NEW TOWNS IN NORTHERN AUSTRALIA
by
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(1958)

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Signature of Author........................... 
Department of City and Regional Planning, April 7, 1967.

Certified by............... Thesis Supervisor.

Accepted by............... Chairman, Departmental Committee
on Graduate Students.
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His debt to his wife for patience and forebearing can never be repaid.
ABSTRACT.

New Towns in Northern Australia

George Wellings Smith.

Submitted to the Department of City and Regional Planning on April 7, 1967 in partial fulfilment of the requirements for the degree of Master of City Planning.

At the present time there are a number of new towns being developed in northern Australia as parts of mineral exploitation projects. This thesis explores some possibilities of these towns becoming major urban centres. From a survey of national goals and economic prospects, it is concluded that the development of mineral processing activities in the towns to increase the export value of their products could be in the national interests. High labour costs could render this economically infeasible.

In view of the general desire to 'develop' northern Australia and the very high level of polarization of economic activities evident in the spatial economy, it is suggested that the new towns could offer an alternate national urban strategy if they became major urban centres. It is believed that, if they could achieve 'self generative growth', the centres could overcome their isolation and labour costs would fall to metropolitan levels. If this were so, there is a case for public funds being made available to assist in their development.

The various strategies for achieving such depolarization are examined and the new towns appear to offer the best solution available to the problem, adding further to the arguments that they warrant public assistance. Criteria to guide the extent of such assistance are set forth.

To test the hypothesis, the urban growth potential of one group of mining activities - those based on the Pilbara iron ore deposits - is examined. Their ability to generate urban growth depends upon the feasibility of a steel works in the area. The feasibility of such a steelworks is marginal unless a part of a combined private and public sector endeavour to create a major urban centre. Existing methods of estimating the urban growth arising from such an industry are unsatisfactory making the estimation of the size of the endeavour needed from each sector practically impossible. The latter part of the thesis suggests the data and techniques which could be used to derive a more adequate 'urban growth model' for isolated new towns. No attempt is made to formulate such a model.

Thesis Supervisor: Dr. Lloyd Rodwin.
Title: Professor of Land Economics.
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1. Introduction.

One of the most marked trends in modern society is the ever-increasing level of urbanization: more and more people are living in urban areas and the larger urban areas are attracting an ever-increasing share of the total. This trend to centralization, or polarization, poses one of the most difficult dilemmas faced by planners engaged in national or regional development. There is a great deal of debate over the relative merits or demerits of this trend: on whether or not it is an evil to be overcome or, as a step towards the attainment of a better life for mankind, it is to be welcomed. The position adopted by the various protagonists reflect their own and their cultures values: any determination of the issue is subjective.

Several nations have chosen to regard the increasing polarization of their spatial economies as undesirable and have attempted to implement policies to curb the growth of their great metropolitan centres. Their experience, to date, serves to

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1. 'Polarization' and 'Polarity' will be the terms employed in this study to refer to the tendency for humans to group into fewer, larger communities, and the concurrent movement in the distribution of economic activities. The term is synonymous with 'metropolitanization'. It is distinguished from the term 'urbanization' which refers to the movement of people from rural to urban areas in that polarization infers the additional migration from urban centres to the larger units in the hierarchy of urban centres. The level of polarity is defined as the percentage of the national population living in designated metropolitan areas divided by the number of such areas.

2. Great Britain, France, U.S.S.R., Mainland China, Italy and Brazil are among the nations which have attempted, or are pursuing, such policies.
emphasise the intransigence of the problem. Australia is not among the nations which have elected to achieve more balanced spatial development although it is the world's most sparsely populated continent[^3] and its most highly urbanized and polarized[^4]. It has pursued and continues to pursue, policies of national development which pay little or no attention to the resulting spatial pattern of economic activities[^5]. These policies do, however, have spatial effects as the increasing polarization of the economy reveals[^6].

3. In 1961, the average density of population in Australia stood at 3.54 persons per square mile while the densities of other continents were estimated to be: - Europe (excluding U.S.S.R.), 225; Asia (excluding U.S.S.R.), 165; U.S.S.R., 25; Africa, 22; North and Central America, 29; and South America, 22 persons per square mile. Year Book of the Commonwealth of Australia, No. 54, 1964, p.279.

4. The 1966 Census reveals that 40% of Australia's total population lives in the Sydney and Melbourne Metropolitan Areas and the immediately adjacent urban areas. The 58% of the population classified as metropolitan lives in seven metropolitan areas. No other continent offers comparable polarity.

5. In the sense that there is little evidence of any spatially conscious program for development. The Commonwealth assigns funds to regional development projects on an ad hoc basis moderated to a large extent by current political pressures. Its system of planning has been described as an 'annual marginal variation technique'. See Grenfell Rudduck, 'Planning for National Development', Australian Planning Institute Journal, Vol 3, No. 3; January, 1965; p.81.

6. The following table indicates the levels of polarity over the past 95 years:

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<td>27.1</td>
<td>6</td>
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<td>1901</td>
<td>36.8</td>
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<td>1911</td>
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<td>1921</td>
<td>43.1</td>
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<td>1933</td>
<td>46.9</td>
<td>6</td>
<td>7.8</td>
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<tr>
<td>1947</td>
<td>50.8</td>
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<td>1954</td>
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<td>7*</td>
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<td>1961</td>
<td>56.1</td>
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<td>8.0</td>
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<td>1966</td>
<td>58.1</td>
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1. Percentage of population in metropolitan areas;
2. Number of metropolitan areas; and 3. Level of polarity.
Recent mineral discoveries in northern Australia\textsuperscript{7} have provided protagonists of policies for decentralization\textsuperscript{8} with fresh grounds to argue in favour of national policies which would divert a much larger share of the nation's economic activities to these remote and sparsely populated areas. These mineral discoveries are leading to the establishment of a series of new towns in previously isolated areas. Most of these towns cannot be expected to grow beyond the size of small cities but a few appear to have the potential to support considerable urban growth. Although the small cities and towns will undoubtedly contribute to the development of their local regions, any impact upon the national pattern of polarization can only stem from the few centres which appear capable of becoming significant nucleii for urban growth.

This thesis is primarily concerned with an attempt to evaluate the growth prospects of one group of these potential nucleii - those connected with the Pilbara iron ore mining industry. Whilst this objective is unique, it is believed that the thesis will have wider relevance. The discussion offered of alternate strategies for depolarization, the criteria posited for the guidance of public investment in the new towns and the

\textsuperscript{7} See Appendix I for data on these discoveries.

\textsuperscript{8} 'Decentralization' is seldom defined in Australian discussions. As a goal, it usually implies the attraction of population, or potential population, away from the metropolitan areas to provincial centres. Most of the current discourse on the need for a policy of 'more balanced regional development' refers specifically to northern Australia while 'decentralization' seems to be usually related to the need to solve metropolitan problems. In this paper the two are treated as synonymous. However, it is realized that a 'decentralization' policy may not 'develop' northern Australia and that a policy of 'more balanced regional development' may not solve metropolitan problems. The two terms are intended here to denote problems which would reduce the present level of polarity of population distribution. To simplify the issue the term 'depolarization' is used implying that, either by a reduction in the percentage of the population in metropolitan areas or by an increase in the number of such areas, the level of polarity is decreased.
proposals made towards the evaluation of growth prospects in new towns could have wider application.

It is not the purpose of the thesis to enter the wider discussion of the value of depolarization as a national goal. It is concerned with an evaluation of the means of attaining this goal, and is offered in the hope that it will serve to rationalize the current discussion in Australia about the possibilities of achieving decentralization and of the potential role of the new mining communities in contributing to the achievement of an alternate national urban strategy. It is hoped that the thesis may contribute towards the creation of a more rational basis for a reappraisal of existing policies for national and regional development.

2. The Objectives of the Study

1. To examine the possibilities of the iron ore discoveries in the Pilbara Region of Western Australia stimulating the formation of a major urban growth point in the region;

2. To examine the contribution which new towns based on the exploitation of mineral resources and their processing may make towards the achievement of national goals in the next decade in Australia;

3. To consider the feasibility of various strategies proposed to achieve depolarization in Australia and to show, thereby, that the new towns offer one of the few opportunities available to initiate policies which could influence the future pattern of distribution of population in Australia;
4. To formulate criteria to guide the evaluation of the extent to which public investment should be used to assist in the development of such new towns, with the view to making public policies consistent, bearing in mind that the growth prospects of a new town are dependent upon the extent to which public policies favour and encourage its growth, and that these public policies should take cognizance of the contribution which any new town may make towards the achievement of national goals; and

5. To offer an outline of a more comprehensive method of evaluating (a) the growth potential of a new town, (b) the response of a new town's growth potential to variations in public sector policies towards it, (c) the optimal set of public policies which would maximize the growth potential of a new town under conditions of public sector capital rationing, and (d) the probable annual magnitudes of public sector capital inputs required to achieve this maximization.

3. The Argument Advanced.

It will be argued in this thesis that progress towards the nation's goals would be advanced if the public sector fostered the growth of selected new towns which offer locational advantages for mineral processing industries. It will be argued that, if the Federal Government desires to initiate policies aimed at achieving depolarization, the new towns provide the best opportunity of implementing an effective, practical and low-cost solution. In the case of the Pilbara iron ore discoveries, it is contended that it would be in the national interest to create conditions conducive to the early establishment of an iron and steel industry. If a concerted effort towards this end were made by private enterprise and governments, it is suggested that
an iron and steel industry could be established in the Pilbara by the mid-1970's. Without the participation of public funds in town development, a privately financed steel industry is unlikely to be successfully established in the area and the elapse of time may reduce, rather than enhance, the prospects for its establishment.

4. The Significance of the Study.

1. With the growing realization that it might be in the national interest to actively pursue policies aimed at achieving depolarization of population and of economic activities, the difficulties inherent in attempting to implement such policies should be fully understood;

2. The advantages, offered by a depolarization policy geared to supplement urban growth stimulated by large private enterprise investments, relative to the more conventional approaches now advocated, should be recognized;

3. The need for an adequate assessment of the prospects of the new towns based on mineral exploitation is urgent since these towns are now, or shortly will be, experiencing substantial private investments. Given appropriate policies at this time, they might be launched upon their development as significant growth points;

4. The importance and effects of public policies adopted towards the new towns and their growth potentials must be understood if appropriate public policies are to be devised to encourage their growth; and
5. In view of the present inadequacies of planning techniques for dealing with the development strategies and growth prospects of new towns, any proposal contributing towards a clearer appreciation of the mechanics of their growth processes is significant—if only to focus attention on a neglected area of planning research.

5. The Context of the Study.

It has already been intimated that a number of new towns are being developed in remote areas of Australia and that some of these appear to possess the potential necessary for significant urban growth. In the case of the Pilbara iron ore deposits, this expectation is based upon the size of the deposits and their richness and accessibility; on the scale of the private investments being made in the area and the diversity of the projects being foreshadowed; and upon the fact that two of the consortia involved have signed agreements with the Western Australian State Government which require them to establish integrated iron and steel industries in Western Australia in return for the right to exploit the ore resources.

9. Known reserves of high grade ore (better than 60% Fe) in the Pilbara are in the order of 15,000 million tons. Lower grade ores are of much wider occurrence and, to date, no estimates of their extent have been made. The ore deposits lie from 50 to 250 miles from the coast where ports capable of handling 100,000 dwt bulk carriers are being developed.

10. Private enterprise projects which are underway or in an advanced state of planning call for investments in the order of $650 million in the Pilbara in the next few years. See Department of Industrial Development (Western Australia), Major Investment Projects - Public and Private: Current and Proposed, Issue No. 9, 1966.

11. See Appendix II.
At the same time, there is a growing realization amongst politicians, academics, and individual laymen that more active policies towards depolarization may be desirable. Decentralization has been advocated in Australia for many years. Regional planning and development became the official policy of both Federal and State Governments at the end of World War II. Since the election of the present ruling Liberal-Country Party coalition in 1949, it has ceased to be a meaningful policy at Federal level although the various State Governments have pursued it as far as available funds have permitted. Current Federal Government attitudes on the issue are typified by a statement of the Deputy Prime Minister, Mr McEwan, in which he expressed the opinions that a government would need the support of public opinion before it could give firm incentives to establish factories in country areas; that not enough was known of the costs and benefits that a policy of decentralization might incur; and that city voters are the major group in need of convincing that a better distribution of population was desirable.

Decentralization was the subject of a series of reports during the 1944-49 period when it was official Federal policy. Since then, however, little has been published specifically upon the subject. A number of seminars have been held in recent years and a national organization of interested associations formed. These seminars have not been widely reported and little has been

12. Commonwealth Department of Post-War Reconstruction, Regional Planning in Australia (Canberra: 1949), Ch.1.


heard from the national organization since its inception. The most recent endeavour to stimulate research into the needs for decentralization is that it has been suggested as one of the research projects which might be undertaken by the proposed Australian Institute of Urban Studies being sponsored by the Social Sciences Research Council and the Australian Planning Institute. Among the most recent work on the subject has been an attempt to estimate the social cost disabilities of metropolitan growth relative to the growth costs of provincial cities\(^{15}\) and studies designed to provide planning tools for the analysis of regional growth trends\(^{16}\) and to identify potential growth points\(^{17}\).

On national goals and national economic prospects, the main source is the Report of the Committee of Economic Enquiry\(^{18}\). It is perhaps noteworthy that this massive, detailed documentation of the Australian economy and its prospects pays little or no attention to the spatial aspects of the economy despite the fact that its Terms of Reference clearly called for such consideration.\(^{19}\) This is indicative of the dearth of data available upon these aspects of the economy and the difficulties inherent in analysing and formulating implementable policy recommendations in a Federal system.\(^{20}\)


17. Elizabeth Thomson, 'The Workforce Index - A Technique for Regional Planning'; *Australian Planning Institute Journal*; ibid.


19. Item (h) of the Terms of Reference reads as follows: - 'The pattern of growth and geographical distribution of industry, primary, secondary and tertiary (including the governmental sector)'. *ibid*, Vol 1, Preface.

20. The Chairman of the Committee of Economic Enquiry intimated these difficulties in personal correspondence with the author, November, 1966.
To date no studies in depth have been made of the growth prospects of the new towns in the Pilbara. The most detailed attempt is an unpublished report of the Western Australian Town Planning Department on the future of Port Hedland. Meanwhile, the press and other publications have made widely varying estimates of the future population of the new towns. 21

A similar situation prevails relative to the establishment of an iron and steel industry in the area. The report on Port Hedland tends to discount the possibility of the early establishment of such an industry but recent press reports suggest that negotiations are presently well advanced for the establishment of an oil refinery in the area 'to supply the fuel needs of the emerging industrial complex' and that this refinery is to be on stream by 1975. 22 This seems to indicate that an early start on the steel industry is anticipated. To achieve some sense of the possibilities of an iron and steel industry in the area, this study has turned to an examination of current trends in the world steel industry and attempted to isolate the factors which will probably govern the feasibility of such an industry. Data from a wide variety of sources was used to infer the prospects of an iron and steel industry being established in the foreseeable future. 23

The most thorough documentation of the problems associated with the development of new towns in developed countries appears to

21. Estimates vary from under one hundred to as many as twelve thousand in various news items, etc.


23. These are footnoted as encountered in the text, chiefly in Chapter 3.
be the various works on Canadian single-enterprise communities. 24 & 25 Little published data is available about the development of such towns in Australia, 26 and no other country appears to offer comparable conditions. 27 Urban growth estimation techniques and growth 'models' are now widely available 28 but none was found to relate to the growth of smaller urban areas and none appears adaptable to the objectives sought in this study.

