investment necessary to undertake these major developments will cause further balance of payment problems, though it should be pointed-out that special loans have been arranged.

The assumption is that the balance of payments deficit is the prime constraint on our economic growth. (Wilson, 1980; Simkin, 1951; Weststrate, 1966; Monetary and Economic Council Report No. 2, 1962; New Zealand at the Turning Point, 1976; Campbell and Hayward, 1978; Proster, 1979; Lloyd et al, 1980).

High domestic incomes, generally resulting from improved overseas prices, increased domestic demand, a market increase in both production and productivity occurs in the short-run. This is so because as the economic growth rate rises above the historical average, increased growth in capital and consumer and intermediate imports results. Once the nation's growth rate rises above its historical average the over-all import elasticity values become extremely high (Hayward, 1980). Thus, as soon as the demand constraint on output is lifted, supply shortages appear almost immediately, which spill over into significant increases in imports. This is so because New Zealand's economy works at full capacity and is inflexible when increased output is required. A balance of payments crises is caused by the rapid growth in imports to fill-in the short-fall, for which the associated increase in investment itself is partly to blame. (Figure 4-1).

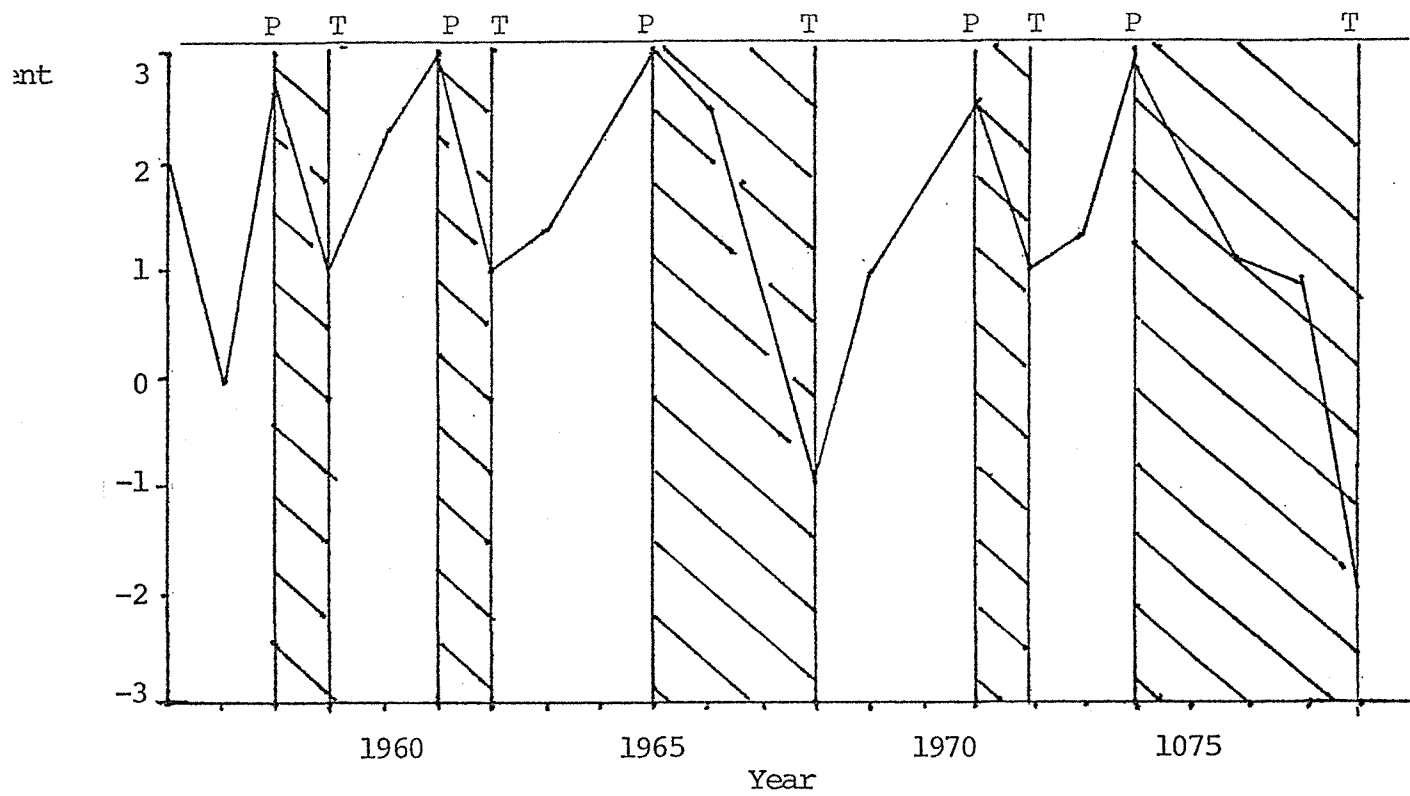
Expansion to the economy becomes depressed and the growth rate again drops to undesirable levels. This has been the pattern in the New Zealand economy since 1956. (Hayward and Campbell, 1976).

The shaded areas represent periods of economic slowdown or contraction. (Figure 4-1).

Increased exports alone will not solve the dilemma because this stimulates imports to meet resource demands. A policy of equal export growth with import substitution might. This would appear to be the force behind the present government growth strategy. Projects such as the Ammonia/urea plant are designed purely to break the cycle described here. This argument stresses the importance of on-going development. Large scale investments, such as those taking place in Taranaki, must continue beyond those presently planned, if economic growth is to be maintained.

This section has developed an argument which best reflects the direction and theory of the Government's growth strategy

Figure 4-1: Fluctuations in Economic Growth



P = Peak
T = Trough

Source: Haywood and Campbell, 1976

based on the available evidence. It is apparent that the key element is the earning of foreign exchange and the reduction of these imports which can be produced in New Zealand on a scale large enough to have a large impact also on the balance of payments. The Ammonia/urea plant fits well into the framework of this argument. It will produce for the domestic market, but in the main produce for the export market. This would seem to be its priority, with regional and sub-regional considerations lagging some way behind this.

CHAPTER 5

NITROGEN FERTILISER PRODUCTION AND
NEW ZEALAND AGRICULTURE

This chapter outlines the implications for agriculture in New Zealand of the establishment of an Ammonia/urea production facility at Kapuni. First, present use and demand for nitrogen fertiliser is discussed. Secondly, market opportunities are identified, and finally, the impact on the environment of the use of nitrogen fertiliser and whether or not this should be encouraged is looked at.

Present use of Nitrogen Fertiliser

New Zealand primary industries have relied directly or indirectly almost entirely on biological nitrogen fixation to meet nitrogen requirements. Intensive horticulture is the only sector which substantially depends on nitrogen fertiliser. The use by other sections of primary production is outlined in Table 5-1. (N.Z.I.A.S., Working Party Report, 1980).

New Zealand uses 21,600 tonnes N per year of Nitrogen Fertiliser. Two-thirds of this is for pastoral use with the balance made up by arable and horticultural sectors. The Forest sector accounts for only 2 per cent of the total used.

The pastoral industry is based on the export of products developed or grown on the land. This industry uses the fertiliser elements nitrogen, phosphorous and sulphur (ratio : 1:10:11). Compared to other countries, especially Europe with its temperate climate, New Zealand's use of nitrogen is small. The importance of biological fixation to this sector is made plain by comparison of the ratios of fertiliser use in herbage ; 10:1:1 respectively.

In developed well-managed grass-clover pastures as well as the less developed seasonal situations exist when nitrogen

Table 5-1: Nitrogen use by categories 1978

Category	Tonnes N
Grain	3500
Vegitable crops	1800
Tabacco and hops	200
Potatoes	700
Grass seed	1600
Horticultural crops	900
Forestry	400
Pastoral use	12500
Total	<hr/> 21600 <hr/>

Source: O'Connor, 1979

deficiency restricts pasture growth. (During, 1972; Ball, 1979; Lynch, 1981; N.Z.I.A.S., 1980). Application of fertiliser nitrogen in these circumstances provides a short-term solution to the problem. The reaction is for total herbage yield to increase mainly due to a response from the "grass" component, while the "clovers" remain suppressed (Walker, 1979). This places the requirement on the farmer to use this type of fertiliser tactically, i.e. only in periods of nitrogen stress, while for the remainder of the year normal biological fixation is used.

The farming of crops, which usually occurs in rotation with grassland farming, does not require the use of nitrogen fertiliser. This is because during the grassland phase soil nitrogen accumulates and provides all the necessary supply needed in cropping. In horticulture areas, where continued and intensive farming is undertaken, use of nitrogen fertiliser is great. This type of farming is dependant on continued inputs of nitrogen fertiliser.

Less than 2 per cent of nitrogen fertiliser currently in use is spread over New Zealand forests. The tactical use of fertiliser, including the use of nitrogen fertiliser, can increase production by 30% over non-use. This has important an implication for the future use of nitrogen fertiliser in this area (N.Z.I.A.S., 1980).

Market Opportunities for Nitrogen Fertiliser

Pastoral farming and Forestry are the two most promising domestic markets which might be developed. The latter is the more promising of the two given that its present fertiliser use is very low. A four-fold increase in production is predicted by the year 2000 while this decade will see a short-fall. In the years to come New Zealand will be in a position to export more.

In the past exotic plantings in New Zealand have been in poor soils, especially in Northland and Westland, and nutritional stress exists in these areas and areas like them. With second plantings this deficit in soil fertility could be balanced by the application of nitrogen fertiliser. Table 5-2 summarises sector demand potential.

The pastoral industry is a major potential market for nitrogen fertiliser (4.5 million ha. of intensively farmed lowland). An average use of 20 kg N per year per ha. is possible which represents a considerable demand. For demand to exist cost/price relationships will need to be favourable. This is affected by the balance between high energy-input agricultural systems overseas and New Zealand's own high transport costs to the market place. Provided good returns for pastoral products persist then attention can focus on increased production per unit area. This is usually associated with increasing use of nitrogen fertiliser. (Taylor, 1980).

Menzies, (1980) shows that plant production to 1985 will exceed domestic demand. This is influenced by a number of factors the most obvious being the economic state of the agricultural sector, the cost of nitrogen fertilisers and fertiliser policies in forestry.

This gives Petrochem three main options

- i) Export any surplus production,
- ii) Operate the plant at reduced capacity,
- iii) Subsidise the product to reduce its cost.