In addition to the wide range of published sources used, a number of people and organizations 29 were approached for first hand data and the author's own experience was drawn upon. 30

6. The Structure of the Study.

The next chapter presents a case for the application of public funds to foster the growth of selected new towns in northern

24. See Appendix III for accounts of efforts to 'plan' single-enterprise communities.

25. Single Enterprise Communities in Canada, A report by the Institute of Local Government, Queens University, (Ottawa: Central Mortgage and Housing Corporation, 1953) and Ira M. Robinson, New Industrial Towns on Canada's Resource Frontier (Research Paper No. 73, Chicago: Department of Geography, University of Chicago, 1962).

26. Geoffrey Blainey, Mines in the Spinifex (Melbourne: Melbourne University Press, 1961) is an example of the best Australian data. It is a history of Mount Isa Mines Ltd and deals marginally with the town's growth.

27. Viz, the development of new towns in extremely isolated locations in a nation with a well developed industrial economy and a high standard of living.

28. These are referred as encountered in the text, chiefly in Chapter 4.

29. See Appendix IV for documentation.

30. See Appendix V for documentation.
Australia and develops criteria whereby the extent of involvement of public funds might be evaluated. The argument developed is that it would be in the national interest to foster the development of large new urban centres in the north based upon mineral processing industries. The cost of developing these could best be met from Federal funds. However, present Federal policy towards national development is non-spatial in character and, if anything, does not favour investment in urban facilities. To undertake to support the new towns, it would seem that Federal Government would have to make a major policy change. Among the policies it might elect to pursue, would be one favouring depolarization. From an examination of the various strategies for achieving depolarization, it appears that assistance to the new towns would be the best method of achieving such a goal. Thus, if the Government adopted a depolarization policy, it could logically give assistance to the new towns. However, before committing itself to such a program, the Commonwealth would need to be assured that any such policy would be as effective as its present policy is in achieving national goals and that its low level operational policies were achieving maximum benefits for the funds invested. These issues are discussed in the latter parts of Chapter 2.

Chapter 3 turns to the Pilbara situation. It sets out to establish if a steel industry could be developed in the area; what public assistance it might need; when it might be feasible; and what urban growth it might support. The determinants of the industry's feasibility are isolated and evaluations of the probable implications of a steel industry for public policies and for urban growth are made. Because of the many variables affecting costs in steel production, which clearly lie outside the scope of any enquiry such as this, definitive answers are not possible.

One of the major issues confronting policy makers in determining whether or not to assist in the development of a new town is expected to be its long-term growth prospects. A second major
issue is the strategy to be adopted to gain maximum benefits from the public funds invested in such a project. A third issue is the determination of annual capital inputs required under alternate strategies. Chapter 4 brings together some suggestions as a 'first pass' towards the development of a simulation model of the economy of a new town which might be used to assess these factors. It lists the inputs that might be used, the techniques whereby they could be manipulated, and the linkages that would tie them into a whole. Data sources are examined together with the shortcomings and advantages of such a system.

The final chapter summarizes the arguments presented, outlines conclusions and suggests the next theoretical and practical steps indicated by the study.
CHAPTER 2 THE NEW TOWNS AND NATIONAL DEVELOPMENT

Prologue.

The objectives of this chapter are to present a case for the application of public funds to foster the growth of selected new towns in northern Australia, and to offer a set of criteria whereby the eligibility for, and the extent of any involvement of, public funds in their development might be determined. Because of the nature of the topic, the treatment is qualitative.

The chapter opens with a statement of national economic goals in Australia and a discussion of the nation's economic prospects in the near future. Problems of maintaining external viability will probably confront Australia for the foreseeable future. Increased mineral exports could contribute substantially to the resolution of these problems. If these minerals could be processed domestically before export, their export value would be increased and, at the same time, the growth of the local economy would be stimulated.

If the new towns offer significant geographical advantages for mineral processing industries engaged in the export trade, it would be in the national interest to locate such plants there. Isolation may cause the new towns to be high-wage locations which could annul their geographical locational advantages. If they were developed into major urban centres, these costs, arising from isolation, could be overcome. To do this would require substantial capital investments, well outside the scope of private enterprise or of the State Governments concerned. The Commonwealth Government would be the most desirable source of this capital. Because there may be several growth points where the investment of public funds could help increase export earnings, very large sums could be involved in any
program designed to foster their growth. Such a program should not be entered into on an ad hoc basis. Some system of justifying the expenditure of public funds would be necessary, especially, as there may be charges that the funds were being used to benefit selected groups of private investors. The investments could be better justified if it could be shown that they were an integral part of a wider policy of national development. The present Commonwealth policy of national development does not favour urban expenditures of the type needed in the new towns. To justify a change in policy to assist their development the Commonwealth may seek an alternate policy of national development. One such policy could aim to achieve depolarization.

After a discussion of some of the issues which are presently influencing the development of Australia's spatial economy, an evaluation is made of the possible strategies which the Commonwealth might adopt to achieve depolarization. The conclusion reached is that the use of public funds to assist the transformation of new towns initiated by private investments into major urban growth points would be the most effective, practical and least-cost (for the public sector) solution that could be adopted for implementing a national development policy involving depolarization as a goal. Thus the Commonwealth could justify its actions in providing funds to the growth points.

However, there remains the issue of determining which of the policies - the one based on sectoral development of the economy, the other based on regional development - would contribute most to the achievement of national economic goals. No data or techniques are available to make such an assessment. However, some of the issues involved are discussed and from them, criteria are derived to guide the determination of the eligibility of new towns for public assistance and the extent
of that assistance. These criteria would be valid irrespective of the nature of the overall policy on national development.

The chapter is organized into six sections as follows:

1. National Goals and the Contribution of the New Towns;
2. The Case for a Change in Federal Policies Towards National Development;
3. Sources and Effects of Polarity;
4. Strategies for Depolarization;
5. Evaluation of Costs and Benefits;
6. Criteria for Public Involvement.

The Epilogue rounds out the discussion and sets the stage for the following chapter.


The new towns with which this study is concerned are manifestations of economic activities. They are spawned by economic activities; if they grow, it will be because they become the locations for other economic activities; and, if they disappear, it will be because they have ceased to be centres for such activities. Consequently, the major contributions which they offer towards the achievement of national goals can be anticipated to be directed towards economic goals.

In Australia, as in most modern nations, there are clearly stated but very broad economic goals for the maintenance and improvement of the welfare of its citizens. Sir Robert Menzies, as Prime Minister in 1963, established a Committee of Economic Enquiry to consider the nation's economic prospects through 1975. In the Terms of Reference of that Committee, he set forth that:-
".... the objectives of the Government's economic policy are a high rate of economic and population growth with full employment, increasing productivity, rising standards of living, external viability, and stability of costs and prices...."1

There is no apparent dissention from these goals amongst Australian political leaders.2 Differences arise over the policies which should be pursued to achieve them; the rate at which they should be pursued; and the relative importance to be assigned to each goal. In point of fact, all of the factors mentioned are interrelated and the national goal becomes one of maximising national income and the standard of living while expanding population at a high rate.3

What contribution might new towns make towards the achievement of these goals? To answer this question, it is necessary to consider the nation's economic prospects. The Report of the Committee of Economic Enquiry presents one view of these prospects. While their views have been criticized,4 their work serves to underscore the problems which will beset Australia in its pursuit of these economic goals. The Committee considered that a reasonable rate of economic growth to 1975 would be 5% per annum.5 They based this upon the


2. See policy speeches by political leaders in November, 1966 Federal Election, news items, The Australian (Canberra), November, 9, 10 and 11, 1966.

3. For a discussion of this inter-relationship see Report of the Committee of Economic Enquiry, op cit, Ch.2.


expected rate of increase of the workforce and the rate of increase in productivity evident in recent years. It is therefore not a high rate of growth but rather a rate selected as that required to maintain past increases in the standard of living. The Committee's general conclusion was that the economy would have difficulty in achieving this rate of growth whilst maintaining the other goals set by the Prime Minister.\(^6\)

They based their opinion, in part, on the belief that the economy would continue to demand a high level of imports, most of them essential for its expansion, while export earnings from goods and services might prove to be inadequate to maintain external balances.\(^7\) The Committee also believed that it would not be in the national interest to seek higher levels of capital inflow than then existed because of the increasing share of the nation's assets which were being transferred to foreign ownership; and the strain that income payments on these investments, would add to the maintenance of external viability.\(^8\)

If the Committee's projections prove true, Australia will be faced with the problem of increasing its export earnings or accepting a lower rate of economic growth. The latter is not an acceptable alternative for it implies that unemployment levels will increase or the rate of increase in the standard of living will decline. A further possible source of adjustment (which would occur automatically to some extent) would be to decrease the rate of immigration, the desirable rate of which was assumed by the Committee to be 100,000 per annum.\(^9\) This is not a palatable solution for Australia either. One of the major national goals is a rapid increase in population, desired not

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6. ibid, p.429 and Chapter 17.  
7. ibid.  
8. ibid, Chapter 11 and p.414.  
9. ibid, pp.89-91.
only for strategic reasons,\textsuperscript{10} but because it strongly stimulates economic growth. Expanding domestic markets are important in rendering import replacement activities feasible and efficient. They also permit all industries to gain greater economies of scale\textsuperscript{11} and enhance prospects of becoming successful export industries.

The most desirable solution to the problem of external viability would be to increase net export earnings. The Committee's 'not unreasonable expectations' were that export earnings could rise at a rate (compound) of increase between 3.3\% and 4.2\% per annum. The lower figure they believed to be well within the nation's capacity and prospects but the higher figure, while not impracticable, was much more dependent upon market availability, prices and quality of supply. Moreover, they suggested that even this higher level of export earnings increase may not be sufficient, despite extensive import replacement, to maintain the balance of payments under the pressures generated by a 5\% annual growth of the economy without excessive reliance upon capital imports.\textsuperscript{12}

Table 1 in Appendix VI sets out the export levels projected by the Committee for 1974-75. The nation's reliance upon the export of products of rural industries is expected to remain although a decline from present levels is anticipated. The present trends towards lower world prices for these products is expected to continue to offset production increases.\textsuperscript{13}

\textsuperscript{10} The massive post-war migration program was launched on the slogan "populate or perish".

\textsuperscript{11} Australian productivity increases have traditionally depended heavily on gaining economies of scale. Colin Clark, \textit{Australian Hopes and Fears} (London: Hollis and Carter, 1958), pp.246 ff.

\textsuperscript{12} \textit{Report of the Committee of Economic Enquiry, op cit}, p.346.

\textsuperscript{13} \textit{ibid}, pp. 340-346.
However, while the Committee was preparing its report and since its tabling, parts of Australia have experienced severe droughts and these may have affected the nation's ability to produce the quantity of rural products anticipated in the Report. Adding to the problem, are the prospects of over-production, in the face of declining world markets, in certain products.

The Committee foresaw a doubling in value of mineral export earnings. The chief sources of increase are expected to be iron ore; bauxite, alumina and aluminium; and coal. Manufactures were expected to provide a major source of export earnings. The Committee points out that:

"By attention to quality and design, Australia is finding that it can compete in consumer goods, even in the textile field. The general principle is clear, namely, the more Australia uses the two advantages which it possesses - high-quality raw materials and the growing pool of skilled labour - the more likely is it to follow the United States in offsetting high wage costs".

Of particular interest to this study, is the Committee's identification of the iron and steel industry as one in which Australia exhibits competitive advantages.

14. Recent droughts are reported to have resulted in the deaths of 1,000,000 head of cattle and 13,000,000 sheep. "Urgent Call for Water Conservation" news item in Australian News Weekly Roundup, (New York: March 22, 1967).

15. Sugar is one such crop. Concern is being expressed about wheat over-production also: E.J. Donath, "Record Harvest - but who is going to buy it?" News item, in The Australian, (Canberra: Jan 30, 1967).


17. ibid
Despite the optimism in some quarters, import replacements may become increasingly difficult in Australia for it has long pursued autarchic trade policies. It already extends protection to a number of industries where the domestic production levels are inefficient by world standards, due to the absence of economies of scale. While increased scale through production for an expanding market, both local and export, may aid the process and with the exceptions of changes wrought by possible new mineral discoveries, e.g. of phosphates, oil, or sulphur; import replacements will probably proceed slowly by marginal increments. The same constraints will apply to the expansion of exports of manufactured goods where one of the major difficulties confronting efforts to increase exports is the unenthusiastic response of manufacturers to suggestions that they build and produce specifically for export markets. Progress may be steady but it will be slow - at least in the next decade.

If there are to be any sudden major changes in the level of export earnings, it will come from the mineral production sector. Already, estimates of iron ore exports earnings from Western Australia alone for 1968/9 exceed those suggested by the Committee for the whole of Australia in 1974/5, by some 20%.

18. The Australian Industries Development Association submitted to the Committee of Economic Enquiry that 46.7% of all imports to Australia in 1961/2 could have been produced locally, ibid, p.339


20. For example, petrochemicals.


In these circumstances, where Australia needs the export earnings; where there are a number of projects under consideration and development; and where the emphasis on exploration is rising; it seems probable that a significant number of new mining ventures will be inaugurated over the next decade. For the most part, these new ventures will be in areas where new towns will be needed to house the mine workers. Thus the initial answer to the question posed, is that the creation of new towns based on mining ventures will, as an essential part of the mining projects, contribute towards the attainment of national economic objectives by contributing to the maintenance of external viability.

However, mining activities exporting raw materials do not provide many significant opportunities for value to be added through local processing. This is a characteristic of the bulk of Australia's exports. As Table 2 in Appendix VI shows the greater part of its exports are classified as unprocessed. This reflects the limitations upon the degree of processing of the products of rural industries, particularly foodstuffs, possible in all but very high income markets. This limitation does not apply to non-foodstuffs or to mining products. The major industries of the so-called industrial nations are, in fact concerned with the processing and manufacture of mineral products for final consumption.

It would be to Australia's advantage to increase the degree to which its mineral products were processed within Australia before export because not only would their value as sources of export income be increased, but the value added by local production would expand the domestic economy by its direct and indirect effects. It follows from this also that it would be in the national interest to have their plants established as soon as possible. Their beneficial effects upon the balance
of payments position would then be available to offset crises as they arise.

2. The case for a change in Federal Policies towards National Development.

Two conditions dominate any consideration of spatial aspects of Australia's economic development - the huge 'under-developed' north and the intensely developed metropolitan regions. The first provides a challenge, a mystery, a myth - a last frontier to be 'developed'. The metropolii - huge in urban scale, tiny at the national scale - are confronted with the increasing problems of modern urban society. Together they constitute 'push' and 'pull' influences towards a new strategy for national development based on depolarization as a national goal.

a. The 'pull' factor - the need to develop the north.
Three products - iron ore, bauxite and coal - are expected to provide the major sources of increased export earnings from mining activities. Iron ore and bauxite both permit considerable processing between raw material and the steel and aluminium they yield. Bauxite requires large quantities of low cost energy for its reduction and this is the major determinant of the location of the processing plants. While the iron and steel industry is capital-intensive, it also requires large labour inputs.23 Moreover, being a very low value to weight product, ore transportation costs may be expected to feature prominently in the costs of producing steel. Consequently, there is a locational advantage to be gained if ore can be reduced and converted to steel close to where it is mined.24 The major

23. e.g. A million ton capacity steel plant will employ in the order of 10,000 workers.

Australian deposits are large enough to permit very large scale production over a long period and so may warrant the establishment of integrated iron and steel plants close to them. This possibility is discussed in detail in Chapter 3.

Foreshadowing its conclusions, it appears that there are two marked disadvantages which such plants might encounter. The first is the absence of housing and urban facilities and of an existing urban housing market which might provide them. It appears unrealistic to expect that a viable steel industry could be established if it had to bear the burden of providing housing for its workers from its own financial resources. Consequently, there appears to be a case for public sector assistance to the industry through the provision of housing. This would not involve establishing a precedent because almost all industries in Australia enjoy the benefits of publically-financed worker housing. Nor is it unusual for the housing to be provided exclusively for the benefit of workers in one plant. However

25. The normal criteria adopted is that local deposits should be sufficient to support 40 years production, i.e. A one million ton t.p.y. plant could be based on a deposit of 66 million tons of (60% Fe) ore.