Petrochem have already succeeded in finding an export market in Australia which guarantees sales for the next three years. This places the emphasis on the development of the domestic market, especially in forestry and pastoral farming. Option (iii) is the least likely method which the Government would adopt especially if it intends to end its subsidisation

Table 5-2: Sector Demand Potential

Category	1978	Predicted Range	Use 1985 Predicted
Pastoral	7.5	12.0 - 18.0	15.0
Grain	5.0	5.0 - 9.0	7.0
Vegetable	2.0	2.0 - 5.4	4.0
Tabacco & Hops	0.3	0.4 - 0.6	0.5
Potatoes	1.0	1.0 - 2.0	1.5
Grass seed	2.0	2.0 - 3.0	2.5
Horticulture	1.0	1.5 - 3.5	2.5
Forestry	1.0	4.0 - 6.0	5.0
Industry	4.7	6.0 - 8.0	7.0
Total	24.5	34.5 - 55.5	45.0

Source: Menzies, 1980

of agriculture after 1984.

Environmental Considerations

Two reasons are given for using nitrogen fertiliser efficiently. First, nitrogenous fertilisers are costly to use and involve a considerable energy expenditure. Secondly, nitrogen not used in production may leak into ground waters downgrading water quality and ameliorating surface water eutrophication in susceptible areas.

At a local level the situation has potential for problems. There are local areas where high intensity grazing and cropping under irrigation, horticulture and intensive dairying have resulted in nitrate levels of ground-water exceeding World Health Organisation standards. (NZIAS, 1980).

The present domestic market for nitrogen fertiliser is largely undeveloped. The main potential exists in the pastoral farming and forestry sector. The export of surplus nitrogen production is proceeding as planned by Petrochem, with orders three years in advance.

CHAPTER 6

AREA OF SOCIAL INFLUENCE

The purpose of this chapter is to define and quantify the social and economic area of influence surrounding the Ammonia/urea plant. It attempts to identify the depth of penetration through its direct employment.

Area of Social Influence

Two areas of influence have been identified. First, the one related to the workforce, both the construction and productions workforce and their households. Secondly, the area associated with the spending of projects funds on materials and services. These will be dealt with separately.

The Huntly Power Project sheds some light on the likely pattern of residence among the workforce. (Table 6-1). Fookes (1980) found that there was a tendency over a two year period for a high percentage of the workforce to gather in and around the nearest city, Hamilton. Workers tended to commute an average of 30kms. to work each day. This suggests important implications for the Ammonia/urea plant.

If the inflation adjusted cost of travel has reduced in real terms then long commuter journies are not likely to be uncommon. (Industries Development Commission, 1982).

The Kapuni Ammonia/urea plant differs slightly from the Huntly Power Project. The nearest major urban centres are Wanganui and New Plymouth which are both well beyond the 30km. travel distance established by Fookes.

Provisional figures for the permanent workforce at Kapuni's ammonia/urea plant show the patterns outlined in Table 6-2.

Table 6-1 : Population Distribution of Huntly Power Project Workers

	Area	1977 %	1979 %
Staff	Huntly and District	76	63
	Hamilton	17.4	32
	Rest of Region	6.6	5
Workers	Huntly and District	40	31.8
	Hamilton	40	45.6
	Morrinsville and District	8.2	8.3
	Matamata, District & Other	11.8	14.3

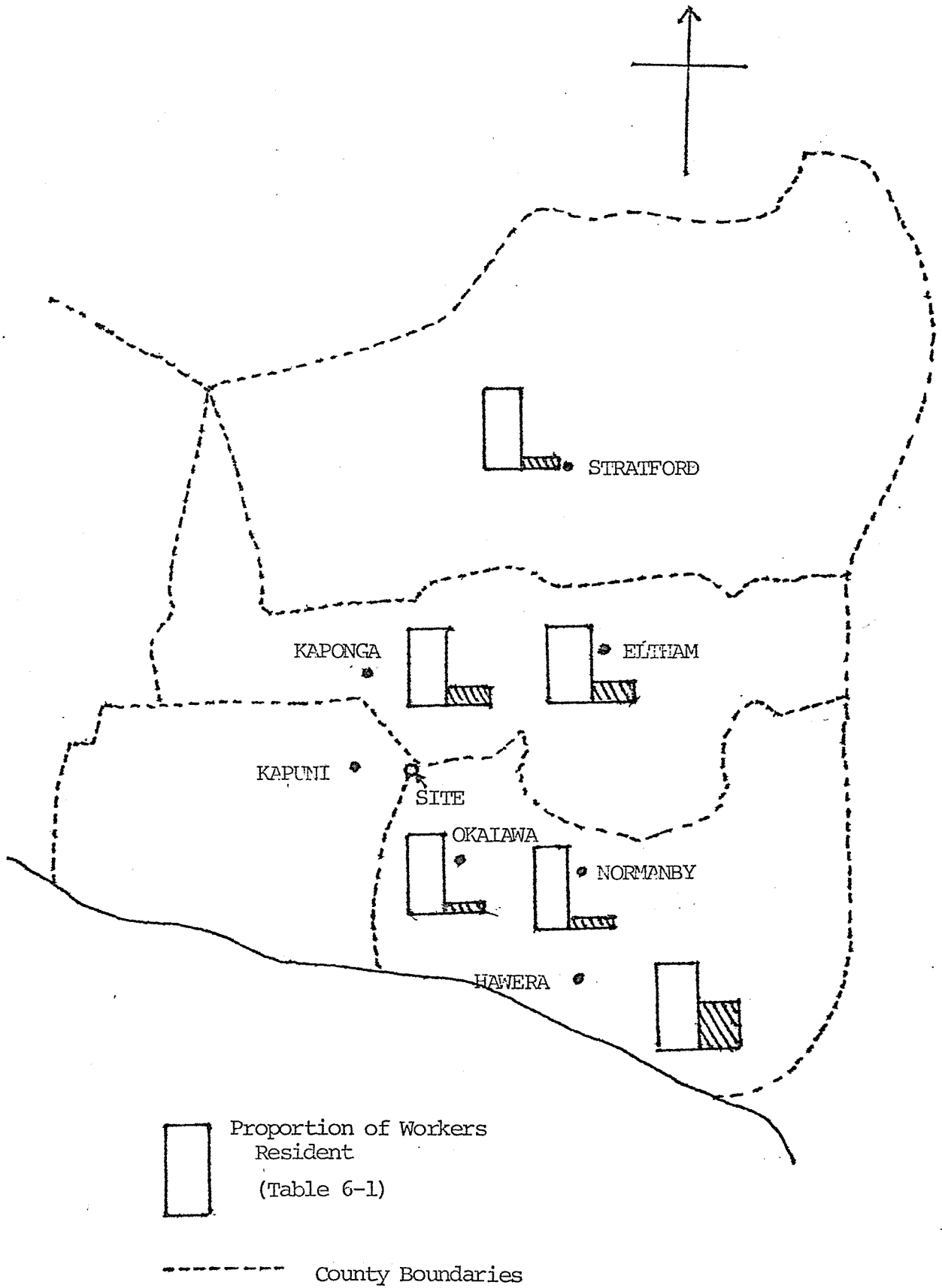
Source: Foakes, 1980, p. 2.41

Table 6-2 : Distribution of Ammonia/urea plant workers

	Number	Percent
Hawera Borough	62	49.5
Normanby	4	3.2
Manaia Town and District	14	11.3
Okaiawa Community	7	5.6
Eltham Borough	13	10.4
Kaponga Community	9	7.2
Stratford Borough	9	7.2
Opunake	1	0.8
Auroa	5	4.0
New Plymouth	1	0.8
	125	100

Source: Field Survey, 1982

FIGURE 6-1 Area of Influence : Distribution of Plant Workforce



The result obtained from Table 6-2 is an area of social influence based on the density of population of plant employees and the 30km. boundary established in Fookes, (1980) (Figure 6-1).

Table 6-3: Numbers commuting during the construction phase from New Plymouth

Contractors (sub-contracting)	No. New Plymouth
Hawkins	20
Robt. Stone	23
Elextrix	16
Capital Plant International	54
Total	113

Source: Field Survey, 1982

For reliable comparison of statistics in the remaining part of this chapter existing statistical boundaries are used to delineate the area of social influence. (Figure 6-1)

These are:

Midhurst
 Stratford County
 Opunake Town and District
 Egmont County
 Kaponga
 Eltham County
 Eltham Borough
 Waimate West County
 Manaia Town and District
 Normanby Community
 Hawera County
 Hawera Borough
 Stratford Borough

Population in the area of influence

During the last decade the area of influence has experienced a net loss of 2,679 persons (Table 6-4). Some of these people have moved to other centres in the region such as New Plymouth which has held its own against the outward trend. The greatest decline in population has occurred since 1976.

The number of people temporarily resident in the area rose only 61 during the intercensal period 1976 to 1981. This is a net change and does not reflect any changes which might have occurred in the meantime, influenced by construction work at Kapuni. It does go some way, on the other hand, to support the evidence that a high proportion of the construction workforce was resident in New Plymouth and commuted to work daily. This is possible because on census night the workforce employed constructing the Ammonia/urea plant peaked at 300.

The result of net out-migration suggests that some spare capacity exists in the area of influence and that the permanent workforce at the Ammonia/urea plant will slow the outward flow but not stop it. The employment of 100 workers is unlikely to stress the social infrastructure. The increase in local spending can be expected to have some impact on the local economy. The extent of this is discussed in Chapter 2.

Employment Characteristics

It is to be expected that in a predominantly rural area the greatest proportion of people is employed in agriculture. This is the case in the area of influence (Table 6-5) as the figures clearly show. Numbers employed in agriculture are nearly three times the national average.

Table 6-4: Population Change in Area of Influence

Statistical Area	1971	1976	1981	1976	1981	1976	1981
						Temp	Temp
Midhurst	322	298	258	-24	-40	2	3
Stratford County	4976	4786	4272	-190	-514	81	87
Opunake T and D	5398	5444	5298	46	-146	224	204
Egmont County	1384	1463	1593	79	130	39	42
Kaponga	4364	4142	3648	-222	-494	44	48
Eltham County	496	494	390	-2	-104	9	9
Eltham Borough	2569	2405	2058	-164	-347	74	24
Waimate West Co.	2321	2334	2295	13	-39	33	114
Manaia T and D	2460	2074	1911	-386	-163	21	24
Normanby Com.	921	953	975	32	22	26	18
Hawera County	552	667	732	125	55	7	12
Hawera Borough	3970	3873	3645	-96	87	43	75
Stratford Borough	8134	8506	8112	372	-394	236	240
			Net	-417	-1947	839	900

Source: 1976, 1981 Census of Population and Dwellings,
Taranaki Statistical Area

Sector / Area	Ag Hunting Fishing	Mining	Manu- fact- uring	Elec- tric, Gas Water	Con- struc- tion	W + R Sale	Trans- Port	Fin- ance Ins.	Comm Service	Total
Midhurst	9	-	36	3	6	12	9	-	9	81
Straford Co.	972	9	117	12	78	72	39	18	87	1422
Opunake T.	30	39	72	15	66	66	36	9	57	396
Egmont Co.	319	9	105	6	24	48	9	3	42	1089
Kaponga	12	3	36	3	9	24	9	3	12	117
Eltham Co.	507	3	51	9	21	18	9	6	24	666
Eltham Bor.	42	15	288	30	54	69	36	18	87	654
Waimate West	453	9	69	3	15	18	6	-	21	606
Manaia T & D	12	9	81	3	27	30	9	6	42	234
Normanby Com.	12	9	75	3	15	30	12	3	24	192
Hawera Co.	48	48	747	63	222	384	111	105	372	2151
Hawera Bor.	528	27	210	21	90	123	42	21	93	1161
Stratford Bor.	51	12	312	81	177	258	177	57	252	1416
Total	2995	183	2199	249	804	1152	504	249	1122	9459
Percentage	32	2	23	2.5	8.5	12.0	5.5	2.5	12.0	100
Percentage NZ	11.2	0.3	24	1.3	7.0	18.2	8.6	7	22.2	100

Source: 1981 Census of Population and Dwellings, Taranaki Statistical Area

Table 6-5: Employment by Major Industry Divisions in the Area of Influence

Mining (1.7%) and construction (1.5%) are only marginally above the national average. In Table 6-6 the change since 1976 is shown. In mining and construction an increase has occurred in the area of influence which is a move against the national trend.

Table 6-6: Increases in Employment since 1976 by Sectors.

Sector	1976 (%)	1981 (%)	Change (%)
Agriculture, Hunting, Forestry & Fishing	26.6	32	4.4
Mining and Quarrying	1.1	2	0.8
Manufacturing	19.9	23	3.1
Electricity, gas and water	1.8	2.5	0.7
Construction	7.7	8.5	1.2
Wholesale, Retail trade	16.7	12.0	-4.7
Transport, Storage and communications	3.9	2.5	-1.4
Community service, Personal services	15.3	12.0	-3.3

Source: 1976, 1981 Census of Population and Dwellings
Taranaki Statistical Area.

Unemployment in the area of social influence is 1 per cent higher than in 1976. For 1981 it stood at 2.4 per cent. At the same time the total number of people actively employed in work rose 14.9 per cent during the intercensal period. In real terms part of this increase would be accounted for by special work schemes.

Income within the Area of Influence

No clear statement of total income for the area is to be found in the 1981 census. By combining the total number of males and females (Table 6-7) currently employed fulltime,

and multiplying their average income by this number an approximate figure (Table 6-8) is obtained.

Based on the above figures the total annual income for the area of influence was \$171.4 million for 1981. The average income per head was \$9,611. A figure for the national average income was not available, but for the same area in 1976 the area average income was \$7,418 per head and \$9,904 for the national average. Both figures are inflation adjusted.

In contrast the average income for Ammonia/urea plant workers was \$12,525 after tax in 1982. Adjusted for inflation to represent the 1981 level of income this becomes \$10,796. This figure is well above the national average and above the regional average. All figures used above are calculated after tax has been removed.

Two implications become apparent. First wage levels at the Ammonia/urea plant might influence those of the community at large. Secondly, the multiplier impact could be greater for plant workers than as a result of other sectors of the local economy.

Rental and Housing Stocks

The availability of housing and rental stocks is equal to the national average. A spot check of local real estate agents revealed that a shortage of housing was not a reality, nor had it been since the thirties. The problem was not one of short supply but of difficulty by certain socio-economic groups to finance a home. This difficulty is compounded by inflation and high interest rates from traditional mortgage sources.

The likely impact on the social infrastructure of the Ammonia/urea plant will be negligible. The excess

Table 6-7: Numbers of Males and Females by Income Level and Residence

Area	Under 1999	2,000 4,999	5,000 7,999	8,000 9,999	10,000 11,999	12,000 13,999	14,000 17,999	18,000 24,999	25,000 Over
Midhurst Com.	18	12	24	21	21	12	18	9	3
Stratford Co.	276	327	429	264	243	150	231	186	210
Opunake T.	135	96	153	78	78	42	69	51	27
Egmont Co.	201	228	291	159	165	102	138	141	257
Kaponga	36	21	27	24	27	21	12	6	3
Eltham Co.	126	141	201	120	105	90	96	117	111
Eltham Bor.	192	129	174	150	183	102	108	60	24
Waimate West	81	108	135	105	105	93	102	105	147
Manaia T & D	102	63	60	60	42	36	27	18	6
Normanby Com.	51	42	54	36	60	52	18	15	6
Hawera Co.	211	255	333	249	225	150	180	156	150
Hawera Bor.	897	609	549	411	471	324	369	231	306
Stratford Bor.	576	363	471	345	381	243	231	111	36
Total	2902	2394	2901	2022	2106	1417	1599	1206	1287

Source: 1981 Census of Population and Dwellings, Taranaki Statistical Area

Table 6-8: Estimation of Income for the Area of Influence

	Under 1999	2,000 4,999	5,000 7,999	8,000 9,999	10,000 11,999	12,000 13,999	14,000 17,999	18,000 24,999	25,000 Over
No. of Earners	2,902	2,394	2,901	2,022	2,106	1,417	1,599	1,206	1,287
Av. Earnings	1,000	3,000	6,000	8,500	10,500	12,500	16,000	21,500	27,500
Dollars Earned (000)	2,902	7,182	17,406	17,189	22,113	17,712	25,584	25,929	35,392

capacity in the region, the result of out-migration is the main reason for this. Future job creation might come about and with it a stemming of the movement of the population to the major urban centres. The area is predominantly agricultural and the Ammonia/urea plant is unlikely to affect this. The increase in population of one hundred workers and their dependents will easily be accommodated in an area which recorded a net migration loss during the intercensal period to 1981 of 1,947 people.

CHAPTER 7

INCOME AND EMPLOYMENT MULTIPLIERESTIMATION

The estimation of regional income and employment multiplier is used here to determine the impact of the Ammonia/urea plant at a sub-national level. This is not without precedent (Brown, 1967; Sadler et al., 1973), and has been developed out of a need for information to assist with regional policy and planning decisions.

In this chapter the Keynesian multiplier is used. This is appropriate in this case and has provided the basis for similar studies at the regional level (Brownrigg, 1975; Gover, 1978; Aldwell, 1980). In Chapter 8 the regional non-survey input/output method will be applied in an attempt to gauge the impact of the Ammonia/urea plant on employment, income and linked industries.

Keynesian Multiplier

Multipliers were first applied at the national level. This has an important bearing on the present use because of the nature of leakages. Leakage from a national economy is quite straight forward as funds are exchanged for goods and services abroad. In the regional setting one other element is introduced, that is interregional trade.

At the regional level the greater dependence on imports reduces the effect of the multiplier markedly. The smaller the region the greater is the dependence upon imported goods and services, because the smaller region is not capable of supplying these itself and is deficient as a result (Hubbard and Brown, 1979).

With the Keynesian income multiplier the notion that export earnings are necessary to create additional regional income is central, hence the relationship between regional income and the propensity to consume locally (Aldwell, 1980).

The Keynesian income multiplier used in this study is derived from a simple Keynesian income determination model. (Hubbard and Brown, 1979). This is:

$$Y = C + I + G + E - M \quad 7-1a$$

where Y = regional income

C = consumption = $C_n Y_d$, the marginal and average propensity to consume locally

I = investment (autonomous)

G = Government expenditure (autonomous)

E = regional exports

M = regional imports

$$Y_d = +Y - sY - \text{disposable income} \quad 7-1b$$

t = marginal and average propensity to tax

s = marginal and average propensity to save

From this model the regional income multiplier K, is derived:

$$K = 1 - C_r \left[(1 - S) (1 - t) (1 - m) \right]$$

where C_r , s, t and m are the leakage coefficients relating to savings, taxation regional imports and the average propensity to consume. This model identifies the variability of the individual components of leakage.

The method followed in the calculation of the multipliers in this chapter is based on the work of Aldwell (1980). He isolated leakage into :

- 1) The nonwage multiplier (K_1) which gives an estimated value for all plant expenditure excluding wages.
- 2) The wage based multiplier (K_2) which provides an estimate of the impact of the average wage.

Disaggregation of the aggregate income multiplier into the wage and non-wage components allows the employment

multiplier (KE) to be estimated in terms of regional factor payments as all direct leakages such as taxation, savings, and exogenous payments are withdrawn (Aldwell, 1980).

Two categories of multiplier are identified :
Type I multipliers and Type II multipliers.

Type I income multipliers are expressed as the ratio of direct plus the indirect income change resulting from a unit increase in final demand for a given industry or project. (Richardson, 1972). i.e.

$$\text{Type I multiplier} = \frac{\text{Direct and Indirect Effects}}{\text{Direct Effects}}$$

Type II income multipliers are expressed as the ratio of direct, indirect, and induced effects to the direct change of some initial injection. i.e.

$$\text{Type II multiplier} = \frac{\text{Direct, Indirect \& Induced Effects}}{\text{Direct Effects}}$$

Type II multipliers tend to be larger than Type I multipliers because of the extra round of induced income generation effect. In this study estimated income multipliers refer to the direct and indirect effects of an injection and so Type I multipliers are used.

The multiplicand (Brown, 1972) refers to the sum of regional factor payments by the plant and its employees. The latter refers to that part of the wages spent in the region after tax, holiday expenditure, savings, insurances, and other withdrawals have been deducted. The two components of the multiplicand, wage and non-wage multipliers, identify where greater regional expenditure is generated. Thus, the larger multiplicand will create the greater demand for goods and services.