26. Public housing in Australia developed early in the present century. The Commonwealth Housing Commission Final Report (Canberra: 25th Aug., 1944) established the philosophy of the current housing program: "We consider it essential that, in Australia, the governments should accept responsibility for ensuring adequate housing for the people, especially the low income group". p.24.

27. e.g. The Queensland Housing Commission is providing housing at Weipa in connection with bauxite mining etc. (Investment Queensland, a brochure issued by the Qld. Dept. of Industrial Development, 1965). The West Australian Housing Commission built '653 homes at Medina and Calista between 1952-3 and 1955-6, in terms of the agreement contained in the Oil Refinery Industry (Anglo-Iranian Company Limited) Act, 1952....the construction of 100 houses to be built under the provision of the Laporte Industrial Factory Agreement Act, 1961.....' (Year Book of the Commonwealth of Australia, No. 50, 1964. pp.390-1)
it is usual for this housing to be provided in response to a demand evident in the local housing market, i.e. after, rather than with, industrial expansion.\textsuperscript{28}

The second disadvantage a steel industry in northern Australia would incur is that its labour costs would be high - not only relative to its competitors\textsuperscript{'} in the export market, but also relative to those in the more settled parts of Australia.\textsuperscript{29} These costs are a direct consequence of the area's isolation and represent (a) a margin paid to workers to offset the real and psychic disabilities suffered because of their isolation from modern urban society and its facilities and for the discomforts often associated with living in a tropical area, and (b) for the major part, a margin paid to offset the higher real living costs that prevail in these remote areas.

It may be that by using modern, automated equipment, some of the disadvantages created by the high labour costs could be overcome. However, simultaneously with these high costs, plants operating in small remote communities usually experience high rates of labour turnover, necessitating additional expenditure on job training and causing loss of efficiency through inexperience, etc. These arise because of the attraction of these plants for young single males who wish to make 'a stake' quickly by working for a short time in a high wage industry. Even where 'family' men are attracted to the industry and are prepared to remain, there is the continual problem which arises when their children approach

\textsuperscript{28} Exceptions exist, for example, those quoted in the preceding footnote.

\textsuperscript{29} G.M. Neutze, \textit{op cit}, p.77-81, produces some evidence of the rises in living costs with increase in distance from the metropolitan area.
adolescence. If the community is small, the children will have to leave their home town to get a higher education or to gain employment.

These problems can be overcome if the town can be made large enough to support adequate educational facilities and to provide employment for the indigenous youth. Obviously, not every type of plant could support such a community, but it is suggested in Chapter 3 that a steel industry could - partly, because of the large work-force it will employ, and, partly, because of the many opportunities it provides for linked industries to congregate around it. If the new town associated with a steel industry could be stimulated to achieve the status of self-generative growth, or that of a 'major urban growth point', soon after opening the steel plant, a number of significant results could be expected. If the town achieves self-generative growth, i.e. the rate of creation of new job-opportunities exceeds the rate of entry to the employment market of job-seekers.

30. There appears to be a tendency towards high birth rates in isolated communities. The author found that in Mount Isa in 1963 over 25% of the estimated population was under the age of 10 years. There was little prospect of these children finding local employment when they reached adolescence. The nearest centres where they could be reasonably assured of finding employment would be Brisbane (900 air miles away) and Adelaide (1000 air miles). The nearest large labour market would be Townsville (500 miles).

31. Many families cannot afford to send their children away to school and rather than deny them the opportunity for further education, they elect to move to metropolitan areas where the child can live at home while attending advanced classes. A similar situation can arise with youngsters seeking work - many families do not like their young children being hundreds of miles from home earning their own living while still in their early teens.

32. For this study a 'major urban growth point' is defined as any growth point which has achieved self-generative growth; an incipient metropolis. An urban growth point might be defined as any urban area which evidences rapid growth.
from the local resident population, new industries must be entering the local economy or existing industries must be expanding. Thus the local market must be expanding and as it expands, the possibilities for further local production must expand. If local production is increasing, transport costs will play a lesser role in the cost of living in the town and this should lead to a marginal decline in the cost of living. At the same time, the increase in population will enable economies of scale to be achieved in the transportation of those goods which are imported to the town. This should further reduce the cost of living. As the cost of living falls relative to those in the rest of the nation, given a sensitive wage policy, wage increases should be relatively lower than those in the rest of the economy. Thus the high wage margins should begin to decline and the steel industry will begin to enjoy a more competitive position in the export market, perhaps even to the extent of increasing its sales, production and workforce. At the same time, the town should attract a more stable population and the industry should gain through the availability of a stable trained work-force.


34. By permitting direct manufacturer-retailer supply without the necessity of repacking at a metropolitan warehouse before shipment to the new town; by providing larger volumes of goods, with commensurate increases in the size of units engaged in transport (i.e. large road trailers or containerized ship); and also through more frequent and reliable deliveries permitting a reduction in inventory levels and thus reducing the capital/sales ratio.

35. Australia's high level of union membership and the tendency to write wage awards on a state-wide or even a nation-wide basis could prove to be an obstacle in this decline.
However, for the town to achieve this status over a short period, it will need to overcome some substantial problems. In the first place, such an urban growth point must be large, just how large will depend upon its rate of growth, long-term growth prospects and the industry-mix upon which it is based.\textsuperscript{36} To build a large urban centre in a short time, whilst maintaining reasonable standards of environment and building, will involve very large capital expenditures. Second, there is the possibility that the steel industry, of itself, may not be sufficient to support self-generative growth. Other 'leading sector' industries may have to be induced to locate in the town to give it the momentum it will need to achieve self-generative growth. However, offsetting this to some extent is the probability that very rapid growth in the new town will create an aura of excitement about the project. This may help attract activities and capital to the area.\textsuperscript{37} Diversification of the industry-mix would enhance the attraction of the new town for risk capital so that more private sector funds for housing and service facilities could be expected, relieving the burden on the public sector. If the town does become a 'boom' town, it may well attract activities and capital at a rate well beyond that which would be ordinarily associated with a town of its size.\textsuperscript{38}

The significance of 'boom' conditions should not be lightly dismissed. If the growth point does not achieve self-generative growth, its economy may be described as a 'city' economy in that it will tend to approach an upper limit of growth without further stimulus from the 'leading sector'. It will remain

\textsuperscript{36} The state of knowledge on this point of urban growth and urban economics is very poor. W.R. Thompson, op cit, has made a 'first pass' at a more rational approach to the problem.

\textsuperscript{37} c.f. Eliot Lake, Ontario, see Appendix III.

\textsuperscript{38} In this context, if the town's future could be simulated in a 'model' and the results made widely available, they could influence the growth-prospects.
dependent upon outside sources of supply for most of its needs. It will tend to stagnate. Despite its size and the apparent advantages which should be exploited by local production because of the high transport costs incurred on almost all goods sold in the town, the high local labour costs will annul these and render import replacement in the urban economy infeasible. Unless the growth point can achieve a size sufficient to present local producers with opportunities to use highly mechanized production processes or to gain other economies of scale, local production will be limited and self-generative growth impossible.

While it would be in the interests of the steel industry to induce the growth point to self-generative growth, the costs involved in urban facilities clearly lie beyond their capabilities. Because of the town's dependence upon a single industry, other private investors, who might be prepared to invest in such projects in metropolitan regions, would tend to regard the project as a high risk venture and to minimize their commitments in the area.

The national economy would benefit because, if the growth point could be so stimulated, the competitive advantages of the steel industry in export markets would be increased and would provide a more reliable and probably a larger source of export revenue.

39. e.g. if a population of 100,000 persons were assumed to be sufficient to achieve self-generative growth, the total cost of urban facilities alone would be in the order of $750 million. See R.B. Lansdown, "Some Financial Aspects of an Australian New Town", Australian Planning Institute Journal, Vol 4, No. 4, (Oct. 1966) pp. 174-80.

40. Even in these prime housing market areas, private developers are experiencing difficulty in obtaining finance and their expectations of profit do not appear to be very high according to Edward E. Eilicher (New Communities and Urban Growth, Catherine Bauer Wurster Lecture, Harvard University, October 27, 1966) in reporting upon a Ford Foundation study of new towns in America.

41. Since lower costs should enable it to gain wider market penetration and larger sales. Note also that as the volume of sales increases, production increases, and economies due to greater plant utilization and, ultimately, economies of scale enable a further reduction in costs. The process is self-inducing to some extent.
From the viewpoint of the State Government involved, the development of such a growth point in a remote area should fit admirably into their policies of developing the north and decentralization. But the States are not independent financial entities: they depend upon the Commonwealth for their funds. Although they may allocate the funds they receive from the Commonwealth within their own state so as to achieve their own goals, the funds normally allocated to them would be insufficient to promote such a growth point.

The Commonwealth, if it were convinced of the desirability of a major export steel industry, could make sufficient funds available but it could not lightly allocate such large funds on a purely ad hoc basis. The allocation should be made as part of a wider policy. The present goal of maximizing economic growth would scarcely be sufficient for such a policy. The existing steel industry could probably advance a case whereby it could produce as much for export markets for a lower overall public investment. To attempt to justify such an allocation without some broader policy framework, would cause protests from the States (all those who did not have potential growth points could advance alternate projects as worthy recipients for such largesse), from other firms and industries and from metropolitan interests. There would undoubtedly be charges of malpractice and corruption because one private group would appear the major beneficiary of the investment of public funds.

42. Queensland and Western Australia, the two states involved, both emphasise the need to develop the northern parts of their States, rather than decentralization which is more actively advocated in the more closely settled areas of New South Wales and Victoria.

43. See Appendix VII for an outline of these financial arrangements.

44. e.g. Queensland for the year 1962/3 received total revenue of $474 million with a further $52 million loan expenditures. Western Australia in 1961/2 received a total of $150 million and loan expenditures of $38 million. Queensland Year Book, No. 25, 1964, pp.399 and 406: Official Year Book of Western Australia, 1964 No. 4 (new series) pp.204-5.
At the same time, Federal aid to a steel industry-based growth point in north Australia could make one of the most significant contributions to the development of the area - the emergence of a metropolis which would act as a new 'base point' for the isolation of the entire area. On a national scale, the new metropolis could become the second in Australia's 'second generation of metropolitan centres' which will be needed to overcome the present high levels of polarity. Whether it can be developed or not depends upon the willingness of the Federal Government to put into action its recent statement about the need for decentralization - i.e. to make depolarization part of the nation's economic goals.

b. The current political attitudes.

Most current discussions of the need for a national policy which takes regional development specifically into account, are related to the need to 'develop' northern Australia. There appears to be a political unanimity about the need to 'develop' this area. However, there are serious divergencies of opinion over what priority it should receive in the national development program and over what constitutes its 'development'. Some advocate development without regard to the costs or benefits involved,

45. This would create local markets for rural produce. It would decrease overall costs in the area by introducing a new major service, production and wholesaling centre. It would mean improved transport services to part of the area, at least.

46. Canberra is well upon the way to becoming the first such centre.

47. e.g. Lansdown, op cit, quotes Mr McEwan, Deputy Prime Minister and Minister for Trade and Industry as saying in March, 1966 ".....we must, as a nation, develop new policies.....that will bring a shift of population, of the pattern of location of industry away from the large cities towards other areas".

48. See the policy speeches in the recent Federal election. The Australian, November 9, 10 and 11, 1966.
believing that the nation has a 'moral obligation' to 'develop' this area and that the benefits accruing must be to the advantage of the nation. Another school is strongly opposed to this course arguing that due consideration must be given not only to the cost/benefit ratio of each project in the area, but also to the cost/benefit ratio of projects in the north vis-a-vis those in other parts of the nation. The present Federal Government appears to adhere to this latter line of thought although the Committee of Economic Enquiry expressed concern at the lack of evaluative procedures employed in determining which projects merit public investment.

The goals set by Sir Robert Menzies are entirely non-spatial in character, and it seems that the present Government's thinking emphasises sectoral development of the economy rather than its spatial development. On the other hand, the Federal Opposition supports policies aimed at achieving more balanced regional growth, adhering to its earlier stance which made regional planning concepts part of official Australian policy in the post World War II years.

49. The advocates of this policy tend to take emotional rather than rational approaches to the subject. They rarely commit themselves to writing, preferring to deliver their appeals from notes at seminars on northern development, etc. Ivan O'Riley in Frontiers North (Perth: n.a.) tends to present this highly optimistic outlook.


51. As exemplified by their withdrawal from the Ord River Irrigation Project in November, 1966.


In a recent article, Kenneth Davidson, has pointed out that 'the present system of State-Federal financial relations make it completely impossible for any form of welfare or cost-benefit analysis to be applied to the full range of public spending'. "Spending Clouds Premiers Talks", The Australian, Feb. 11, 1967.


54. Commonwealth Department of Post War Reconstruction, op cit.
The various State Governments also pursue policies aimed at achieving decentralization, but, to date, they have not been noticeably effective policies. To achieve success, such a policy appears to require investments in projects with long gestation periods or high capital-output ratios. The diversion of scarce resources to these projects may well hamper the short term rate of progress towards economic goals and because of their dependence upon the Federal Government for funds, the State Governments have been restricted in their endeavours to implement this policy. They have little option but to follow Federal policy which, at the present time, is not greatly concerned with the spatial pattern of growth.

There is evidence that the Federal Government would be prepared to support policies for depolarization if it could resolve three issues. The first is to find practical strategies for implementing such a policy. The second is to gain some prior knowledge of

55. e.g. Whipple, op cit, shows that the major urban regions were the only areas in the mainland States which specialized in the national growth sectors being examined using shift analysis techniques.

56. The incremental capital-output ratio for a national economy is usually 3 or 4 depending upon whether or not capital is measured gross or net. By sector, services have a low I.C.O.R, agriculture and manufacturing have intermediate values, but infrastructure and mineral exploitations have high I.C.O.R.'S.

57. The greater part of the State's programs to assist industry is comprised of subsidies on rail freights and power costs, i.e. of discounts from State owned enterprises. Where worker housing is provided as an incentive, this is achieved by a reallocation of resources within the State, not by any additional grant of housing funds from the Commonwealth. The programs have been limited in magnitude,e.g. Queensland's total advances to industry, from 1929, when provision for assistance to industry was introduced to 1963, was $9,824,000. Queensland Year Book, No. 25, (Commonwealth Bureau of Census and Statistics, Queensland) p.444.

58. The Deputy Prime Minister, Mr McEwan, in The Country Party's Policy Speech in Nov. 1966 Federal Elections said: "Decentralization requires practical policies which make country areas profitable locations for industry and attractive places for people to live". This coupled with his remarks referred in footnote 14, Chapter 1, have led to the definition of these issues.
the costs and benefits of such a policy (an issue of whether or not it would contribute to the more rapid achievement of national goals than present policies). The third, closely related to the second, is to gauge voter support for the policy. In essence, the Federal Government sees depolarization as an alternate strategy for the achievement of national economic goals and it is concerned with the price the adoption of such a strategy might involve in terms of real costs and benefits to the nation and in terms of its own electoral support. The Federal Government is apparently not placing any great significance upon the non-economic aspects of arguments for decentralization. This is probably a realistic appraisal of their present worth but in doing so it may be under-estimating some sources of public support for the pursuit of an alternate national urban strategy which must be closely allied to the overall policy for national development.59

c. The 'push' factor - the growing urban problems.

In its pursuit of maximum economic growth, the Federal Government has tended to minimize the growing problems confronting the major metropolitan areas. For example, it has insisted that the major part of the reimbursements to the States from petrol tax be used in rural areas.60 The major deterrent has probably been the high capital-output ratios which characterise investment in urban public works and the lack of any apparent contribution to the gross national income from such investments.


60. Under the Commonwealth Aid Road Act, 80% of all reimbursements to the States must be spent in non-urban areas. In 1963, the Commonwealth made grants to the following non-urban activities:- The Encouragement of Meat Production; Cattle Tick Control; Dairy Industry Extension Grant; Expansion of Agricultural Advisory Services; Cattle Roads Grant; Brigalow Lands; Cattle Dip Chemicals; Tobacco Industry Extension Grant. The only specifically urban grant was that to Universities. Two grants were ambiguous in their spatial benefits: to Railway Construction and Coal Loading Works.
Thus Australia's existing metropolitan areas are beset with problems. Large sections of metropolitan areas are unsewered, others remain without sealed roads or adequate drainage. Mass transit facilities have received little capital investment in recent decades and have failed to keep pace with suburban expansion. Given a national policy of encouraging home ownership (manifestation of the underlying equalitarian ethic in Australian society); the universal insistence by suburban local authorities upon rigid low housing density standards (usually, about four houses per acre); and their entirely incompatible goal of minimizing the costs of public service installations and maintenance; the results are dull housing estates, aptly characterised by Gazzard as 'slurbs'. These low density areas, unrealistic insistence upon rigid segregation of home and work in zoning schemes, a high standard of living and inadequate mass transit facilities lead to a high level of car ownership. However, little or no provision has been made for the increasing use of the motor vehicle by commuters or by

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61. e.g. in 1960, the City of Brisbane (population 600,000) was 37% sewered.

62. These areas are usually confined to low-cost public and private housing estates built in the early post-World War II period. Local authorities now insist on high standards of street and drainage works, but provision of sewerage is not yet a universally compulsory part of urban land development projects.


64. Donald Gazzard, Australian Outrage (Sydney: Ure Smith, 1966).

65. There are presently about 4.3 persons per car in Australia. This places it fourth in the world in car ownership levels after the U.S.A., Canada and New Zealand. Report of the Committee of Economic Enquiry, op cit, p.587.
commerce. Expressway systems are virtually non-existent. 66 A recent report suggests that it will cost $300,000,000 to provide an adequate expressway system for Brisbane for projected 1980 traffic flows. 67 Using this as a basis and taking into account the greater topographical variations of other areas and their higher land values, plus the need for inter-metropolitan express-highways, it seems that some $3,500,000,000 might be needed to meet 1980 traffic demands. In 1963/4, the total amount allocated for roads in the whole of Australia for new construction and maintenance was $370 million. 68 From this, some conception of the magnitude of the urban problem can be grasped.

However, as has been suggested in the United States, 69 the average Australian metropolitan dweller is largely apathetic to the problem. His standard of living is higher than ever before and he appears content to accept traffic congestion, long journeys to work, inadequate parks and playgrounds, overcrowded schools and the like as part of the 'price of progress'. He tends increasingly to consider only his own circumstances e.g. evidence of a double standard in the approach of adults to the provision of community facilities is reported in a recent paper. 70 The universal problems of increasing crime rates and anomie are evident. 71 A recent study has revealed the existence of a level

66. Sydney has less than five miles of modern expressways, Perth has about ten. Melbourne will shortly have several miles of freeway in its fringe areas. Brisbane and Adelaide have no freeways at present.


71. e.g. Sydney had a wave of major "hold-ups" in 1966.
of poverty few Australians had suspected.72

One of the 'escapes' that the metropolitan areas have traditionally offered has been rapid and easy access to recreational facilities - particularly to ocean beaches. However, these are becoming increasingly more difficult to reach with traffic congestion and terminal parking problems. The first reaction to this, the erection of holiday homes and weekenders at more distant beaches, threatens to be self-defeating as Australians respond to the attraction of ocean front living and the geography of amenity and large stretches of coastline succumb to low density urbanization - in many cases, bordering upon slum housing conditions.73 As the average Australian, the 'city voter', becomes increasingly aware that even his traditional 'escapes' from the metropolitan area are being destroyed by this seemingly endless process of urbanization, he may become more susceptible to policies advocating alternate strategies. Accelerating this realization will be the increasing level of education; the decreasing insularity and isolation of Australians as they absorb more immigrants into their culture and as they travel abroad more widely; and the impact of imported mass media material presenting overseas lands as virtual 'utopias' by comparison. It may well be that a concern with the 'quality' of life', or a rejection of present conditions, may prove an exploitable source of support for a policy favouring decentralization.

72. A recent survey by the Melbourne University Inst. of Applied Economics, reported at the Australian and New Zealand Association for the advancement of Science, Melbourne, (Jan. 17, 1966) showed that 60,000 or about 10% of all families had incomes below the poverty level (defined as a weekly income of $33 for a family of four).

73. Because of lack of services, including water and sewerage, poor quality housing, a lack of urban amenities (shops, roads, medical assistance), exacerbated by the increasing use of 'weekenders' for year round living as rented holiday homes, etc.
There can be little doubt that these apathetic voters could react strongly to any proposal to spend large amounts of public funds in the development of new towns in northern Australia, unless it could be shown that their development was part of a wider policy designed to improve the lot of all Australians. Their elected representatives can be expected to react strongly in any case.

d. The prerequisites for a change in policy.
Thus the Federal Government would be faced with the problems of changing an existing policy which, to date, has not favoured the provision of urban public works into one which would favour intensive action in new towns. Such a change could only be justified by a significant shift in its entire policies towards national development. Before committing itself to such a change, the Commonwealth would undoubtedly need to reassure itself that the supported projects were in the national interest and that it was achieving the maximum value from the investments made. It could not enter the program on an ad hoc basis, supporting one town here and disregarding another there, or supplying every new isolated community without regard to its ability to make adequate returns to the nation's economic growth. Criteria would be needed to determine performance standards that the new towns should meet to be eligible for assistance and to determine the extent of assistance. A deeper knowledge of urban growth mechanics would enable the Commonwealth to find the most efficient use of capital investment.

In the absence of wider studies of the social costs of polarization and in the virtual absence of techniques and data with which to undertake a comprehensive evaluation of the relative advantages of polarization or decentralization as policies contributing to the achievement of national goals, the decision to change policy must be largely an intuitive political one.
It should not be inferred that the only option open to the Commonwealth in its choice of an alternate policy for national development is one including depolarization as a goal. However, it seems to be the logical choice as a policy favouring greater polarization could only add to the already manifold problems of the present metropolitan areas. Needless to say, the Commonwealth is under no compulsion to act on the matter at all.

Finally, it must be noted that although this discussion has centred around a new town based upon a steel industry, there are other centres, some existing, which could well qualify as major urban growth points e.g. Gladstone (Qld.) with its growing industrial complex, Townsville (Qld.), and the possible Gove Peninsula alumina/aluminium smelter complex in the Northern Territory.

3. Sources and Effects of Polarity

Before examining the available strategies for the achievement of depolarization and an assessment of its practicability as a further goal in the nation's economic policies (and the role of new towns therein), some aspects of the present factors contributing to and maintaining the level of polarity in Australia deserve mention.

Map 2-1 shows the distribution of Australia's population in 1961. The bulk of it lies in the "fertile crescent of economic Australia";

74. Based on a alumina plant (and possibly an aluminium smelter), a fertiliser works, an ilmenite refinery, and a booming coal export industry, all under development.

75. Already the major entrepot for northern Queensland, Townsville has 56,000 residents and exhibited a growth of 16% over the past five years largely due to new industries associated with the establishment of a copper refinery.

76. The Commonwealth Government is seeking developers for the bauxite deposits at Gove and is asking that they undertake to establish an alumina refinery and township and an aluminium smelter as soon as it is economically feasible.

AUSTRALIA
POPULATION DENSITY
AND DISTRIBUTION

LEGEND

TOWNS WITH OVER 20,000 PERSONS
CAPITAL CITIES
MORE THAN 15 PERSONS PER SQ MILE.
4 - 15 PERSONS PER SQ MILE
0 - 15 4 PERSONS PER SQ MILE.
LESS THAN 0.125 PERSONS PER SQ MILE.

MAP 2-1
the area where the climate and rainfall are conducive to agricultural production and where Europeans experience the least difficulty in adaption. Partly because of the closer settlement it supported heightened the probability of their discovery, and partly because of the geology of Australia, the bulk of the nation's known mineral resources were, until recent years, located in or close to this crescent. The interior and the north have remained sparsely settled. In the two-thirds of the continent where population density is less than one person for each four square miles, there are only five towns with more than 5,000 residents. However, the major mineral discoveries of recent years have been in this virtually uninhabited area.

At the same time, the tiny Central Coastal Region of New South Wales contains a quarter of the national population. The Melbourne–Geelong Region in Victoria contains about one fifth. Projections of the growth of these regions suggest they may contain in the order

78. They are:- Broken Hill in Far Western N.S.W., (silver-lead mining) pop. 30,000 and declining. Kalgoorlie in Southern Western Australia, (gold mining and pastoral activities) pop. 20,000 and declining; Darwin in the Northern Territory, (administrative centre) pop. 20,000 and growing rapidly; Mount Isa in North West Queensland, (copper, lead and zinc mining) pop. 15,000 and growing rapidly; and Charleville in South West Queensland, (pastoral centre) pop. 5,500 and stable.

79. This region embraces the Sydney Statistical Division (pop. 2,539,627) and the Newcastle (pop. 327,503) and Woolongong (pop. 178,100) Statistical Districts as well as areas such as Gosford-Woy Woy (about 40,000 pop.). Field Count Statement No. 4, Census of Australia, 30 June, 1966.

80. Melbourne Statistical Division (pop. 2,228,511) and Geelong Statistical District (pop. 111,278). The Latrobe Valley Urban District (about 50-60,000 pop.) may be included in this area also.
of 5 to 6 million residents in the year 2000. At the same time, Brisbane and Adelaide will have populations in the order of 1.5 - 1.7 millions each while Perth will probably be slightly smaller. Canberra is expected to have about 500,000 inhabitants. No projections of the growth of the smaller cities are available. Thus some 15-17 million of the expected population of 24 million forecast for Australia in the year 2000 will live in the seven metropolitan areas; and the level of polarity will have increased.

However, this may understate the growth of these regions. Rural population has been declining in recent years. The Committee of Economic Enquiry foresees a further decline in the order of 12 1/2% by 1975. Another source suggests that there will be no increase in the rural work-force through the year 2000. Any decline of population living on farms will be accompanied by a decline in population in the small rural service centres which serve the rural community. This decline may result in the order of

83. Estimated by the National Capital Development Commission.
84. See Table 3, Appendix VI.
300,000 to 500,000 emigrants from rural areas in the next decade. Although there are no published studies of rural-urban migration available in Australia, it seems probable that the bulk of these emigrees will settle in the metropolitan areas. It is quite possible that a movement of this magnitude may have much wider ramifications on the higher-order provincial centres although they may be offset by rising farm incomes. The trend to greater urbanization and polarization may be intensified.

The sources of the present level of polarity and urbanization can be traced to the earliest days of settlement. The original penal settlements were urban in character. The first eighty years of settlement saw the expansion of pastoral activities over most of the continent. These activities were too sparse to foster the creation of towns. The discovery of gold in the 1850's saw the rise of urban centres and the creation of markets for local agricultural products. With the passing of the gold rush, many disillusioned miners turned to the land for a living. From this the spread of wheat farming began and more towns came into being as service and milling centres as the density of settlement increased. The introduction of refrigeration to shipping in the 1880's encouraged the expansion of other agricultural industries and created more new towns. Throughout the period, the original penal settlements, which had evolved into the centre of administration and the principal port in each colony, were clearly the largest centres of population. They were also the only centres which commanded any real trading hinterland. Thus, when manufacturing for anything more than the immediate local market was considered, they were the logical locations.

87. A 50,000 person decline in rural workforce may cause a decline of 175-200,000 in farm population. This in turn could lead to a similar decline in the population of villages and small towns, see Dept. of Local Government, op cit.

Emphasis must be placed upon the impact of the railway systems in Australia's pattern of urbanisation. With the exception of Queensland, all the mainland States have rail systems which fan out from their capital city. These systems were built by the colonial governments because they were the only groups which could command the financial resources for the task. The routes followed responded to the existing economic pressures although later branch lines were developed as stimulants to closer settlement. While these fan rail systems have undoubtedly contributed to polarity and act to maintain it, they were not the cause of it. The causes of polarity in 1860, as in 1960, were the economies of scale, external economies, and locational advantages accruing to a plant located at the centre of the market and at the major transhipment point. These influences remain and are likely to continue to influence the location of manufacturing and service activities in the future. The Australian market has always been small compared to the efficient scales of operation achievable in contemporary plants. It seems probable that technological progress will raise the threshold levels of economic scale more rapidly than Australia (or Australian cities) can hope to expand population. Consequently, there will be a tendency to increased polarity as more industries seek to achieve economies of scale by unifying their production operations and others seek to maximize plant efficiency to justify their continued tariff protection.

Another important influence which the railway systems introduced, and have maintained, was the graded system of rail freight rates i.e. the cost per ton mile falls with increase in the length of the


90. Report of the Committee of Economic Enquiry op cit p.20
trip. This freight structure was introduced to enable primary producers in remote areas to compete on equal terms with those more centrally located.91 It is a manifestation of the equalitarianism which underlies so much of Australia's past and present public policies. At the same time, the policy discouraged the growth of local production since manufactured goods from the central market could be supplied at a price which understated the locational disabilities of the manufacturer. There can be little doubt that these policies destroyed the opportunities for the establishment of petty workshops in some provincial centres in the earlier days of settlement.92 Had these petty workshops been permitted to survive, Australia's pattern of industrial development, its distribution of economic activities and the entire structure of the economy may well have been much less centralized than it is today.93

The diversity of railway gauges selected by the colonies in the last century also played a role in polarization. Had these not existed, Australia would probably have an even higher level of polarity than it presently exhibits. The Committee of Economic Enquiry has urged that greater attention be paid to the development of an adequate inter-metropolitan transportation system to enable manufacturerers to obtain better access to the total national market.94 By 1969, four of the five mainland capitals will be

91. Colin Clark, op cit.


93. See P.H. Karmel and M. Brunt, The Structure of the Australian Economy, (Sydney: Angus and Robertson, 1962) for a description of the present centralization of the economy.

served by the standard gauge railway system. This development will undoubtedly result in greater centralization of economic activities. Whilst this may be desirable for the maximization of short-term economic growth, it must also add to the problems being confronted in the two major metropolitan areas - Sydney and Melbourne.

Thus far the discussion has centred upon the major urban centres. What factors are preventing the emergence of new urban centres and the expansion of existing provincial centres, for they are not exhibiting any signs of rapid growth? The chief factor is the lack of markets - those that exist are too small or too scattered to provide adequate support for local manufacturing industries. The practice of equalizing prices, e.g. of petrol in all areas and of steel in the capital cities, inhibits the development of local production. In all, the problem in provincial Australia parallels that in under-developed nations - lack of adequate markets to permit economies of scale; scattered markets; little local capital; a more traditional society; an insufficient workforce and one that is less well-educated and trained, a lack of infrastructure and

95. See Table 4, Appendix VI.

96. A factor exacerbated by the fan-shaped rail systems feeding to the capital cities and by the practice of developing road systems along the same pattern.

97. There are only seven commercial banks - a factor which inhibits retention of capital in local areas and restricts the availability of capital for local projects which display marginal elements of risk.

98. In the sense of an urban/rural social dichotomy: rural life tends to be more influenced by folklore and to be less receptive to modern technology.

99. The small size of many provincial centres makes it difficult to locate plants processing local primary products in them because of the lack of an available labour supply, especially if the employment is seasonal.
public goods investment;¹⁰⁰ & ¹⁰¹ and a less well developed system of recreational, social, cultural and educational opportunities. Two significant differences exist in this analogy - the provincial area offers no pool of low cost labour (in fact, labour costs may be higher than in metropolitan areas for work of equal skills) and the provincial area cannot implement an autarchic trade policy to foster its industrialization. Both operate to reduce the possibilities of these rural and provincial areas being able to overcome their present relative stagnation in economic and population growth, and these problems are self-sustaining.