Estimation of Leakage Values

Leakage is one of the main constraints on the multiplier for any given injection into a regional economy. If there is no leakage from derived income and the propensity to consume is equal to 1.0, all of the initial injection of income would continue to be spent within the region, round after round. This would result in an enormous multiplier. (Aldwell, 1980).

If none of the income was spent in the region the propensity to consume would be zero and the value of the multiplier would be 1.0 (Stonier and Hague, 1957).

The principle components of leakage are taxation, savings, and imports (Brownrigg, 1971, 1973; Hildebrand and Mace, 1950; Richardson, 1972; Steele, 1969, 1972).

Taxation has two components ; direct and indirect taxation. Direct taxation is regarded as an income leak, while indirect taxation is considered to be an expenditure leak (Allen, 1969). The average propensity to tax is determined directly as a fraction of the average wage for the sector in the region e.g. where the average tax paid is 25 per cent of gross income, $t = .25$.

The taxation component assumes greater importance in this study than in those which developed the methodology for multiplier calculation. This is largely because wage rates have risen in sympathy with inflation in dollar terms, while the rate of taxation has remained unchanged. This results in a high leakage in real money terms due to inflation.

Savings includes: all private investment and savings accounts and superannuation. Savings is a leakage because the withdrawal of money from circulation prevents its use in the normal rounds of spending. Employee average propensity to save is derived from questionnaire data and refers to all savings withheld from circulation for the 12 months prior to September 1982 in this study.

The leakage variable which most affects the multiplier is the import coefficient. This is, in the main, because the import coefficient is generally six or seven times the size of the savings or taxation coefficients (Aldwell, 1980). The average propensity to import refers to exogenous expenditure by employees. This includes transfers outside the region such as donations, income spent on holiday, insurance payments. It refers to the final demand items, where no further value added is derived.

The final variable is the average propensity to consume (Cr.) The average propensity to consume is that proportion of income remaining after taxation, savings, and imports have been deducted. It is the magnitude of "Cr" that largely determines the size of the income multiplier and hence the secondary effect of a regional injection of funds.

The above procedures for estimating leakage and consumption propensities were employed in the estimation of the three income multipliers : the nonwage multiplier; the aggregate multiplier; the wage-based multiplier. Figures used in their calculation were obtained from a field survey of the construction workforce and this data is assumed to reflect the probable pattern of spending for the production workforce. Other financial details were obtained through Petrochem from the Natural Gas Corporation, Bell Block.

Disaggregation of the regional income multiplier permits the identification of the direct and indirect effects of the initial injection of money. Part of this is spent locally on goods and services, and part is spent as wages. The nonwage multiplier reflects the portion of total income spent on goods and services and the wage-based multiplier reflects the portion of the wage bill spent locally by plant employees. (Aldwell, 1980).

Regional unemployment is one variable which has not been considered by previous studies as it effects the employment multiplier. The emphasis in the past has been on full employment.

Now spare capacity exists and retailers and other employers tend to be overstaffed. This has led to a reluctance to replace staff and in some cases lay-offs have taken place. This raises the question of whether or not the Ammonia/urea plant is large enough to influence this situation in Taranaki.

The Employment Multiplier

The employment multiplier is calculated using the results of the three multipliers mentioned above. The employment multiplier refers to the additional demand created through the spending of income. To meet this demand suppliers might require more staff. The extent of this depends on the size of the employment multiplier. Conditions of low unemployment can determine whether or not the increase in the demand for labour can be satisfied. This estimates the number of jobs generated directly and indirectly.

The employment multiplier in turn depends in part upon the differential labour efficiency among regions (Appendix B). To compensate this effect an adjustment is made to reflect regional productivity in the service sector.

The next step is to utilise a model based on the above information which draws together regional income and employment data and incorporates the regional under-employment variable. Thus the model is:

$$K.E. = \frac{\frac{\overline{(x \cdot K_1)} + (Y \cdot K_3 \cdot n)}{e} + n}{n}$$

where: x = plant nonwage regional expenditure

K_1 = nonwage regional income multiplier

Y = average employee regional expenditure

K_3 = wage based income multiplier

n = number of employees in plant

e = regional productivity as a percentage of the national average

l = national service sector sales required to support one job.

Primary data was used for : x , K_1 , Y , K_3 , and n . The table adapted from the Department of Statistics 1980, and found in Aldwell, (1980), was used for e , and l . (Appendix B).

By incorporating the wage based multiplier and multiplier, and a measure of regional productivity the derived model provides a more sensitive measure of the impact resulting from an injection of funds into the regional economy.

The Non-Wage Multiplier (K_1)

The size of exogenous expenditure is determined through the location of the plant relative to its raw materials. In this case the plant and resource are at the same location.

Of the variables listed in Table 7-1 the import variable is the most significant. The import coefficient tends to be six or seven times the size of the other variables, although less in this case. The importance of this is that their purchase occurs outside the region and this constitutes a leakage. The higher the import content the lower the multiplier and this indicates a reduced effect.

Table 7-1: Non Wage Multiplier (K_1)

Imports	(m)	0.118
Taxation	(t)	-
Savings	(s)	0.470
Regional Expenditure	(Cr)	0.412
Non-wage income multiplier	(K_1)	1.24

Source : Field Survey, 1982

In this study the purchase of raw materials located at Kapuni constitutes an import leakage, for while the resource might be located within the region the purchase of it occurs outside the region between the Oil Companies and the Government, and then through Petrocorp and Petrochem.

Taxation is not paid by Petrochem. No reason was given on the questionnaire (Appendix D-2) but two reasons are suggested. First, the majority of nitrogen fertiliser produced in the first year, for which the figures provided apply, is for export to Australia. It is assumed that this gives Petrochem the right to claim the export tax incentive. Secondly, many expenses such as mortgages and loans are tax deductible.

Savings here apply to the surplus income produced after all expenses are deducted. In the first year of operation a profit of \$9.8m. is anticipated. This figure was arrived at through extrapolation. The figures provided by Petrochem were for one year's operation to 31st March 1983. This included only 3 months production but 12 months expenses, many of these being fixed. This confusion was resolved through further enquiries and the figures used in this study relate to 12 months operations.

Once the above elements are deducted from total expenditure the regional expenditure component remains. The regional expenditure component generates the indirect income and employment effects. In the final analysis it is the size of the propensity to consume within the region that determines the size of the multiplier.

Aggregate Income Multiplier (K_2)

The aggregate income multiplier is derived from total regional wage and non-wage expenditure. This refers to the net expenditure only, in the region, by the plant and its employees.

Calculation of this multiplier follows the same procedure as for the non-wage multiplier. Although the variables are the same the inclusion of the regional wage

Table 7-2 : Aggregate Income Multiplier (K_2)

Imports	(m)	0.118
Taxation	(t)	-
Savings	(s)	0.408
Regional expenditure	(Cr)	0.473
Aggregate income		
Multiplier K_2		1.3

Source : Field Survey, 1982

Table 7-3 : Incremental change between non-wage (K_1) and Aggregate (K_2) Multipliers

Aggregate Multiplier	(K_2)	1.33
Non-wage Multiplier	(K_1)	1.24
$K_2 - K_1$		0.09
<hr/>		
$K_2 - K_1$	0.09	
K_2	1.33	6%

Source : Field Survey, 1982

component makes the values different (Table 7-2).

The relative difference between the regional imports of the wage component is shown in the incremental change in value of the multiplier (Table 7-3).

The aggregate multiplier is much larger than the non-wage multiplier. The net result of this is an increased sensitivity of the region to changes in plant expenditure levels. Compared to other studies (Hubbard and Brown, 1979; Aldwell, 1980) this figure is quite acceptable for the Type I multiplier.

Wage-based Income Multiplier (K_3)

The magnitude of the impact of the wage-based multiplier reflects the proportion of wages spent locally. The more employees spend locally the greater the benefit to local retailers and the service sector.

The method used for the calculation of the wage-based multiplier is the same as that used for both the non-wage and aggregate income multipliers. One important distinction must be drawn. Where (m) represents imports in the other calculations, here it is used to represent exogenous remittances by employees. This includes items such as holidays, donations, and goods and services which are purchased outside the region and for which local income is used.

Savings by employees working at the plant amounted to a propensity to save of 0.055. This closely resembles the national average propensity of 0.05 (Department of Statistics, 1979.)

On average employees each saved over a twelve month period \$1,024.00. This is a reflection of the national average figure. Aldwell, (1980) demonstrates a similar figure for Otago.

Table 7-4: Wage Based Income Multiplier

Mean gross income	\$18,537	
Mean tax (t)	6,012	(0.324)
Mean savings (s)	1.024	(0.055)
Mean exogenous remittances (m)	2.379	(0.128)
Mean local consumption (Cr)	10,996	(0.593)

Source: Field Survey, 1982

Compared to the tax component savings has only a small impact on the resulting multiplier, and thus any variation in savings is not likely to effect the overall result. This is confirmed by similar studies by Hubbard and Brown (1979) and Aldwell, (1980).

A high proportion of employee income was spent within the region (0.593). Excluding taxation (0.324) this indicates that leakage from the region is minimal as a result of employee expenditure.

Employment Multiplier (K_E)

Employment multipliers are intended to summarise the total employment generated by those employed in a basic industry (Weiss and Gooding, 1968). Studies have estimated employment multipliers for projects or industries in New Zealand in the past (Business Development Centre, 1980; Grant, 1976; Hubbard and Brown, 1979). In each case the objective has been to measure the employment generating effect of the project or industry on the surrounding area.

The employment multiplier was calculated in this study using the Keynesian Income and Employment Multiplier Model. A value of 1.55 was derived which reflects the net effect of all factors relating to the Ammonia/urea plant including both direct and indirect employment.

Table 7-5: Direct Income and Employment Impact Summary

Employment Effect	Employment Multiplier	1.55
Income Effect	Non-wage multiplier	1.24
	Wage-based multiplier	1.49

The employment multiplier suggests that a maximum 55 additional jobs will be created as a result of operating the Ammonia/urea plant. This assumes that 100 employees are engaged full-time at the plant, and it also assumes that the Ammonia/urea plant is working at full capacity (Appendix A-3).