4. Strategies for Depolarization

If the Commonwealth wishes to adopt a policy of national development involving depolarization, which of the strategies available to achieve this goal should it adopt? Would all the advocated strategies be equally effective? Three broad strategies, which have specifically spatial characteristics, have been identified:

Rural settlement;
Industrial dispersal; and
Urban growth points.

In this section, the chief variants of these strategies are described and evaluated. No attempt is made to evaluate

¹⁰⁰. The concept of a 'public good', following Kindleberger, is that it is such that where a service exists, one person's receipt of it does not lessen the amount that any other person may get, e.g. fire protection, defense, use of highway, etc.

¹⁰¹. A sizeable industrial plant in the average provincial centre could necessitate a major addition to such 'public goods' as water supply headworks or the sewerage system, in contrast to the marginal impact its demands would have in a metropolitan area. The results are delay and uncertainty for the entrepreneurs which drive them to the metropolitan area.
other strategies which might be described as sectoral, rather than spatial in character, but which would have marked spatial effects.

The criteria adopted for the evaluation have been selected from the remarks by government leaders identifying apparent impediments to the adoption of a policy of decentralization. They are:

1. The impact that the strategy may have upon future pattern of economic activities and population distribution;

2. The impact the strategy may have upon voters; and

3. The impact the strategy may have upon the achievement of national goals.

The measures used to assess the performance of each strategy against these criteria are:

1. The apparent potential of the strategy to attract population to non-metropolitan areas, particularly, to tropical Australia;

2. The potential sources of opposition to the strategy and the reasons for them; and

3. The probable extent of the public funds required and their contribution towards the achievement of national economic goals.

102. See footnotes (47), this chapter and (14) chapter 1.
Strategies considered in this evaluation are:

A. Rural settlement under public and/or private sponsorship;

B. The present industrial dispersal policy with State Government assistance to provincial areas;

C. This State Government assistance wedded to the growth point concept;

D. Growth points stimulated by public sector investments;

E. Growth points stimulated by private investments;

F. The use of public sector funds to supplement the stimulation of a growth point by private investment or the mixed economy growth point.

The term 'leading sector' is used to refer to any investment from either sector which provides the initial stimulation of a growth point. 'Supplementary sector' refers to any major investment from either sector which further stimulates growth in the growth point.

A. Rural Settlement.
The past sequence of settlement in Australia has followed this strategy. Expansive pastoral settlement was followed by more intensive agricultural settlement. The process is still in progress and is being fostered by both private and public sectors, e.g. private enterprise has been largely responsible
for the Esperance Land Settlement Scheme in Western Australia, and for the expansion of wheat growing northwards over the pastoral areas of Central Queensland. Public sponsorship has been concerned with irrigation projects but the Brigalow Lands Scheme in Central Queensland is similar.

The limiting factors on the strategy are soil fertility, climatic conditions, availability of run-off, dam sites, markets and access. Most of the schemes sponsored under the strategy are in the temperate areas where crop technology, markets, access and infrastructure exist. Those schemes which have sought to use this strategy to develop northern agriculture have not been markedly successful. The privately-sponsored Humpty Doo rice experiment failed and now the publically-sponsored Ord River Scheme has suffered a severe setback. The Commonwealth's present policy of providing access roads to cattle producing areas in northern Australia is a variant of this strategy but its prime purpose is to increase productivity, not to promote

103. The U.S.-financed Esperance Land Development Company is developing an area of 1,450,000 acres under an agreement with the W.A. Government. Some 600 farms are involved. United States Investment in Western Australia (Perth: Department of Industrial Development, 1966).

104. The Queensland and Commonwealth Governments are undertaking a long-term program to clear some 10 million acres of 'brigalow' land. The first stage to cost $32 million will clear 4.2 million acres and provide 500 farms. Investment, Queensland, op cit.

105. The Humpty-Doo rice project failed when yields proved uneconomic. Davidson, op cit. A diversion dam to irrigate 20,000 acres on the Ord River was opened in 1963. In November, 1966 the Commonwealth withdrew its support for the scheme claiming that a fall in the world price of cotton (expected to be the major crop) had rendered the project economically unjustifiable. The main dam was proposed to irrigate 150,000 acres and total public investment in the dams would have been in the order of $50 million. Davidson, op cit, p.150.
The value of these schemes to the achievement of depolarization is limited because, by and large, they do not involve very significant numbers of people. The 500,000 acre Coleambally Irrigation Scheme is expected to support about 4-5,000 rural residents and possibly 2,000 town dwellers in an area which previously supported fewer than 500 persons. This 6,000 increase, while a major local change, is scarcely noticeable at the national level. Beyond 1980-1990, more intensive production may evolve in the area to support a larger population increase but even this may be insignificant beyond the regional level. The Ord River Irrigation Project would support less than 10,000 population. These low population densities reflect the high level of mechanization on Australian farms but in future schemes, they may be even lower because of further advances in farm efficiency.

On the second criterion of voter opposition, these schemes have never been a major issue in national politics. The Commonwealth's withdrawal of support from the Ord River Scheme did not become a serious issue in the last Federal election but seems to have lost the Government some sympathy - the pioneering ethos of the Ord appeals to Australians. Furthermore, many

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106. This scheme, financed by Commonwealth Special Grants, will provide several thousand miles of sealed roads from cattle raising areas to railheads and fattening areas to increase turn-off and reduce the effects of droughts.


108. Davidson, op cit, p.197

109. It was overshadowed by the Vietnam War. Few recent elections featured national development as a major issue.
of the schemes to date have been associated with land settlement schemes for returned soldiers and this has possibly influenced voter acceptance of them. City voters may be apathetic to the issue but there has been increasing publicity of the subsidies paid to farmers in Australia and urban voters might be expected to adopt a more questioning attitude towards rural development schemes henceforth.

This introduces the third criterion and opens up a vast field of debate into which it is not proposed to enter here. A current example is the debate as to whether or not dairying in Australia contributes to the nation's wealth through its export earnings; or detracts from it because of the subsidies paid to farmers, the artificially high domestic price of dairy products, and the quotas placed upon the local production of cheaper substitutes. In land development schemes, the Bureau of Agricultural Economics has prepared cost/benefit studies of the Brigalow Lands Clearance Scheme, but Davidson has made a strong attack upon the studies that preceded the initiation of the Ord River Project. His analysis of that project concludes that the public funds invested, or to be invested, would have made greater returns to the economy if they had been invested in similar schemes in more temperate areas. The

110. An advertising campaign has been in progress for the past year between a major margarine producer and dairy and Govt. interests on margarine production quotas.


112. Davidson, op cit, pp. 263 ff.

113. ibid, pp. 192-201.
Committee of Economic Enquiry expressed the opinion that greater use should be made of cost/benefit studies in assessing the desirability of projects involving public capital investments in northern areas. The Treasury has since urged the States to adopt these practices in submitting their proposals to the Commonwealth. At present cost/benefit studies are not widely used in Australia. However, more significant than cost/benefit studies are those of costs of production and availability of markets.

Thus rural settlement is a practical strategy which, to date, has not encountered voter opposition. It appears to be more suited to temperate regions than to the north despite that area's greater potential in water resources. On a project basis, the benefits tend to exceed costs although due consideration must be given to subsidies paid for crops produced. They may contribute to export earnings or provide import replacement, but their ability to do so varies from project to project. However, as a meaningful strategy towards a more balanced distribution of population it is unlikely to involve large populations and so major urban growth points are not among its probable


outcomes, despite the large sums of public funds involved. Consequently, the existing major centres will continue unrivalled and there will be little or no reduction in the level of polarity.

B. Industrial Dispersal.
The contention of this strategy is that by supporting industry in any provincial area - whether it is locally derived or migrating from a metropolis or a new plant, decentralization will be achieved. It is the policy which has been pursued in those states which have tried to encourage decentralization. Little or no noticeable effect upon the national distribution of industry or population has been achieved by it. The towns which have experienced the most industrial growth under this policy are mainly those where war-time munitions plants were occupied by private industries after World War II and even there little marked growth has occurred. The chief incentives offered were, initially cheap rental factory space in a period of post-war shortages and thereafter rail freight concessions, electric power subsidies and an allocation of

117. For example, the Brigalow Land Clearance Scheme will cost the public sector about $64,000 per farm or $16,000 per capita rural population. If, for each person on the farm, there is one in a rural service centre, the cost per capita of non-metropolitan growth induced is $8,000. If, as the author’s investigations for the Coleambally New Town show, the ratio is closer to two persons on the farms to one in the towns, the cost is about $10,000 per person. The Ord Scheme would cost about $5,000 per person resident in the area for dam works alone. Urban facilities, based on the Coleambally New Town, may cost a further $2,500 per person to the public sector. Sources:- Investment Queensland, op cit; Murrumbidgee Shire Planning Scheme and Development Plan for Coleambally New Town, op cit; Department of Local Government (N.S.W.) op cit; and J.S. Nalson and M.L. Parker, Irrigation on the Gascoyne River (Perth, School of Agricultural Economics, University of Western Australia, 1964).

public housing for workers. Recently there has been a trend in New South Wales towards providing cheap factory space once more and local authorities are offering free sites.

The problems which this strategy encounters are numerous and include:

1. **It ignores external economies.** By dispersing the small amount of industry which is willing to decentralize over a number of small, almost non-industrial, provincial centres, the strategy ignores the significance of external economies. For any one centre to gain sufficient industries to begin to offer attractive external economies to other industries may take years, if, in fact, such a state is ever reached. The absence of external economies reveals itself in such items as lack of skilled workforce and in the need for each plant to train its own workforce; the lack of locally available services for plant maintenance; the absence of skilled professional advisers, e.g. in financial aspects of business operation and in advertising, etc.\(^{119}\)

2. **The problem of isolation.** Living costs, for an equal standard of living, tend to be higher in provincial centres than in metropolitan areas, although lower rents tend to offset this to some extent. Social, cultural, recreational and educational opportunities are limited **vis-a-vis** those available in metropolitan areas, making it difficult to attract skilled workers and managerial staff. Wage rates, for jobs of equal skill, may

\(^{119}\) There appears to be some dispute as to whether or not these are external economies. See T Scitovsky, "Two Concepts of External Economies", Journal of Political Economy (April, 1954) M.I. Logan in his "The Geography of Manufacturing in an Australian City" (unpublished doctoral dissertation, University of Sydney, 1965) places emphasis upon their importance.
be higher if the provincial centre lies outside the metropolitan zone for wage awards. Employers face a limited choice of workers - a situation not conducive to maximum efficiency or productivity. The individual firm is confronted with difficulties such as high costs of communication with its metropolitan-based suppliers and markets.120

3. The marginal nature of the subsidies provided. The extent to which the Government can offer subsidies is very limited. First, there are limits on the funds available. Second, the subsidies to individual firms can only be marginal upon their total costs because overly-large subsidies could give decentralized firms competitive advantages over their metropolitan rivals. It is most unlikely that any Government would continue to support such subsidies in the face of the storm of protest it would create from the more numerous, and better organized, metropolitan firms. Theoretically, the subsidies paid are to offset the disadvantages of location outside the metropolitan area. However, they cover only part of these disabilities and, in the event of a business slump, the decentralized producer is likely to be the first to feel its effects because of his smaller overall profit margin.

In evaluating this strategy, it is obvious that it will not be effective unless pursued on a very large scale and backed with substantial funds. However, if it is backed by substantial funds, other parts of the public sector must be denied them or the total supply of funds must be increased. In either event, voters are apt to react against this strategy unless very convincing evidence is presented to them that the reduction in other public services or the increase in taxes is producing some real benefits for them as individuals. For metropolitan voters, the argument which might be presented

120. G.M. Neutze, op cit, pp. 82-108.
would be evidence in the rise in their standard of living. To relate any rise in the standard of living to the decentralization of small numbers of firms, would tax the ingenuity of any politician.

It is debatable if the short-term effects of any major policy of decentralization would be a rise in the standard of living. If public funds are diverted to help meet production costs in decentralized industries when these funds would not need to be diverted if the industries were in a metropolitan location, seems to indicate that additional funds are being spent to gain the same level of output. Unless the social costs incurred in a metropolitan location for the industries exceeds the subsidies granted, this is the case. But, in the Australian context, social costs are often non-existent in the short run because little or no effort is being made to keep public works and living conditions abreast of metropolitan development, e.g. the deficiencies in the transport system. Undoubtedly, this is merely a postponement of the day of reckoning but the voters are probably more inclined to enjoy immediate real benefits than to forego them in the hope of a better future.

Thus the strategy is caught between two opposing influences. To be successful, it must be large and well-funded. To be acceptable, it must be small and its funds limited. Clouding the situation is the doubt over whether or not it is in the national interest - an issue which largely resolves around the period over which the maximization of economic growth is to be measured. In addition, the strategy can be best used to help expand existing centres, not to create new ones. Therefore it is not suited to northern development.
Urban Growth Points.

This strategy is based on the recognition of the deficiencies of the industrial dispersal strategy. Instead of a haphazard program of support for industries anywhere, it implies that industries wishing to accept non-metropolitan locations will be directed towards selected towns, or new towns, and that State public works programs will be designed to provide facilities for these and other industries in the towns which are designated 'growth points'. By these means, scarce resources are husbanded and the growth points have a much better opportunity of acquiring the external economies which characterize an attractive industrial location. Once they are well developed, the growth point's industries will not need further such direct public assistance.

This strategy has not been an articulated feature of government policies in Australia to date. However, growth points do exist – one significant example is the Federal Capital, Canberra, produced by government action. Others have been produced by private investment e.g. Newcastle, Wollongong, Mount Isa and Gladstone. If the analogy between the underdevelopment of provincial areas and low income nations is extrapolated, the growth point strategy is analogous to the 'big push' theory of economic development – through a massive investment program, the urban economy is freed of its inertia and given the momentum necessary for expansion. Although efforts are being made to identify growth points in Australia, no one has presented a

121. It has been advocated since the post-war years. For example, see T.H. Halsey, Decentralization - Its Social and Economic Implications (Canberra: Commonwealth Division of Regional Planning, 1949), draft mineograph, pp. 72-78.

workable operational policy for their development.\textsuperscript{123}

C. Government Assistance to Growth Points

In this discussion, the first strategy examined is an outgrowth of industrial dispersal. The sources of funds are the same but are allocated to specified areas along with public works expenditures. Given that funds for subsidies and other assistance to firms will probably be limited by fear of voter reaction, the number of growth points selected will have to be small if rapid achievement of external economies is desired. But parochial interests are unlikely to accept that one town is a more viable growth point than another. The equalitarian ethic of Australian culture will not lightly accept that one town should receive preferential treatment - particularly in public works expenditures - while others are virtually left to wither on the vine. This is the first hurdle for the growth point strategy.

The firms, which a decentralization assistance program seeks to help are made up of those growing in situ in provincial areas, new firms and those seeking to move out of the metropolis. It is difficult to envisage funds being denied to a firm because it has developed in an area not designated a growth point. Consequently, dispersal of funds will occur despite the growth point strategy. Migrating firms or new firms seeking locations may not wish to move to a designated growth point for any one of a number of reasons - isolation from raw material sources, lack of specific locational requirements, or personal preference of the owner. Under the existing system of allocating Federal revenue to the States, it is clear that no State can afford to forego any opportunity to gain new industries.\textsuperscript{124} If the State adopts the attitude that new plants must be located

\textsuperscript{123} e.g. Elizabeth Thomson, \textit{op cit}; and Lansdown, \textit{op cit}.

\textsuperscript{124} \textit{Vide} Appendix VII.
in a designated growth point, the firm will probably move to another State which has a more lenient policy of industrial location. Thus the industries have the advantage of choosing locations and this is likely to lead to a further diversion of funds from the growth points.