The wage-based multiplier indicates an additional 49 jobs could be created resulting from employee expenditure. An important point to make is that in this case employees are distributed over a very wide area (Table 6-2) which conceivably would reduce the impact to a level below the maximum. Only in Hawera is there a substantial concentration of workers resident (49.5%). This is particularly important in this study because of the small number of employees permanently working at the Ammonia/urea plant (one hundred).

The nature of forward and backward linkages associated with a chemical fertiliser plant suggest that a high proportion of actual impact will be associated with employee spending activities rather than through interindustry linkages. This was outlined in Chapter 3. This applies here more than anywhere else because of the isolation of the plant from linked industries within the region, and the export orientation. Thus, at a sub-regional level the major impact will result from employee spending.

CHAPTER 8

NON-SURVEY MULTIPLIERS : INPUT-OUTPUT TABLES

Input-output tables allow for the study of individual sectors within the economy and their inter-relationships as reflected in the sectoral multipliers. This approach requires a vast amount of data to derive the original input-output model. This is too expensive and time consuming a task to be justified in a study such as this.

In an attempt to overcome this some researchers have approximated input-output tables for regions by making adjustments to a national table based on readily available secondary data. One such model is used in this study (Hubbard and Brown, 1981).

Inter-industry relationships within an economy are represented in the input-output model by the Transactions Matrix. This is constructed by assigning a row and a column to each industry. Since one industry's output is frequently another industry's input the interdependence of industries is built into the matrix on this "from - to" or "sales - purchases" basis.

The output not used by another industry goes into a Final Demand quadrant. Those inputs not derived from another industry are treated as Primary Input. The completed input-output table shows the source of each industry's input and the destination of each industry's output. Row and column totals for each industry will be equal since total input must sum to total output. In this study the industry sector of interest is defined as Chemicals and Chemical Petroleum, Coal, Rubber and Plastic Products.

The non-survey procedure used in this study concentrates on making adjustments to the transactions Matrix of the national table. The Transactions Matrix of a regional input-output table will contain all transactions between those industries located

in the region. This is of particular interest here, because it is these inter-industry and household relationships which give rise to the regional multiplier effects.

Imports affect the size of the regional multiplier. Regions are more dependent than nations on imports because they will not only import from overseas, but also from other regions those goods and services in which they are deficient. The smaller the region the greater is likely to be the dependence on imports and consequently, the smaller the multiplier (Hubbard and Brown, 1981).

Multipliers from non-survey input-output tables will almost certainly be overstated when compared with those from a corresponding survey based table. Schaffer and Chu (1969) found that all the non-survey procedures they tested produced mean income multipliers which were substantially higher than those from the empirically derived tables. Type I multipliers were overstated less than were Type II multipliers. (Morrison and Smith, 1974). This is because it is assumed in the calculations that if a firm can buy inputs locally then it will do so.

Overstatement is also the result of aggregating the national input-output tables. The national input-output tables consist of 130 industry groups. In the approach adopted by Hubbard and Brown (1981) and used in this study this has been aggregated into the 25 sector industries classification of the Department of Statistics (Department of Statistics, 1978, 1980).

Multiplier Calculation

Output, income and employment multipliers were calculated from the aggregated 25 sector tables. In calculating the employment multipliers an employment sector for the region was estimated by dividing employment in each industry sector by the output from that sector. The direct employment co-efficients therefore reflect, as do the output and income coefficients inherent

in the input-output tables, average rather than marginal changes per unit of output. The multipliers are presented in Appendix G-1 along with the regional transactions table for the Taranaki Statistical area. (Hubbard and Brown, 1981).

The simple output multipliers show the direct and indirect output generated in response to a unit increase in sales to Final Demand. The total output multipliers incorporate the induced effect of household consumption, and so account for the direct, indirect and induced output generated by a unit increase in Final Demand sales.

The income and employment multipliers reflect direct, indirect and induced incomes or employment impacts given a unit increase in Final Demand sales.

Reservations

Hubbard and Brown (1981) list a number of reservations relating to the calculation of multipliers using non-survey input-output tables. First, the important assumption of linearity. The column coefficients of the transaction matrix (Appendix G-2) are treated as constant and are representative of average rather than marginal input requirements. Constant returns to scale are implied precluding economies of scale. Secondly, it is assumed that all sectors in the economy are working at a constant level of excess capacity or at full capacity. Thirdly, if some industries are operating at less than full capacity, then any increase in output might be accomplished without increasing all inputs, for example labour and fixed capital costs. The end result is an overstatement of the multipliers.

The reduced multiplier effects resulting from increased imports and discussed in Chapter 7, applies equally here. If an increase in demand for inputs cannot be satisfied by local suppliers then these must be imported.

The overall impact on the economy of a development

project, such as the Ammonia/urea plant, is measured in total by the multipliers, however no indication of the length of time taken to achieve this can be gained. This depends on the rate at which transactions occur.

Impact Calculations at the Regional and National Level

Calculations have been made at the national level and the sub-regional level using data collected during the field survey and recorded in appendix C-2 and appendix C-3 respectively. The information used relates to expenditure after leakages (tax, savings and imports) have been deducted. Interregional imports have not been deducted in the calculation of the national impact. This information is applied to the Sectoral Multipliers of the national table and Taranaki Statistical area (appendix G-1, and appendix G-2).

The Ammonia/urea plant is represented by sector 9 in the aggregated 25 sector GRIT input-output table (appendix G-3). The quantity and proportion of transactions made by the chemicals and chemical products sector are presented in appendix G-4. This sector is comprised of twelve sub-sectors, which appear in the national 130 sector input-output tables (appendix G-5). Calculations are based on the aggregated input-output tables and reflect approximate models of the national and regional economies only.

National Non-survey Multipliers

Calculations for the national level were based on the combined figures of local and non local factor payments. This amounted to \$11,064,600 per annum based on projections supplied by Petrochem. The results appear for the income multiplier in table 8-1 and for the employment multiplier in table 8-2.

The figures in table 8-1 indicate that the nation will benefit by \$5.0 million as a result of the annual production of the Ammonia/urea plant. Employment (table 8-2) will increase

Table 8-1: Income paid per dollar of output

	Cumulative (\$)	Change
Direct	1.7 m	-
Direct and Indirect	3.2 m	1.5 m
Direct, Indirect and Induced	5.0 m	1.8 m

Table 8-2: Employment multipliers ($\times 10^{-3}$)

	Cumulative	Change	
Direct	608	-	
Direct, Indirect	1,029	421	
Direct, Indirect and Induced	1,615	586	

by 1,615 in the same industry sector as the Ammonia/urea plant and related sectors.

Sub-Regional Multipliers

Calculations were based on the average propensity to consume locally by employees working at the Ammonia/urea plant. Employee expenditure was isolated for these calculations because this was the only expenditure activity undertaken as a result of the plant's operation which was wholly taking place within the region.

It was pointed-out above that the Ammonia/urea plant was designed primarily as a export earner. The implications of this for regional development centred on benefits gained through employee spending only. Thus it is appropriate to use the average propensity to consume, expressed in dollars, as the benchmark against which to measure the sub-regional impact.

The average spending by employees at the Ammonia/urea plant was estimated at \$10,996. This figure is the amount remaining after taxes, savings and imports have been deducted. Table 8-3 shows the multiplier effect, in dollars, of the expenditure of one employee. Total employment at the Ammonia/urea plant when it reaches full production will be one hundred.

Table 8-4 represents total employment impact. The method was the same as for Table 8-3, and adjusted for the total number of employees required at the plant. Included in this table is the percentage of overstatement. This refers to the difference between the non-survey input-output multipliers and the wage-based employment multiplier calculated in Chapter 7.

For the purpose of direct comparison with the survey employment multiplier (1.55) only the "direct" multiplier impact is appropriate. The "indirect and induced" effects are not adequately represented in the survey based multiplier because they are derived using the transactions matrix. Thus

Table 8-3: Income multipliers - subregional

	Cumulative (\$)	Change
Direct	1,165	-
Direct and Indirect	1,990	825
Direct, Indirect and Induced	2,518	528

Table 8-4: Employment multipliers - sub-regional

	Cumulative	Change	Over state- ment
Direct	61.5	-	10%
Direct and Indirect	86.8	25.3	35%
Direct, Indirect and Induced	104.4	17.6	47%

the overstatement amounts to 10 percent for the Type I multiplier.

Schaffer and Chu (1969) found that all of the non-survey procedures they tested produced mean income and employment multipliers which were noticeably higher than those empirically derived. With the procedure used in this study they found that Type I multipliers were 21 per cent higher than those based on survey material on average. Morrison and Smith (1974) confirmed this result with an overstatement of 20 per cent on average.

CHAPTER 9

CONCLUSIONS

This study has set-out to discover :

- i) how the Ammonia/urea plant might be placed into the national economic environment;
- ii) how the Ammonia/urea plant fits into the industrial structure of the region;
- iii) the place of the Ammonia/urea plant in any industrial complex which might emerge in Taranaki based upon Maui Gas;
- iv) what kinds of sub-regional impacts might arise from the establishment of the plant.

The evidence presented in this study suggests that the government's growth strategy aims at establishing economic growth in part through the easing of the balance of payments problem. The main constriction of economic growth is the in-elasticity of the economy to cope with increased demand without increasing the import of raw materials for production to meet this demand. The New Zealand Government is following a policy which combines the old "solution" of import substitution with greater investment in export oriented industries aimed at reducing the spending of overseas funds or the saving of overseas funds. This policy also emphasises increasing productivity as a major means to international competitiveness and economic growth.

The Ammonia/urea plant fits well into this strategy. The large production capacity and export orientation give it a export earner emphasis. In addition to this the plant has the capacity to supply the domestic market, where the potential lies with pastoral farming and forestry.

At the sub-regional level the impact of the Ammonia/urea plant will be negligible. The social infrastructure will easily accommodate the immigration of the permanent workforce and slow the trend of out-migration to large urban centres.

This impact will not be very great because the plant will create only one hundred new jobs.

The wage-based multiplier indicates that approximately 50 additional jobs will be created as a result of the direct labour at the plant. The impact on the wider community through the continuing rounds of spending will be weakened by the distribution of the workforce among a number of communities (Table 6-2). Only Hawera will experience any noticeable change.