Interstate rivalries could be removed if the Commonwealth accepted responsibility for selecting growth points, allocating public works expenditures and the negotiation of industrial assistance to decentralized industries. This is a most improbable development since it would virtually infer Federal direction over the spatial allocation of State expenditures, i.e. the abandonment of a Federal system in favour of unified central government. Even in these circumstances, there remains the problems associated with the extent of the assistance to be granted firms in the growth points for, initially at least, these locations would offer no external economies and firms there would suffer marked disadvantages. Yet in the interests of the success of the strategy, governments may seek to avoid the failure of any firm in a growth point. In these circumstances, inefficient operations may be supported and efficient operations penalized - a hazard always present when public action interferes with the private economy at the level of the individual firm.

If any industry requires a subsidy in a provincial centre but not in a metropolitan location, this implies, on the surface at least, that additional funds are being consumed to achieve the same level of economic growth. This conflicts with the national goal of maximizing economic growth. The tax increase arguments previously presented also hold. The short-term consequences of a policy of subsidising decentralization, whether by industrial dispersal or by growth point, are the same: to be effective, there must be a relative decline in the standard of living.
To have any real impact, i.e. in terms of population affected, the program would have to be large but such a program may encounter voter resistance and will, almost certainly impede short-term achievement of national economic goals. This is not to say that, in the long-term, such a policy may not prove to be in the national interest. However, in a political system, which responds to immediate pressures and which lacks any overall framework of long-term planning, it is difficult to foresee the emergence of policies which would rationalize the relative merits of these long-term benefits. Indeed it is debatable if techniques exist to enable the outcomes of such policies to be foreseen clearly enough to permit such a rationalization.

D. The Public Sector as the Leading Sector.

The growth point's 'big push' may come from the agglomeration of many incremental stimulants as suggested by the above strategy or it may be generated by a single enterprise - the leading sector. The public sector of the economy may provide this leading sector. If it does, its role changes from that under the previous strategy, from one of directing and inducing to one of leading and attracting private sector investments. The public sector has only a limited range of possible leading sectors to offer for such a strategy. To be effective, the single-enterprise big push should be capable of a once-only impact, sufficient to create a large market which would attract other activities, or of generating a sustained growth cycle so that incoming firms are assured of an expanding market over the long term.

The most obvious candidate for a big push, leading sector from the public sector is government administration itself. It has proven eminently successful in Canberra, primarily because of

125. Rudduck, op cit.
the size of the effort it involved. Australia may experience the formation of new states as they are constitutionally feasible. If they emerge, they will be limited in number. However, the capital cities of new states would be growth points where the public sector was the leading sector. It is debatable whether or not the proliferation of new public services would be conducive to greater national economic growth.

Regional administrative offices, while providing excellent supplementary sectors, are probably not sufficient to act as leading sectors in any growth point intended to achieve metropolitan status. Other governmental activities suitable as supplemental factors include power generation, education, research facilities and defense establishments. In combination, these could provide the leading sector. However, they are generally closely tied to existing metropolitan areas. There is little point in a remote power station to supply metropolitan markets if other energy sources are close by. Educational establishments have markets - students in metropolitan centres - and it will cost more to house and to educate them away from their homes, etc.

Neither of these possible leading sectors is likely to be common in Australia's future. Voter reaction is difficult to judge. Canberra has gained acceptance although there has been criticism of some of its more 'lavish' public works.\textsuperscript{126} The contribution which such growth points might make towards national goals is also difficult to assess. Lansdown estimates that the costs per capita of a new regional city at 70\% of those current in Sydney.\textsuperscript{127} Thus there is an apparent economic advantage in

\textsuperscript{126.} Particularly, of the artificial Lake Burley Griffin.
\textsuperscript{127.} Lansdown, \textit{op cit}, p.177.
building new cities or growth points but the division of responsibility for the costs between the public and private sectors is significant. If the public sector is to provide the raison d'être for the growth point, it can expect to bear the major share of the costs. Moreover, Lansdown's argument fails to take any account of the costs of linking the growth point to existing centres or the costs of operating these linkages which, presumably, would be borne by the public sector. Canberra has succeeded without these linkages but this is a reflection of its unique "Mohammed and the Mountain" position in the economy. Unfortunately, there are few such indespensible centres. Moreover, Canberra will need these linkages in the near future to cope with the increasing level of inter-urban traffic it generates, and these will be charged against the public sector.

The public sector can and has spawned growth points. However, the opportunities for its doing so are limited. Whether or not they foster progress towards national economic growth cannot be resolved. No one can say whether or not Australia's progress would have been better or worse had the Federal Capital remained in Melbourne. In the economic growth of Australia, the difference, if any, could only be marginal. The decision to create new growth points, provided sufficient stimulii can be accumulated in the public sector to make the effort worthwhile, is a political one and depends to a large extent upon the strengths of the politicians' beliefs in the advantages of decentralization and in the disadvantages of metropolitization. Moreover, any growth point fostered by this strategy will almost certainly lie in the settled temperate areas because, while it may be possible to induce firms to move a hundred miles or so from their main markets, it is most unlikely that they will move thousands of miles away.
E. Private Enterprise Leading Sectors.

In the private sector, while there are fewer limitations upon the possible sources of 'big push' leading sectors, there is a strong tendency for many of the potential stimuli to seek metropolitan, rather than provincial, locations. The one group of firms which cannot follow this trend are those which need the locational advantages of particular sites for their operations to be possible or competitive. Among these, those concerned with mining and mineral processing are outstanding. Not all mining and processing activities have the potential to generate major urban growth points; but the steel industry, at least, has traditionally been associated with such growth.

If a plant enjoys very favourable prospects, the private investors sponsoring the project may be prepared to build an entire town to house its workers. However, such an undertaking involves a very large additional investment. It may react upon the project's competitive advantage and the project may be rendered infeasible or its execution be delayed. In Australia's case, it may necessitate larger amounts of foreign investment - an outcome not particularly favoured by many Australians. Modern building codes and welfare state provisions have also affected the ability of companies to meet the full range of services expected by workers. Failure to provide these and the aura of company ownership of everything, engender industrial disputes and confront the individual entrepreneurs with social and community management problems which they are ill-equipped to handle. Consequently, companies generally limit their involvement in town building to the minimum necessary to serve their own best interests.  

128. Single-Enterprise Communities in Canada, op cit, deals with this problem and recommends company towns be avoided.

This may, of course, prove to be ample to generate further growth. One of the dangers of this is that unless adequate public finance is available to provide infrastructure and other facilities, as well as housing finance for such 'overgrowth' the new town may develop in virtual slum conditions - a situation to be avoided at all costs in a modern developed nation.\footnote{Mount Isa, in Queensland, exhibits the effects of this overgrowth and lack of adequate public assistance. Mount Isa Mines Ltd have provided a large number of homes for their workers, chiefly through financing Building Societies. In the rapidly growing town there has been a large amount of owner-built housing, often of very poor design and quite unsuited to the intense heat of the area. These sit starkly on the barren landscape, their only public service, in some cases, being electricity. Streets are unpaved and often unmade. Drainage is almost non-existent. Water supply, once inadequate, now depends upon the Mines private supply. Sewerage is being installed. Since 1960, a large number of Housing Commission homes have been erected and an endeavour is being made to improve the situation but, with a 10% annual growth rate and inadequate funds, it is a difficult task.}

If this occurs, public funds will have to be used to remedy these defects. In the interim, the town will have lost all pretentions of being a modern attractive community and few firms will seek to locate there unless they can see opportunities for very high profits. The momentum of the initial big push will be largely lost and the public funds used to repair damage rather than to promote growth.

Since this type of strategy would place the whole initial cost on the private sector, it would not incur voter resistance and would be the lowest-cost short-term solution for the public sector. However, it could incur voter opposition if it implied greater control of natural resources by foreign interests but this would be a delayed, indirect effect. In the long-term, the public sector will be faced with rising costs and since these are to alleviate hardships, the Australian equalitarian ethic will subvert any opposition. However, such a strategy tends to minimize the possibility of a leading sector emerging in the
private sector and also minimizes growth prospects once it has appeared. A 'city' economy is the probable result. Contrary to all the preceding strategies, isolation from existing centres tends to foster the growth points' initiations but not necessarily their continued growth.

F. The Mixed Economy Growth Point. (Note: the discussion in Section 2 of this Chapter relates to this strategy). The dominant characteristic of this strategy is that it assumes that an agreement can be reached between the public sector and private interests whereby each agrees to undertake, simultaneously, a specified program of investments in a selected area. This might involve the leading sector private interests providing employment while the public sector provided urban facilities. The costs of certain projects, e.g. water supply, power, or harbour facilities might be shared between the public sector and the leading-sector private interests. Other private capital e.g. for commercial establishments or housing, would be free to enter the growth point at will and the public sector could provide supplementary sectors e.g. defense installations and regional administrative offices.

The unusual features in such a strategy in the Australian context, would be the size of the investment required of the public sector and the fact that it would be made simultaneously with the private investments, instead of following them as is the usual practice. 131

131. Public funds are available in Australia to cover all the works necessary for the creation of a new town. Thus the program would establish no real precedents. In several cases, these funds have been placed at the disposal of, or under the co-ordination of, a single authority and new towns have been built e.g. Canberra, Elizabeth (S.A.), Kwinana (W.A.), and the proposed developments of Mt. Druitt (N.S.W.) and Churchill (Vic.). In all cases except Canberra, the State Housing Authorities have been the responsible authorities. Again with the exception of Canberra, none have involved works which include the raison d'être for the town. Churchill and Kwinana most closely resembled the mixed economy growth point strategy suggested here.
Under this strategy, the public sector is relieved of the costs of providing the raison d'etre for the growth point and the private sector is enabled to consider many more projects as economically feasible. Both of these seem to be desirable features from the viewpoint of maximizing economic growth. As noted in Section 2 of this Chapter, this is not a strategy to be pursued on an ad hoc basis. Too liberal entry into agreements could confront the public sector with huge outlays.

The strategy would be most effective in new towns but could be used in existing centres. However, vested interests in the existing towns could provide many additional problems. The establishment of growth points under this strategy will occur mainly in isolated areas. This could place an undue strain upon the public sector to provide transport links. These are an integral part of the costs of developing isolated areas and should be included, along with their benefits, in the evaluation of the eligibility of the project for public funds.

132. i.e. it can regard more projects as feasible than would be the case if the entire development costs were to be met from the private sector.

133. If the costs to the public sector of building an urban centre of 100,000 pop. are $375 million as suggested by Lansdown, op cit, several such projects running concurrently would require an annual outlay in the order of hundreds of millions of dollars. It is doubtful if the economy could support this outflow since it would have to be largely additional to existing public expenditures. A continued flow of funds would be required to metropolitan areas where lags exist to be overcome. The strategy would have to be financed in the early stages, at least, by a diversion of resources from irrigation and other projects of national development plus a reallocation within the State's programs of housing expenditure, etc.

134. e.g. if a small city were to be expanded, where should the new entity's major centre be located? If it were to coincide with the present centre should this be fully redeveloped or permitted to evolve incrementally?

135. Since this is where the mineral processing industries are most likely to be needed.
It should also be noted that the cost of providing roads to isolated areas are not likely to vary greatly whether it has 5,000 or 100,000 residents. Thus a purely private sector new town, such as the iron ports in the Pilbara, may require just as much expenditure on roads as a much larger centre. 136

This strategy appears to offer the same advantages as Strategy D above. If its growth points can achieve self-generative growth, it will undoubtedly affect the distribution of population. It has an advantage over strategy D in that it should be able to engender a larger number of growth points. It may, however, incur voter opposition unless it is part of a wider policy for national development upon which some concensus has been established. It appears such concensus almost prevails in Australia. The scale of the public investment involved may cause dismay but, it should be borne in mind that they are probably equal to or less than those of alternate strategies in terms of costs per capita. Furthermore, there are economies of scale to be obtained by a massive investment program in urban facilities. 137

136. e.g. the W.A. Government is planning to spend $17 million over the next eight years to realign and seal the 550 miles of highway needed to connect the iron ore ports of the Pilbara to the remainder of the State highway system. Western Australia: Major Investment Projects - Public and Private: Current and and Proposed, op cit.

137. In comparison with the rural development strategy which costs in the order of $7,500 to $10,000 for each person involved, Lansdown estimates of urban costs per head to the public sector are $7,000 per capita in a town of 10,000 falling to $3,750 in a city of 100,000. These indicate that in terms of population relocation, urban solutions are considerably cheaper. However, this may not be the case when productivity is considered, as rural productivity in Australia is higher than in other sectors of the economy, except mining. Report of the Committee of Economic Enquiry, op cit, p.96.
Finally, it should be noted that if the growth point is in an isolated area of northern Australia, the costs per capita of housing and urban facilities may be higher than in more temperate areas, due, for example, to the need for air conditioning and isolation from sources of raw materials. Once the project is well under-way, costs due to isolation should decline and, by pursuing housing and urban facilities designed specifically to suit the climate, other costs may be reducible. However, it would be unwise to assume that the marked cost advantages of a new city over a metropolitan area noted by Lansdown will persist in an isolated locale. 138

Summary
From this evaluation, the following Table (2 - 1) presents an estimation of the merits of each strategy examined.

From this table, it would appear that strategy F, the mixed economy growth point, has the most merits. It involves the least voter opposition (given its adoption in the specified context of policies), has maximum effects upon the spatial arrangements of the economy and it appears to require the least amount of public sector expenditure of the two strategies which would have some real impact on population. Indeed, the expenditure per capita of new non-metropolitan population generated may be the lowest of all strategies.

Thus if the Commonwealth adopted depolarization as a national goal, it would probably find that the mixed economy strategy, based on a large private sector, leading-sector, would be the most effective, practical, and least cost strategy of achieving this goal especially in northern Australia.

138. Lansdown, op cit.
### Table 2 - 1

<table>
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<tr>
<th>The strategies dealt with in the text.</th>
<th>The scale of the Project</th>
<th>The impact of the program on non-metropolitan population.</th>
<th>Possible voter reaction.</th>
<th>Contribution towards national goals.</th>
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a) Voter reaction to privately sponsored projects would be favourable at any scale.
b) Because of parochial opposition as well as voter opposition as in D.
c) Because a large effort may produce a metropolis with social costs of its own.
d) Reflects the 'city economy' problem.
e) Assuming a national development policy favourable to its adoption.
f) 1 and 2: ranking of preferences where no clear judgement is advanced.
x) A firm judgement.
5. The Evaluation of Costs and Benefits.

This section brings together some concluding remarks on why self-generative growth is believed to be desirable in the growth point and then proceeds to discuss how this and other factors influence the evaluation of the merits of such projects and the appropriateness of cost/benefit analysis to this task.

The significance of self-generative growth. It is appropriate to commence by distinguishing between the two issues which, this far, have been subsumed under the term depolarization - 'decentralization' and 'more balanced regional growth'. The bases of arguments for decentralization are essentially anti-metropolitan in character - the metropolis is essentially 'evil' - an economic parasite and the scene of social evils. 139

Decentralization urges the establishment of 'new towns' - small urban entities - which have little prospects of achieving the external economies which permit growth to a metropolis. 140

139. Australian attitudes towards the metropolis show strongly the influences of Ebenezer Howard and Town and Country Planning Association and less the urban values of Dr Johnson. See John R. James, "Regional Planning in Britain", Sam Bass Warner, Jr, (ed.) Planning for a Nation of Cities (Cambridge: M.I.T. Press, 1966), pp.194-5. As early as 1880, legislation had been enacted in Queensland 'to control the subdivision of land' which established minimum lot sizes and created 'suburbs'. This was largely a reaction against overcrowding experienced in England prior to immigration. "The Garden City Movement" was strongly established. See "Proceedings of the Second Australian Town Planning Conference" (Brisbane 1917). The attitude persists. The County of Cumberland Planning Scheme Report, (Sydney, July, 1948) refers to "...whose children in their manhood must withstand the disastrous effects of overcrowded cities, derelict country towns..." Recent emphasis has been on the diseconomies of large urban masses, e.g. Neutze, op cit.