The nature of the forward and backward linkages associated with a petro-chemical based industry suggest that at the sub-regional level the impact will come from employee spending only. A plant multiplier of 1.24 supports this argument. Geographical isolation and the export orientation are other major factors. It is unlikely that the Ammonia/urea plant will form the basis for future industrial development, nor does it appear that this was ever intended by the Government.

The limited local impact and the desire to earn overseas exchange, the change from a small plant designed mainly for the domestic market to one dependent upon export sales begs the question whether the Ammonia/urea plant constitutes the best use of resources. This is measured by an industry's potential to contribute to national economic growth and its ability in the long-term to utilise national resources efficiently in relation to the possible uses to which they might be put by other economic activities. This includes aspects of the community's welfare derived from employment, its contribution to regional development, the degree to which it imparts skills to the community which would not otherwise arise, its contribution to Government revenue and its contribution to the balance of payments through its earning or saving of foreign exchange.

Against these criteria the Ammonia/urea plant is clearly one-sided. Its major contribution will be to the balance of payments problem. Other aspects have been measured in this

study and found to have a minimal effect. However, the analysis of the Government's growth strategy indicates that the short-fall of the Ammonia/urea plant is taken-up by other development projects, and that the primary function of the Ammonia/urea plant is as an earner of overseas funds.

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APPENDIX A-1

Ammonia/urea plant expenditure November 1980 to November 1982

(\$000,000)	Allocated in New Zealand	Allocated overseas
Equipment, materials, spares, licence fees	11.3	47.7
Mechanical erection, commissioning	21.8	2.1
Planning approval, site preparation, foundations	6.6	-
Buildings	1.5	-
Construction, Management and pre-operating expenses	7.3	-
Total	48.5	49.8
		<u>98.3</u>

APPENDIX A-2

Expenditure (12 months of Production)

	Taranaki	Other N.Z.	Overseas
Wages and salaries (Gross)	1,288,000	234,000	
Maintenance			
- Materials	131,000		
- Labour	232,000		
Cartage - Rail	193,000	384,000	
Energy & Fuels	3,967,000		
Raw Materials	2,788,000		
Insurances		150,000	
Plant Hire			
Capital Inv.		94,000	
Depreciation		2,600	
Admin & Mktg		1,695,000	
	\$8,599,000	\$2,465,600	\$11,064,600

Income

	Taranaki	Other NZ	O/s	Total
Sales	1,500,000	6,000,000	11,880,000	
Interest		1,500,000		
	1,500,000	7,500,000	11,880,000	
			\$20,880,000	Gross
			\$ 9,815,400	Net

APPENDIX A-3

Notes

1. The plant will use less than 4 petajoules of Maui or Kapuni gas annually, The Government has contracted to take or pay for 166 petajoules of gas per year. This is a final cost. 4.15 petajoules has been allocated to Petrochem and this appears in the expenditure column as a fixed expense.
2. The objective is for the plant to be operating at 65% capacity by 1983.
3. Initially the ammonia/urea plant will need to operate in excess of 50% capacity to cover all costs including loan repayment. After the loans have been repaid the plant will be able to breakdown at rather less than 50% capacity.

Appendix B

Regional Underemployment as a Percentage of the National
Average Output per Employee in the Service Sector

Region	Output per service sector employee (dollars)	Output per service sector employee as a percentage of national average (percentage)
Northland	43,000	72
Central Auckland	57,000	97
South Auckland - Bay of Plenty	47,000	80
East Coast	45,000	76
Hawkes Bay	52,000	88
Taranaki	47,000	80
Wellington	84,000	142
Marlborough	63,000	107
Nelson	50,000	85
Westland	39,000	66
Canterbury	53,000	90
Otago	51,000	86
Southland	53,000	90
North Island	74,000	125
South Island	52,000	88
New Zealand	59,000	100

Adapted from : Department of Statistics 1980

Source, Aldwell, 1980

APPENDIX C-1

Calculation of the Employment Multiplier (K_E)

$$K_E = \frac{\frac{\left[\frac{(X \cdot K_{r1}) + (Y \cdot K_{r3} \cdot n) \cdot e}{1} \right] + n}{n}}$$

Where :

 K_E = employment multiplier

n = plant nonwage regional expenditure

 K_1 = nonwage regional income multiplier

Y = employee expenditure (wage)

 K_3 = wage-based income multiplier

n = number of employees

e = regional productivity as a percentage of the national average

l = average national service sector sales required to support one job.

APPENDIX C-1 (continued)

K_E = employment multiplier

x = \$7,311,000

K_1 = 1.24

y = \$ 15,848

K_3 = 1.49

n = 100

e = 0.80

l = 59,000

$$K_E = \frac{\left[(7,311,000 \times 1.24) + (15,848 \times 1.49 \times 100) \right] 0.80 + 100}{59,000}$$

$$\frac{\quad}{100}$$

= 1.55

APPENDIX C-2

Plant MultiplierNon-Wage Multiplier (Based on Production)

GROSS INCOME (Local and Nonlocal and Export) _____ A

Factor payments (Nonlocal)

A.C.C. & Superannuation

Maintenance

Energy and fuels

Cartage

Contract

Raw materials

Services - (accounting, legal, advisory,
commercial etc)

Insurances, interest, dividends

Plant Hire

Capital investments (land, Buildings and
plant inside last 12 months)

Other (warehouse space, advertising, travel) _____

TOTAL _____ B

Income Remaining _____

Factor Payments (Local)

Taxes and Rates

Maintenance

Energy and fuels

Water

Cartage

Contracting

Raw Materials

Services, (accounting, legal, commercial)

Fork charges

Other (warehouse space, advertising)

TOTAL _____ C

Income Remaining _____

Taxes Paid (income, company and others non local) _____ D

Surplus (as this is regarded as income not spent
it is treated as savings) _____ E

$$\text{Multiplier (K)} = \frac{1}{1 - Cr \sqrt{(1-m) (1-s) (1-t)}}$$

CONT.

Appendix C-2 cont.

Where: Cr.	= Regional average propensity to consume	= $\frac{C}{A}$
m	= Average propensity to import	= $\frac{B}{A}$
s	= Average propensity to save	= $\frac{E}{A}$
t	= Average propensity to tax	= $\frac{D}{A}$

Source: Aldwell, 1980

Appendix C-2 (cont.)

Gross income	\$20,880,000	A
Factor payments (nonlocal)	2,465,600	B
Factor payments (local)	8,599,000	C
Taxes paid	None	D
Surplus	9,815,400	E

$$Cr = \frac{C}{A} = 0.412$$

$$m = \frac{B}{A} = 0.118$$

$$s = \frac{E}{A} = 0.470$$

$$t = \frac{D}{A} = -$$

$$\text{Multiplier } K_1 = \frac{1}{1 - Cr \left[\frac{1}{1-m} \right] (1-s) (1-t)}$$

$$= \underline{1.24}$$

Appendix C-2 (continued)

Aggregate Income Multiplier (K_2)

Gross income	20,880,000	A
Factor payment	2,465,600	B
Factor payment (local)	9,887,000	C
Taxes	None	D
Surplus	8,527,400	E

$$Cr = \frac{C}{A} = 0.473$$

$$m = \frac{B}{A} = 0.118$$

$$s = \frac{E}{A} = 0.408$$

$$t = \frac{D}{A} = -$$

$$\begin{aligned} \text{Multiplier } K_2 &= \frac{1}{1 - Cr \sqrt{(1-m) (1-s) (1-t)}} \\ &= \frac{1}{1 - 0.473 \sqrt{(1-0.118) (1-0.408) \underline{1}}} \\ &= \underline{1.33} \end{aligned}$$

APPENDIX C-3

WAGE BASED MULTIPLIER

Mean gross income	_____	A
Nontaxable superannuation and insurance allowance		
Clothing allowance (and other allowances)		
Mean taxable gross income		
Tax paid	_____	B
Net disposable income		
Savings - average for year	_____	C
Income remaining		
Income spent outside region (donations, holidays, consumer goods)		
Less state rental, and mortgage payments		
Total exogenous expenditure	_____	D
Income spent in region	_____	E
Average propensity to consume locally	=	$\frac{E}{A}$
Average propensity to save	=	$\frac{C}{A}$
Average propensnity to import (\$ spent exogenously)	=	$\frac{D}{A}$
Average propensity to tax	=	$\frac{B}{A}$

Source : Aldwell, 1980

Appendix C-3 (continued)

Mean gross income	\$18,537	A
Tax	6,012	B
Savings	1,024	C
Income spent (nonlocal)	2,374	D
Income spent (local)	10,996	E

$$\text{A.P.C. (Local)} = \frac{E}{A} = 0.573 \quad (\text{Cr})$$

$$\text{APS} = \frac{C}{A} = 0.055 \quad (\text{s})$$

$$\text{API} = \frac{D}{A} = 0.128 \quad (\text{m})$$

$$\text{APT} = \frac{B}{A} = 0.324 \quad (\text{t})$$

$$K_3 = \frac{1}{1 - \text{Cr} \sqrt{(1-t) (1-s) (1-m)}} \\ = \frac{1}{1 - 0.593 \sqrt{(1-0.324) (1-.055) (1-0.128)}} \\ = \underline{\underline{1.49}}$$

INCOME/EXPENDITURE PROJECTIONS FOR THE AMMONIA/UREA PLANT

Adapted from Aldwell, 1980

(1) Number of employees on wages
on salaries _____

(2) Towns and percentage of work force resident in each, if known, when production begins.

Annual Government grants, concessions, or incentives to workers (Please describe and quantify).

(3) Expected Annual Expenditure 1982/83

	Taranaki	Other N.Z.	Overseas
Taxes and rates			
Accident Compensation			
Wages and Salaries (Gross)			
Maintenance - Materials			
- Labour			
Energy and Fuels			
Water			
Cartage - Road			
- Rail			
- Port/ Wharfage			
Raw Materials			
Insurances			
Plant Hire			
Capital Investment (plant, equipment, building).			
Depreciation			
Other (Storage, executive travel, etc.).			