140. e.g. Ebenezer Howard's suggestion of 30,000 as the ideal population for a new town; the British new towns are presently of about 60,000 persons. But recent British proposals are for much larger centres. James, op cit, pp. 205-6: Neutze, op cit, (p.109 ff) favours cities of from 200,000 to 1,000,000. "The Hard Road to Decentralization", Editorial Article, The Australian (September 5, 1966) suggests cities of '150,000 to 250,000...and they are large enough to generate their own growth'. These larger estimates reflect the growing realization that external economies and economies of scale are essential to successful decentralisation.
From the viewpoint of regional development, such cities would be of little value. They would represent 'enclaves' of industrialization or urbanity in an under-developed area.141 Once their economy reached stagnation, their effects upon the region would cease to increase. For regional development the need is for a dynamic urban nucleus - a metropolis, whose ever-expanding economy would place continuously increasing demands upon, and opportunities before, the resources of its hinterland region. Only in this way, can the growth point foster the development of its region. In northern Australia, it is important that the growth point achieve self-generative growth for there the task is one of regional development. 142

The achievement of self-generative growth has important connotations for the financing of the public investment in the growth point. Regardless of how the funds are put to use, it would be desirable that they be recoverable and, if possible, represent a profitable investment. Grants (i.e. non-recoverable advances) should be avoided. There is no reason to believe that the growth point should be incapable of repaying the public funds invested in it. 143 Admittedly, a grace period before

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142. Decentralization is not the issue in northern Australia. One of the arguments which can be advanced in its favour is that it would spur the growth of Brisbane and Perth and so enable them to offer more attractive industrial locations. This in turn would enable them to contribute more to the development costs of the rest of the states. See Marion Gough, et al, Queensland, Industrial Enigma (Melbourne: Melbourne University Press) for a statement of this latter argument.

143. By and large, urban development costs in existing towns are recouped either through user charges or by passing the costs on to the consumer.
repayment begins may be necessary. The ability to repay depends upon the ability of the town to expand and thereby increase land values and to ensure that mortgages to private individuals represent less than the market value of the property involved. This can be best achieved under conditions of rapid growth which will lead, ultimately, to self-generative growth. However, the ability to repay depends upon the size and timing of the public investments as well. A large premature public investment which requires servicing before the town has achieved a 'take-off' stage, may inhibit further growth by adding to the high cost structure of the economy. If the growth point fails to achieve self-generative growth, the burden of meeting repayments on public sector advances may thus inhibit growth. If the centre achieves self-generative growth, the fixed payments on these advances represents a decreasing burden upon its economy. The growth point can then seek additional loans, if so desired, to increase its growth rate and consolidate its position in the region and in the nation.

Assuming that the goal of the national development policy is to maximize economic growth, it is implied that public capital

144. Lansdown, op cit, p.179, comments that "The real increase in the improved capital values of the first commercial leases was nearly 400% between 1944 and 1964. It is highly relevant to note that the population in 20 years in Canberra grew from 12,000 people to 77,000 people". If the town stagnates, property values will fall and the probability of delinquency in mortgage repayments increases as the mortgage decreases more slowly than market value. This is prone to happen in Australia where initial equity requirements are very low and mortgages written for long terms.


146. vide, the discussion in Section 2(a) of this Ch.
investments will be allocated so as to maximize the returns to the economy. To evaluate these, concepts of risk and prudence must be introduced. In the case of the mixed economy growth point being evaluated, the private leading sector may enjoy a substantial competitive advantage in, say, export markets, or it may enjoy only a marginal one. It might be in the short-term national interest to gain export income by encouraging the high risk, marginal industry. However, would it be prudent for the public sector to invest funds in a long-term project such as a growth point to gain this short-term goal? If, despite the advantages its export income would mean to the short-term prospects for economic growth, the long-term prospects for an industry are ambiguous, should a growth point be built around it? The answer can only be determined in terms of the risks—is it a risk that a prudent government should accept? If the industry failed, the public sector would be faced with the dilemma of absorbing substantial losses of capital and of political support; or of trying, by further inducements and expenditures, to revive or maintain the growth points. Neither is a desirable position. Consequently, despite prospects of short-term national economic advantage, the selection of growth points must be based upon their long-term prospects.

Circularity in reasoning should be avoided: the processing plant should not be built to justify the town or vice versa.

147. According to Kenneth Davidson, op cit, it is impossible with the present Federal-State financial arrangements to know if this is being achieved or not.

148. The discussion is in terms of industries earning export revenues. It could apply equally to import replacement, or, with some adjustment, to supplying newly created internal demands.

149. i.e., avoiding the argument that the town should be built to support the industry and that the industry is needed to support the town without reference to the industry's market prospects.
One should be able to stand alone and, in the first few decades, it must be the industry. It is, perhaps, superfluous to note that as the growth point expands, its dependence upon the leading sector industry declines and its resistance to the crises arising from adverse conditions in that industry, increases. Growth points should only be based upon those industries which have a substantial comparative advantage. Such industries may be able to locate elsewhere and still compete in world markets. However, unless the industry locates in a metropolitan region, urban facilities and housing will have to be provided, i.e. any non-metropolitan location becomes a growth point. The issue transforms into a question of where should this be provided? If the raw materials involved are low-value-to-weight substances, a location near their source will lessen the industry's production costs. If such a location is in the national interests as well, it seems evident that the growth point should be located at the source of raw materials.

The appropriations of cost/benefit analysis. If the Commonwealth adopted a mixed economy urban growth point strategy and the suitability of a proposed growth point in northern Australia was being examined, what factors should be taken into account in measuring the probable costs and benefits of the project? Would cost/benefit analysis be an adequate vehicle as has been suggested by the Committee of Economic Enquiry?150

First, it should be clearly noted that the cost/benefit ratio of the urban growth point project is of little relevance unless similar ratios are available for alternate methods of achieving

the same goals. 151 There is no point in comparing the cost/benefit ratio of a growth point project with that of a project involving metropolitan expansion, if the goal of the growth point strategy is to achieve depolarization. If the goal where the maximization of national economic growth or of the return from public sector investments, then there may be some point in comparison of such cases as these.

If the national goals call for the maximization of economic growth, the issue becomes one of determining which plant location will permit the greater progress towards this goal - the metropolitan or that of the source of raw materials. In this context, cost/benefit analysis appears to be the logical method of evaluation. It is doubtful if it is adequate for the task. The Committee of Economic Enquiry has remarked upon the need to take account of non-economic factors in any such evaluation. 152 However, the problem is somewhat deeper than that because the technique cannot, with the present state of knowledge, deal with the purely economic issues involved.

The development of a growth point will involve an inflow of investment over a considerable period even if growth is rapid. Not only are the magnitudes of the investments important but also their timing for, just as future benefits should be discounted, so should delayed expenditures. No technique exists

151. Robert Dorfman in his "Introduction" to Measuring Benefits of Government Investments (Washington: The Brookings Institute, 1965), notes that only in water resource development has cost/benefit analysis reached the stage where alternate means of achieving the same benefits are considered. Most other applications are concerned with conceptual and fundamental issues of determining the relative importance of benefits included and excluded from the analysis. For the application of cost/benefit to water resource studies, see Maass, Thomas, Dorfman and Huffschmidt, Design of Water Resource Systems (Cambridge: Harvard University Press, 1962).

at the present time whereby any reasonable estimate can be made of the flow of funds into a growth point (of the mixed economy type developing without economic planning). 153

Furthermore, it is not yet possible to evaluate how different patterns of inflows of funds might affect growth or vice versa. Would a concentrated massive investment program generate more benefits or growth than a sustained program of smaller periodic infusions? From the viewpoint of the costs of the project, whether confined to the public sector or not, this is important.

If the problems of estimating present costs in the growth point are difficult, they are no more so than those encountered in attempting to estimate the costs of growth in metropolitan areas. 154

It may be possible to itemise the expected costs in the growth point and to prepare 'comparable' costs in metropolitan areas. 155

Because there are lags in the provision of urban facilities in metropolitan areas, e.g. lack of adequate expressways, these comparable costs will understake the 'full' costs. 156

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153. The closest approach appears to be that of the Joint Centre for Urban Studies of Harvard and M.I.T., developed for the Corporation Venezolana de Guayana. This will be reported in a series of publications from the Joint Centre in the near future. The model developed to co-ordinate the program has been reported by William Morsch in a mimeoed document (Rotch Library, M.I.T., April, 1966) and will be the subject of his forthcoming doctoral dissertation.

154. Neutze, op cit, has attempted to make one such estimate. Bruce Hyland reviewing his work in the Australian Planning Institute Journal, Vol 3, No 6 (October, 1965), pp.215-6, has pointed out that Neutze concentrated upon the transport diseconomies of the metropolis and failed to give equal emphasis to the "economies of conurbation" which could offset them.

155. Lansdown, op cit, p.178, appears to base his arguments on this approach since he refers to 'recent comparisons of total expenditures'.

156. i.e., present costs plus the costs of overcoming lags in the provision of facilities.
interests of short-term economic growth, this is a desirable feature but, if the long-term view is taken, the comparison should be between the 'full' costs needed to provide an adequate environment in both locations. With anticipated expressways costs in the order of $300 to $500 per head, the difference between actual and full costs in the metropolitan area could be substantial. More significantly, many people believe that there are inherent diseconomies in metropolitan locations. If these exist, they should be added to the costs of the metropolitan location. However, no adequate techniques exist for identifying, much less evaluating, these 'social' costs.

It should also be noted that the development of a growth point will generate some metropolitan growth, e.g. through increased administrative services. There is no available way of determining whether or not the total growth engendered by the leading sector industry will be the same in each location - be it measured in economic or demographic terms.

The problems of estimating benefits are even more complex. The growth point, if it can achieve self-generative growth, should offer lower costs of production for the leading sector industry and, consequently, access to larger and more stable markets. This is desirable for external viability and overall economic growth. If, from the viewpoint of the public sector, only limited funds are available to meet a wide range of needs, many

157. By not investing in urban facilities with high ICORs the capital can be invested in projects yielding greater returns to the economy.

158. Based on the estimated costs of providing the main expressway system for Brisbane for 1980. (Cost estimated at $300 million; population at time of estimate, approx. 600,000; and population in 1980, approx. 1 million).

advantage to any growth point which achieves self-generative growth. Its expanding economy will permit more intra-regional transactions and will thus swell the gross regional product. Since the growth point's economy is expanding, the discounting of future benefits becomes difficult. There is no 'plateau of growth' where output will be steady. The maximum benefits derived will depend upon the time interval used for the discounting.

Finally, some mention must be made of the indirect effects of any project upon both the national and regional economy. If the objective of depolarization policy is regional development, the indirect effects may be the most significant. There is little doubt that a major growth point in northern Australia would have substantial effects over a very wide area, e.g. in reducing isolation from specialized services and in reducing transport costs. Resources now considered economically unexploitable would become exploitable because of the introduction of infrastructure. In addition to these 'passive' effects, the growing urban economy would 'actively' generate new markets and call other resources into production, e.g. rural settlement to provide milk and fresh foods with the probability that irrigation projects would be offered the opportunity to escape from tropical monoculture.

163. In irrigation and other land development projects and in urban centres which do not achieve self-generative growth, the flow of benefits increases rapidly to a maximum (or optimum) level and thereafter remains relatively constant. Technological changes and other long-run factors will alter this level but not sufficiently to render it inappropriate as a measure of the expected level of benefits.

164. These 'active' effects are synonymous with the concept of the 'service' sector in the economic base theory. The 'passive' effects are those associated with the process of exploration rather than development. Their presence in any project is uncertain.
If the project were to be located in a metropolis, no such consequences would ensue. Adding 100,000 people to a metropolis of half a million or more will make no appreciable difference to the already well-developed regions surrounding and supplying it. Existing resources may be more intensively used but new resources are unlikely to be called into production. Furthermore, the metropolis is destined to add the 100,000 or more persons to its population in the course of its natural growth. Thus the issue devolves into establishing the growth point and setting regional development in motion or postponing any attempt to induce regional growth. The latter course also implies making any later attempt to induce regional growth in the region of the growth point more difficult since the metropolis will increasingly offer greater advantages of scale and external economies to all industries.\textsuperscript{165}

How can these indirect effects be measured? They are part of the consequences of a policy decision and their costs and benefits should be included in its cost/benefit evaluation. Since they involve unknowns, e.g. new mineral resources which may become economically exploitable in the presence of infrastructure, they cannot be fully evaluated.

Because of these factors alone, the use of cost/benefit analysis is spurious. The evaluation of the growth point must proceed against a much broader panorama of the region in which it is to be developed and of its growth prospects. The decision whether or not to embark upon the pursuit of such a strategy in relation to any resource endowment remains a political one.

\textsuperscript{165} Adding to the difficulties will be the growing urbanization of the workforce and the probability that they will exhibit increasing unwillingness to face the hardships associated with developing a remote new town in a harsh environment. The added monetary compensation they will seek for undertaking the task will increase the cost differentials in favour of the metropolitan location.
based on a intuitive evaluation of the merits of such a strategy against those of the others available to achieve the same goal. Research in this context can never provide the decision. At best, it can provide insights into the probable outcomes of certain decisions made in a specified context. Cost/benefit analysis, if it is to be used in conjunction with a research program for a growth point, should be confined to the evaluation of alternate investment or stimulation strategies within the urban economy where the constraints and data limitations tend to be constant in nature and in importance. If cost/benefit analysis is used in any wider context, its use should be predicated by a clear definition of the goals to be maximized and the clear understanding that the analysis is, at best, only a partial statement of the situation even in strictly economic terms.

6. Criteria for Public Involvement.

Neutze has characterized decentralization in Australia as "everyone's policy but no one's program". The States pursue it but cannot afford to finance it. The Commonwealth pays lip service to the concept and will not finance it. The impediments to the Commonwealth's adoption of the policy have been examined. They can be overcome if depolarization, to use the broader term of this study, were to be presented to the electorate as a desirable national goal. This first step is a purely political one. It will not commit the Government to financial expenditures: it might provide some grounds for political criticism at a later date if it is not pursued.

It has been argued in Section 4 of this chapter that practical policies for achieving depolarization exist. Opportunities for implementing the most practical strategy - the mixed economy growth point - may exist now in the new towns being developed in northern Australia. Whether they do or not depends upon the

166. Neutze, _op cit_, Preface.
town's growth potential. In the first instance, could they become the locations of viable mineral processing industries? Second, could these industries provide the bases for viable urban growth points?

If, as has been suggested in the preceding section, cost/benefit analysis is not an applicable technique for evaluating the merits of any urban growth point proposed, what procedures might be adopted to evaluate its merits? Objective criteria are obviously desirable but, as this section illustrates, absolute standards cannot be established: they can only be expressed in relative terms.

Two groups of criteria are believed identifiable among those which are necessary (but possibly not sufficient), for the complete evaluation of any such proposal. The first concerns the viability of the leading sector proposal while the second relates to the growth point which it might stimulate.

A. Criteria for the selection of suitable leading sectors.
The logical order for the proposal of an urban growth point in northern Australia is (i) a resource is discovered and exploited; (ii) a proposal is made to establish a processing industry; and (iii) public assistance is sought in the establishment of the industry and the accompanying urban facilities. The first phase of the evaluation of the proposal from the public sector's viewpoint is a scrutiny of the prospects of the proposed leading sector industry. Five criteria are suggested to define areas where the performance of each proposal should be evaluated.