(4) Expected Income 1982/83

93

	Taranaki	Other N.Z.	Overseas
Sales - Main products			
- Residues			
Stocks, Shares, Loans			
Rents			
Other (Please specify)			

(5) What will be the weekly wages and salaries for the following staffing areas at the plant. (Please include gross incomes only and state the date for which these figures will apply e.g. From 1st Dec. 1982,

Date :- _____

Staffing Area	Wages	Salaries
a. unskilled labourers	\$	
b. skilled labourers	\$	
c. tradesmen, machine operators	\$	
d. foremen, leading hands	\$	
e. laboratory staff	\$	
f. office staff	\$	
g. senior office staff & administration	\$	
h. any others not covered by the above (please describe).	\$	

	KAPUNI	OTHER N.Z.	OVERSEAS	TOTALS
	\$(000)	\$(000)	\$(000)	\$(000)
<u>SALARIES AND WAGES (GROSS)</u>				
Salaries				
Wages				
<u>TRANSPORT AND COMMUNICATIONS</u>				
Freight				
Department Vehicles				
Rental Vehicles				
Post Office Payments				
Fares,				
Travel & Transport				
<u>LEASES AND RENTS</u>				
Hire- Plant & Equipment				
Land Rent				
<u>EQUIPMENT AND MATERIALS</u>				
Miscellaneous Stores & Tools				
Construction Materials:-				
Steel				
Timber				
Concrete				
Cement				
Aggregates				
<u>CIVIL ENGINEERING CONTRACTS</u>				
Civil Eng. Contracts				
<u>HEAVY STRUCTURAL AND MECHANICAL</u>				
(N.Z. ONLY)				
Heavy Structural Contracts (N.Z)				
Heavy Mechanical Contracts (N.Z)				
<u>OVERSEAS CONTRACTS</u>				
Overseas Contracts				

	\$ (000)	\$ (000)	\$ (000)	\$ (000)
<u>MISCELLANEOUS AND LOCAL AUTHORITY SERVICES</u>				
Miscellaneous Services				
Local Authority Services				
Electricity				
Water				
<u>CONSULTANTS</u>				
Consultants				
<u>LAND, PLANT AND OTHER CAPITAL EXPENDITURE</u>				
Land & Buildings				
Plant				
Other				
<u>OTHER OPERATION EXPENDITURE</u>				
Stationary				
Advertising & Publicity				
Plant Registration				
Workshops				
Other Operation Expenditure				
<u>SURVEY AND INVESTIGATION</u>				
Survey & Investigation				
<u>SIGN, ADMIN. AND OTHER CHARGES</u>				
Duty, Freight & Fees on N.Z contracts				
Design, Administration, overhead & other charges.				
<u>TOTAL</u>				

Petrochem

PETROCHEMICAL CORPORATION OF NEW ZEALAND LTD.

PETROCORP HOUSE, 86 LAMBTON QUAY, WELLINGTON.
P.O. BOX 5082: TEL. 739-812: TELEX NZ31146 NEW ZEALAND.

27 September 1982

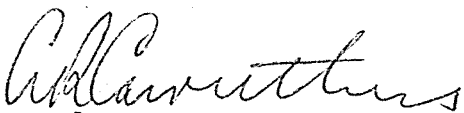
Dear Mr Lusk,

I enclose your forms dealing with the construction phase, production phase, and total expenditure, duly completed.

The extra figures supplied on the total expenditure questionnaire may give you a better overall indication of the general areas of expenditure. As regards the Construction questionnaire, the employee figures are for Natural Gas Corporation staff only. Total staff levels on site peaked at about 300 during 1982, but they varied continuously as different contractors moved on and off the site.

I trust this information together with that obtained by you at the plant site will assist in your study.

Yours sincerely,



G.R. Carruthers
COMPANY SECRETARY

Encls

APPENDIX E

AMMONIA/UREA PLANT SURVEY (EMPLOYEES)

CONFIDENTIAL: DO NOT PUT YOUR NAME ANYWHERE ON THIS SHEET

Adapted from FOREST INDUSTRY SURVEY (EMPLOYEES) ALDWELL, 1980

1. (a) What is your occupation? _____
 (b) Age? (in years) _____
 2. What town or area do you live in? _____
 3. (a) Sex: Male/Female? _____
 (b) Are you Married or Single? _____
 4. (a) If you are married and your wife or husband works,
 what is his or her weekly pay (after tax)? \$ _____
 (b) Number of children? _____
 5. What was your last week's pay (after tax)? \$ _____
 6. How much superannuation did you pay last week? \$ _____
 7. How long have you been working in this plant? _____
 8. What was your last job before this one? (If you worked
 part-time, if you were a student, or if you were unemployed
 please say so.) _____
-
9. Did you come to this job from another area? YES/NO
 If YES where from? _____
 10. Savings or investments: Have you saved or invested any
 money in the last 12 months? YES/NO. If YES how
 much? \$ _____
 11. Have you been away from your home town on holiday or
 business during the last 12 months? YES/No. If YES
 how much did it cost you altogether? \$ _____
 (approximate)
 12. How much have you donated or sent away to relatives
 over the last 12 months. \$ _____
 13. If you are a ratepayer, how much did you pay this
 year? \$ _____

14. During the last week how much did you spend on these things? (See below)

(Please also write down the name of the town where you spent the money).

ITEM	AMOUNT SPENT \$	TOWN
FOOD (Groceries, Hamburgers, etc)		
CLOTHING		
ENTERTAINMENT		
TOBACCO AND ALCOHOL		
CAR REPAIRS, PETROL, OIL		
HOUSING - Rent, (housing corp)		
- Private Rent/Board		
- Repairs/additions		
- Mortgage/Hire purchase		
- Furniture & Appliances		
POWER AND 'PHONE		
SERVICES (e.g. Doctor, Plumber, Accountant or Mechanic)		
INSURANCES		
OTHER		

MANY THANKS FOR YOUR TIME

APPENDIX F-1

Phasing of Major Projects/Export Content/Employment/to 1987

\$NZ Millions/1980	Years ending March						87	Total
	81	82	83	84	85	86		
I. Phasing of Expenditure								
a) Energy and petro-chemical projects	75	305	410	315	210	160	-	1475
b) Energy intensive basic metals	10	140	270	325	260	210	185	1400
c) Forestry based and others	-	60	155	200	160	60	30	665
Total	85	505	835	840	630	430	215	3540
of which:								
Private sector	50	410	750	735	520	340	185	2990
Public sector	35	95	85	105	110	90	30	550
II. Imported Content Total 50%	40	250	420	420	315	215	110	1770
III. Direct job creation *								
i) During construction	100	2500	5700	5000	4400	3300	1300	
ii) Permanent	-	-	80	785	785	985	4285	6920

Source: Major Project Advisory Groups, Ministry of Works and Development

* In addition to the "direct" effect already enumerated there are also multiplier effects, with spending from construction earnings creating additional jobs elsewhere in the economy.

APPENDIX F-2

A. Energy or Petrochemical Projects		
1. Marsden Point oil refinery expansion	definite	1980-1984
2. Chemical Methanol plant, (Petralgas)	definite	1981-1983
3. Synthetic Petrol plant, Motanui	definite	1982-1985
4. Ammonia/urea plant, Kapuni	definite	1980-1982
5. LPG distribution	definite	1981-1988
6. CNG conversion, 150,000 vehicles 5yrs	definite	1979-1984
7. Gas treatment facility (Petrocorp)	probable	1983-1985
8. LPG to fuels plant (Petrocorp)	possible	1983-1985
9. Eltham processing	possible	late 1985
B. Energy - Intensive Basic Metals		
1. Expansion of New Zealand Steel	definite	1981-1986
2. Third potline, Tiwai Point	definite	1980-1986
C. Forestry Based		
1. Marsden Point pulp and paper	possible	1984-1987
2. Northern Pulp and Paper	definite	
3. Tasman Pulp and Paper fourth newsprint machine	probable	1982-1985
D. Other		
1. Main trunk electrification NZ Railways	definite	1982-1987
2. Oamaru Cement Works	probable	1982-1984

Source: NZIER, Quarterly Predictions, Fourth Quarter, 1981

Table 4.14
Sectoral Multipliers
National Table

Sector ^a	Output Multipliers		Income Multipliers			Employment Multipliers (x10 ⁻³)		
	Simple	Total	Direct	Direct + Indirect	Direct + Indirect + Induced	Direct	Direct + Indirect	Direct + Indirect + Induced
			Income paid/\$ of output, 1971-72 prices			No's employed/\$ of output, 1971-72 prices		
1 Agriculture	1.662	2.212	0.105	.252	.397	.086	.141	.188
2 Fishing and Hunting	1.539	2.599	.335	.485	.766	.139	.185	.276
3 Forestry & Logging	1.415	2.098	.196	.313	.493	.052	.085	.143
4 Mining & Quarrying	1.679	2.729	.276	.481	.759	.086	.145	.234
5 Mnf. of Food, Beverages & Tobacco	2.181	2.966	.139	.359	.566	.042	.140	.207
6 Textiles, Apparel & Leather Prod.	1.675	2.633	.260	.438	.691	.115	.181	.262
7 Wood & Wood Products	1.864	2.921	.255	.484	.763	.078	.144	.234
8 Paper, Printing & Publishing	1.710	2.754	.276	.478	.754	.080	.138	.227
9 Chemicals & Chemical Products	1.472	2.094	.158	.285	.449	.055	.093	.146
10 Non-Metallic Mineral Products	1.692	2.673	.248	.449	.708	.073	.130	.214
11 Basic Metal Industries	1.651	2.359	.167	.324	.511	.042	.086	.146
12 Fabricated Metal Products	1.528	2.389	.251	.395	.622	.082	.125	.198
13 Other Manufacturing	1.519	2.472	.292	.436	.688	.089	.132	.213
14 Electricity, Gas & Water	1.732	2.474	.178	.339	.535	.045	.088	.151
15 Construction	1.999	3.154	.254	.529	.834	.080	.161	.260
16 W. & R. Trade	1.482	2.506	.334	.469	.739	.099	.140	.227
17 Transport & Storage	1.582	2.846	.407	.579	.913	.098	.149	.257
18 Communication	1.151	2.731	.675	.723	1.141	.173	.187	.321
19 Business Services	1.350	2.213	.283	.395	.624	.077	.109	.183
20 Owner-Occup. Real Estate	1.567	1.906		.155	.245		.046	.075
21 Public Administration	1.392	3.085	.650	.775	1.222	.127	.163	.307
22 Education Services	1.244	3.189	.819	.890	1.405	.168	.189	.355
23 Health Services	1.322	2.711	.539	.636	1.003	.160	.190	.308
24 Other Community Services	1.495	3.061	.545	.717	1.131	.180	.229	.362
25 Personal & Domestic Services	1.598	2.724	.328	.515	.813	.156	.213	.309

^a Refer Appendix 1 for Sector Definitions.

Table 4.6
Sectoral Multipliers
Taranaki Statistical Area

Sector ^a	Output Multipliers		Income Multipliers			Employment Multipliers (x10 ⁻³)		
	Simple	Total	Direct	Direct + Indirect	Direct + Indirect + Induced	Direct	Direct + Indirect	Direct + Indirect + Induced
			Income paid/\$ of output, 1971-72 prices			No's employed/\$ of output, 1971-72 prices		
1 Agriculture	1.449	1.633	.093	.181	.230	.096	.136	.152
2 Fishing & Hunting	1.237	1.651	.332	.406	.517	.140	.163	.200
3 Forestry & Logging	1.219	1.488	.196	.265	.337	.052	.072	.096
4 Mining & Quarrying	1.493	1.956	.301	.455	.578	.092	.137	.179
5 Mnf. of Food, Beverages & Tobacco	2.038	2.301	.107	.259	.329	.030	.127	.150
6 Textiles, Apparel & Leather Prod.	1.212	1.581	.296	.362	.460	.148	.172	.205
7 Wood and Wood Products	1.380	1.797	.298	.410	.521	.093	.126	.163
8 Paper, Printing & Publishing	1.141	1.587	.390	.439	.558	.124	.138	.178
9 Chemicals and Chemical Products	1.254	1.438	.106	.181	.229	.056	.079	.095
10 Non-Metallic Mineral Products	1.346	1.704	.240	.352	.448	.120	.153	.185
11 Basic Metal Industries	1.465	1.822	.227	.351	.446	.043	.073	.105
12 Fabricated Metal Products	1.337	1.730	.285	.386	.491	.091	.120	.155
13 Other Manufacturing	1.223	1.610	.314	.380	.483	.141	.160	.194
14 Electricity, Gas & Water	1.618	1.928	.176	.305	.388	.046	.080	.108
15 Construction	1.553	1.976	.254	.416	.529	.080	.130	.167
16 W. & R. Trade	1.252	1.674	.339	.415	.527	.101	.125	.162
17 Transport & Storage	1.355	1.900	.426	.536	.681	.103	.137	.185
18 Communication	1.079	1.792	.675	.702	.892	.173	.181	.244
19 Business Services	1.190	1.568	.304	.372	.472	.086	.106	.139
20 Owner-Occup. Real Estate	1.310	1.403		.091	.116		.027	.036
21 Public Administration	1.212	1.947	.650	.723	.919	.127	.148	.214
22 Education Services	1.140	2.018	.819	.863	1.096	.168	.181	.259
23 Health Services	1.186	1.796	.539	.600	.762	.160	.179	.233
24 Other Community Services	1.258	1.934	.571	.664	.844	.183	.210	.270
25 Personal & Domestic Services	1.330	1.767	.320	.430	.546	.163	.198	.237

^a Refer Appendix 1 for Sector Definitions.

A3.6 Taranaki Statistical Area

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1:	14016	3	1	0	75742	4	18	0	1	0	0	0	0	0
2:	0	1	0	0	82	0	0	0	0	0	0	0	0	0
3:	0	0	58	0	0	0	232	0	0	0	0	0	0	0
4:	83	0	2	170	406	1	0	0	89	108	47	1	2	150
5:	1114	4	0	0	1333	10	0	0	30	0	0	0	0	0
6:	87	0	0	0	79	409	0	0	0	0	5	10	0	0
7:	196	2	2	5	46	1	524	0	5	0	0	50	1	0
8:	160	0	0	0	142	16	7	13	19	2	2	52	1	9
9:	4856	2	5	6	329	17	30	3	365	2	9	61	2	2
10:	164	0	1	2	0	0	0	0	0	10	0	0	0	2
11:	394	0	1	3	40	0	12	3	18	3	1374	741	6	3
12:	946	21	18	32	495	16	55	16	99	17	144	1485	2	21
13:	6	0	0	0	7	7	2	0	1	0	0	2	1	0
14:	885	0	3	44	666	25	43	16	86	9	176	140	2	3218
15:	272	0	15	250	351	13	21	9	40	15	12	69	0	50
16:	2804	19	55	86	2652	296	317	100	716	75	343	1185	12	85
17:	1410	18	92	211	3397	61	133	59	335	81	177	311	5	66
18:	346	3	4	9	125	13	14	23	18	3	16	63	0	19
19:	1972	15	18	36	791	75	60	77	94	20	67	286	5	191
20:	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21:	28	0	1	0	15	1	0	2	0	0	0	6	0	22
22:	0	0	0	0	0	0	0	0	0	0	0	3	0	2
23:	283	0	0	0	14	0	0	0	0	0	0	0	0	3
24:	120	0	0	5	86	3	3	7	0	0	0	8	0	2
25:	708	4	15	17	69	8	14	5	7	8	7	59	0	13
26:	8903	168	351	764	12923	1712	1536	1178	1060	336	1647	5114	73	1725
27:	46287	135	887	583	12813	761	733	685	1911	340	1141	2840	49	3625
28:	9396	113	254	318	8377	2332	1403	823	5074	373	2088	5435	73	588
29:	95436	508	1793	2541	120980	5781	5157	3019	9968	1402	7255	17921	234	9796

A3.6 Taranaki Statistical Area (Continued)

	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
1:	29	137	8	0	0	11	9	15	32	5	17	2394	4974	-1979	95436
2:	0	23	0	0	0	0	1	0	2	0	0	41	73	285	508
3:	47	0	0	0	0	0	1	0	0	0	0	0	719	726	1793
4:	455	6	0	0	5	78	11	13	34	5	5	123	58	689	2541
5:	3	1126	18	0	0	0	6	19	70	2	0	10726	5509	101010	120980
6:	2	83	10	2	0	0	5	0	23	4	9	4647	162	244	5781
7:	1732	65	8	0	9	201	10	31	9	4	17	622	426	1191	5157
8:	49	729	32	10	174	0	35	42	11	26	73	783	42	590	3019
9:	189	105	97	2	15	36	21	10	92	16	70	990	355	2281	9968
10:	915	12	0	0	4	21	2	7	1	0	3	8	88	162	1402
11:	206	19	6	0	3	60	6	5	3	0	6	48	785	3510	7255
12:	1659	455	341	31	39	173	69	20	42	12	181	3109	5536	2087	17921
13:	5	5	0	0	2	2	1	2	1	1	8	123	16	42	234
14:	146	601	64	21	105	10	60	142	98	73	101	2545	74	443	9796
15:	5415	338	2015	10	84	770	109	137	27	23	114	180	25615	1758	37712
16:	2350	2500	777	43	357	470	171	76	326	112	592	34369	3836	7695	62419
17:	584	692	913	128	129	67	100	124	115	46	178	2695	2830	4807	19764
18:	78	579	93	0	292	0	88	56	66	42	120	1883	111	545	4609
19:	611	3276	284	15	1373	871	284	43	131	64	274	4876	278	2011	18098
20:	0	0	0	0	0	0	0	0	0	0	0	12086	0	0	12086
21:	175	60	18	1	17	2	32	1	3	47	52	78	6180	195	6936
22:	0	7	3	0	4	2	5	2	0	1	4	1223	6753	28	8037
23:	0	5	0	0	2	0	6	0	100	3	15	3590	5697	-99	9619
24:	37	203	8	3	75	0	63	34	127	52	12	778	901	259	2786
25:	131	732	304	5	114	3	41	28	31	14	348	4970	559	424	8638
26:	9589	21133	8426	3110	5507	0	4507	6584	5185	1590	2763	0	0	0	105886
27:	3916	20837	3308	969	8005	7559	93	115	1901	64	1746	8473	918	0	130694
28:	9389	8691	3031	259	1783	1750	1201	531	1189	580	1928	56911	8406	0	132296
29:	37712	62419	19764	4609	18098	12086	6936	8037	9619	2786	8638	158271	80901	129704	841371

APPENDIX G-4

Industry Aggregation 25 Sector GRIT Table Purch. Demand

1.	Agriculture	1	4856
2.	Fishing and Hunting	-	2
3.	Forestry and Logging	-	5
4.	Mining and Quarrying	89	6
5.	Manufacturing of Food, Beverages & Tobacco	30	329
6.	Textiles, Wearing Apparel & Leather Prod.	-	17
7.	Wood and Wood Products	5	30
8.	Paper, Printing and Publishing	19	3
9.	Chemicals and chemical products	365	365
10.	Non-metallic Mineral Products	-	2
11.	Basic Metal Industries	18	9
12.	Fabricated Metal Products	99	61
13.	Other Manufacturing Industries	1	2
14.	Electricity, Gas and Water	86	2
15.	Construction	40	189
16.	Wholesale and Retail, Restaurants & Hotels	716	105
17.	Transport and Storage	335	97
18.	Communication	18	2
19.	Financing, Insurance, Real Est. & Business Services	94	15
20.	Owner occupied Real Estate	-	36
21.	Public Administration	-	21
22.	Education Services	-	10
23.	Health Services	-	92
24.	Sanitary Services, Welfare, Community Services	-	16
25.	Recreation, Culture and Repair Services	7	70
<u>Primary Input</u>			
26.	Compensation of Employees	1060	
27.	Other Primary Input	1911	
28.	Imports	5074	
<u>Final Demand</u>			
26.	Household consumption		990
27.	Other Final Demand		355
28.	Exports		2281
TOTAL		9968	9968

APPENDIX G-5

Industry Name and Sector 130 Sector National Table

<p>Sector 9. Chemicals and Chemical Petroleum, Coal, Rubber and Plastic Products</p>	<p>57. Chemical products nec. 58. Chemical fertilisers 59. Paint and Varnish 60. Pharmaceuticals, toilet goods and cosmetics 61. Soap 62. Ink 63. Petroleum and coal products 64. Bituminous paving and roofing materials 65. Motor vehicle tyres and tubes 66. Vulcanising and tyre retreading 67. Rubber goods other than motor vehicle tyres and tubes 68. Plastics</p>
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