Criterion 1
The project must offer the opportunities for substantially increased export earnings and/or import replacements; and/or for providing goods needed to improve the level of welfare of
the domestic community, the economic production of such goods being infeasible without the project.\textsuperscript{167} (In respect of export earning or import replacement projects, it may be possible and desirable to establish specific criteria for the definition of 'substantially', e.g. the additional net export earnings accruing from the project should be '\$x' per annum, or these earnings should be 'y' times the average annual public sector investments suggested as necessary for the establishment of the growth point, etc. The specification of such performance standards is a matter for political decision in the light of the nation's economic circumstances. It may be felt that non-economic reasons, e.g. those of a defense nature, call for flexibility in the establishment of these conditions. No such absolute specification is needed if the criterion is used for the purpose of comparing alternate proposals).

**Criterion 2**

The existence of adequate markets to absorb the production of the plant, the ability of the plant to produce and supply these markets at prices competitive with those of their probable foreign competitors, and the ability of the private interests involved to undertake, finance and operate their portion of the proposed project should be clearly established. (These are normal investment financing precautions. Independent assessments of markets, production costs, evidence of contractual arrangements, availability of finance, etc., would be needed. In many respects, the procedure would parallel the analysis of the Tariff Board in its determination of the levels of protection to be given to domestic production.\textsuperscript{168} The significant difference is that, in

\textsuperscript{167} It is difficult to envisage a case under this last provision. Development of a special tourist attraction could be an instance. If Australians acquired a special taste for tropical produce available only in a remote locality, e.g. shell fish, the resultant town might qualify under these conditions.

\textsuperscript{168} For a summary of these procedures see The Report of the Committee of Economic Enquiry, op cit, Appendix I, pp.1043-1080. Also W.M. Corden, 'The Tariff', Alex Hunter (Ed.), The Economics of Australian Industry, op cit.
general, the Tariff Board has evidence of actual production costs and can judge the levels of efficiency, quality of the product and other pertinent matters. Needless to say, the evidence submitted should be consistent and favourable if the project is to be considered for assistance. The public sector should also obtain or make similar assessments of the project from other sources.)

**Criterion 3**
The ability of the plant to achieve the costs of production specified under Criterion 2 should not be wholly dependent upon the location of the plant at the source of raw materials, nor should it be dependent upon the availability of labour, at metropolitan wage levels, in the proposed growth point. There should be evidence that a plant sited in the proposed growth point would enjoy added locational advantages such that, if labour and other costs were equal,\(^{169}\) it could achieve lower costs of production than at any other location. Eligibility to qualify for public assistance under this criterion should not be destroyed if it appeared that the capital required to provide housing and urban facilities would exceed the capacity of the private interests proposing the plant either because of the magnitude of the sums involved or because the annual costs of such a large investment would undermine the profitability of their operations. (That is to say, the plant's competitive advantage should not be marginal.\(^{170}\) It should be able to operate successfully in the growth point before any labour cost reductions arise from the achievement of self-generative growth. It need not, however, enjoy such a wide margin of advantage as to be able to operate successfully while providing all the capital requirements for urban facilities. Considerations of profit margins enter this evaluation. Unless these appear

\(^{169}\) These 'other' costs would be chiefly capital costs. They would exclude the indirect costs arising from the absence of external economies.

\(^{170}\) Marginal in the sense employed on page 74.
so high that a deliberate attempt to exploit is apparent, they should not enter the evaluation. The strategy of underdeveloped nations can be pursued. Initially, Australia needs the investment but, once a major investment has been made, the private investors cannot afford to risk disfavour with the public sector - they need the major growth point as much as Australia does. They will thus do what they can to hasten its development. The significant point is that private investment must be large and offer the prospects of a long-term assured income.171)

Criterion 4
The plant should be based upon ample reserves of raw materials and should produce materials for which there will be continued demand. (Raw material reserves should be adequate to support the proposed level of production for 50-100 years as a minimum.172 The plant should not be being developed to supply a single contract or single market.173 Its products should be ubiquitous and ones for which there is a stable market, i.e. one not historically subject to fluctuations sufficient to cause substantial variations in employment levels.)

171. For a brief discussion of this point in developing nations, see Kindleberger, op cit, pp.334-5.

172. This is suggested because of the high ICORs associated with urban infrastructure investments and the necessity for the growth point to be well established before decline in the leading sector becomes a foreseeable issue. Private risk capital will not flow into a growth point if there is any hint that its main industry is declining, unless it has a well-developed role as a regional centre and a diversified economy.

173. The dangers of dependence upon a single market are exemplified by the history of Eliot Lake (see Appendix III).
Criterion 5
The industry should have reasonable growth prospects either because of expanding markets through increasing world-wide usage or because of ample opportunities for forward and backward linkages to further process the output of, or to supply materials to, the major plant.

While it would be most desirable to be able to establish objective performance standards as criteria, they are not feasible for this evaluation. Further detailed research might yield some means of qualification of the issues involved but this appears improbable in the Australian context. Furthermore, there is the probability that a proposal may fail to qualify for eligibility under one criterion but may be considered satisfactory from the overall viewpoint. However, failure to qualify on one criterion should at least be taken as an indication of a substantial risk. The final evaluation can only be made by an assessment of the risks which it involves relative to alternate proposals designed to achieve the same goal and, in the broader setting, on the significance of that goal within the total set of goals being sought by the Government, i.e. of the risks attached to it viv-a-vis those on all other alternate avenues open to public investment for the achievement of its goals.

B. Criteria for the Choice of Urban Growth Points
Given that there are one or more suitable leading sectors which appear to offer acceptable levels of risk, there remains the issue of deciding which, if any, warrant special assistance and are suitable as the leading sectors of major growth points.

Whereas the preceding criteria were primarily concerned with the benefits accruing directly to the national economy, a second set of criteria are needed to assess the probable 'indirect' effects of the proposed growth point and with its ability to contribute to regional development. They are centred around three issues:

174. At least in the short term, because of the lack of data and the lack of emphasis upon research generally.
6. The location of the project;
7. The probable size of the growth point; and
8. The probable rate of growth.

Criterion 6
Preference should be given to those proposals which appear likely to foster the greatest further regional development. (If two equally acceptable leading sectors were being further evaluated, preference should be given to the one best located with respect to known resource endowments: or, in the absence of adequate data on regional resource endowments, to the one most likely to 'open up' a large hinterland. For example, if the eligible leading sectors under further evaluation were located at Port Hedland and Weipa, Port Hedland would be preferred because (a) it is close to a known, diversified, metaliferous region whereas Weipa is not, and (b) if it were developed it could serve a much wider area than Weipa where the effects of a major growth point would be curtailed because of its location on a peninsular.)

Criterion 7
The proposed growth point should offer good prospects of achieving self-generative growth. (The significance of this has already been dealt with. The initial indicators of self-generative growth are the size of the workforce to be employed by the leading sector and the probability of it attracting further linked industries. Other factors which will influence the growth of the urban economy are the location of the centre; the available resource endowments; the composition and magnitude of final demand and of immediate transactions; the threshold levels of economic scale for various productive processes and the attitude of the public sector towards the new town.

175. See Map 2-1, page 40, for the location of these centres.
Moreover, the ability to achieve self-generative growth can never be rigidly determined. The unexpected may always happen. Consequently, a graduated scale of public involvement in the new town should be devised, providing for increasing involvement as the probability of achieving self-generative growth increases. However, this would necessarily assume a defined set of policies for public assistance to each town. Different towns may respond differently to the same policies and if the public sector is to attempt any maximization of the returns on its investments in the growth points, it should be prepared to vary its policies in relation to each. It should also be prepared to vary policies in any one growth point, with time. In all cases, the public sector's policies should be designed to maximize prospects for the achievement of self-generative growth subject to the constraints imposed by the availability of funds to pursue this goal.)

Criterion 8
The growth point should exhibit prospects for rapid growth. (This criterion is partly an outgrowth of the belief that rapid growth is indicative of, if not a pre-requisite for, self-generative growth. It also stems from the desirability of the project being well-established within the time span during which forecasts of markets, prices and costs retain realism. For example, it would probably be imprudent for the public sector to commit itself to a program of assistance to the new ports being developed as part of the Pilbara mining operations, if the only undertaking given by the companies involved was that they would locate their future steel plants at these ports. 176 The imprudence would derive from the impossibility, at this time, of establishing whether or not the plants would be feasible.

176. Two mining groups have agreed with the Western Australian Government to establish integrated iron and steel industries in Western Australia. See Appendix II for details of one of these agreements.
20-30 years hence and upon the probability that any urban facilities financed now by the public sector would need replacement due to their obsolescence and inadequacy by the time real growth commenced. If, on the other hand, the plants could be established within a decade, a much stronger argument for the immediate commitment of public funds could be made.

The criterion thus spans two aspects – one, the probable rate of growth during and after construction and, say, in the following two decades, and two, the long term average growth from the time of submission of the proposal.177)

As an outcome of Criteria 7 and 8, two further criteria seem desirable. They involve the internal dynamics of growth point and particularly, the degree to which public policies can influence its growth prospects.

Criteria 9
The economy of the growth point should be responsive to public sector assistance. (Preference should be given to projects which

177. The growth of Kwinana exemplifies the problems. Established in the early 1950's as a site for a major industrial complex, it grew rapidly with the establishment of an oil refinery and a steel rolling mill. Growth then ceased for a period of about six years until the establishment of an alumina refinery. This has been followed by a fertilizer complex, a major power station, the initial phase of an iron and steel works and its ancillary facilities, liquid oxygen plant, engineering workshop, etc. The New Town of Kwinana suffered a severe setback at its inception because of technological innovations in the oil refining processes which greatly reduced the workforce needed after construction had commenced. Its population has been swelled by assigning migrant families to the area but has remained almost stationary at about 4,000 for the past decade. It now appears to face another period of rapid growth as some thousands of new workers find employment in the area. However, in the duration it has acquired a poor reputation which strongly influences those workers who can afford privately financed housing to avoid the area. See Clarke, Gazzard and Partners, Rockingham New Town, Report No. 1, (Sydney, 1965) (restricted circulation).
are based on a relatively self-contained industrial complex. For example, a growth point based on an alumina refinery offers little prospects of developing further unless adequate electric power potential is available to permit the location of smelters in the area. No amount of public sector assistance will foster its growth if this is not available. Similarly, if an essential component of the industrial complex is under the control of interests who are not parties to the agreement with the Government in the growth point, there is an obvious case for proceeding with caution. The ideal case would be an economy where public sector assistance could take a number of roles all conducive to further growth.)

Criterion 10
The minimum essential inflow of public sector assistance should be within the capacity of the economy to fulfil. (This is a constraint upon the design of public sector assistance programs and it affects almost the entire evaluation.)

These are far from objective criteria. However, they do indicate measures which might be used to evaluate the merits of various proposals. They are quantifiable issues in so far as present knowledge permits. The problems of determining growth prospects, probable rates of growth, responses to different policies and annual inflows of funds can only be made on the very crudest basis at the present time. There is a definite need for a method which would enable these to be evaluated on a more rational basis.

Epilogue
This chapter has presented the main argument of the thesis. It has attempted to present a case for the combination of public and private endeavours for the development of major urban growth points in northern Australia. These growth points could be based on selected mineral processing activities. Three reasons have been advanced in favour of such endeavours:
1. That the development of mineral processing activities will contribute to the external viability and economic growth of the nation;

2. That, if they can achieve self-generative growth, the urban growth points will:-

(a) provide much better locations for the mineral processing activities enabling them to reduce their production costs and to gain wider markets thereby adding further to the nation’s economic growth; and

(b) provide the dynamic metropolitan cores essential for the development of northern Australia; and

3. That, if the Commonwealth Government wishes to adopt depolarization as a goal for its national development policy, these urban growth points present the most practical choices for the initial moves in pursuit of such a goal.

Finally, criteria were developed for the evaluation of the growth points in these roles.

The author has attempted to avoid arguing the case in favour of depolarization as a national goal. The intention has been to examine the possibilities of implementing policies aimed at achieving that goal. Until practical means of implementing it have been devised, depolarization must remain a political will of the wisp, not material for a national goal.

The treatment has been 'in breadth' rather than 'in depth'. Many assumptions have been made to build the case. The aim
of the chapter was to attempt to draw together many issues in an endeavour to construct an argument to show the merits of a certain course of action. Because of the wide range of issues involved, the network of linkages has necessarily been loose. It is believed that such an approach is justifiable in the present Australian situation. The resulting document will be more useful than an 'in depth' study of a less expansive issue. This belief arises from (a) the lack of any broadly presented hypothesis on the feasibility of any alternate strategy of national development; (b) the need for a broadly based hypothesis to identify, and to assign priorities to, the critical issues which should be given more intensive examination; (c) the dearth of factual data upon which to undertake more intensive examinations and the need to identify the types of data which might be required for such studies; and (d) the facts that decisions which may be of great significance to national development are being taken now, and that opportunities for achieving substantial depolarization may be being lost because of the lack of any study identifying them. There is no time for the collection of data, or for 'in depth' studies on a broad front. This chapter has, at least, outlined one possible alternative whose controversial points can be identified and scrutinized with more rigor. Some direction has been offered to the meagre research resources available for studying the issue of depolarization.

The next chapter takes up a most crucial point to the whole case presented in this chapter. The hypothesis is of no value as a practical alternative to existing policies unless some of the new towns do possess the potential necessary to become major growth points. The Pilbara region appears to offer the most favourable prospects. Might it spawn a new metropolis?
CHAPTER 3  THE URBAN GROWTH POTENTIAL OF THE PILBARA

Prologue.
Until early in the present decade, the Pilbara Region of Western Australia was best known for its aridity, its heat and the fact that one of the off-shore islands was the site of the first British atomic bomb tests. Its economy was based on a few large pastoral properties, and some desultory mining activities for asbestos, gold, tin and manganese. The Census of 1961 revealed that the 171,462 square miles of the Pilbara Statistical Division had a population of 3,243 persons or 0.02 persons per square mile.

In the 1966 Census, the population had increased to 7,186. This is indicative of the changes that have occurred in the Pilbara in the past five years:— the creation of a major U.S. Navy radio communications centre at Exmouth Gulf; the discovery of natural gas and oil in commercial quantities at Barrow Island; the development of large solar salt harvesting; and, most significant of all, the recognition of one of the largest iron ore deposits in the world with the beginnings of their exploitation. Exports of iron ore from the Pilbara are now proceeding at the rate of some 6 million tons per annum. Contracts already agreed call

1. Average rainfall in the area varies between 8 and 10 inches per annum. Average annual temperatures vary between maxima of 85 and 100 degrees and minima of around 65 degrees. Marble Bar has recorded 160 consecutive days when the temperature exceeded 100 degrees. Official Year Book of Western Australia, No. 4, 1964, pp. 48-50. The atomic bomb test was at Montebelle Island.
2. ibid, p. 127.
4. Hamersley Iron is currently exporting at a rate over 4 million tons per annum, news item, The Australian, Feb. 11, 1967, p.14; Mount Goldsworthy Mining Associates are exporting at 1.5 million tons per annum, Mount Goldsworthy Iron Ore, brochure issued at opening of project.
for the export of about 275 million tons of ore from the region in the next fifteen years. The major developmental works are shown on Map 3-1.

More significant than the export of ore are the agreements between Hamersley Iron Pty Ltd and the Mount Newman Iron Ore Co and the Western Australian State Government wherein each of the mining groups has agreed to establish an integrated iron and steel industry in the State; the reported endeavours of the State Government to attract an oil refinery to the area; and the dynamic optimism of the finder of the iron ore deposits, Mr Lang Hancock, who is actively endeavouring to promote a major industrial complex in the area.

If these things come to pass, the Pilbara must develop major urban centres. The question if when. The key to their development is the feasibility of an iron and steel industry in the area. This chapter makes a cursory examination of the prospects of such an industry. On this basis, it is concluded that the establishment of such an industry within the decade is possible.

No definitive answers can be given because of the many technological issues connected with production which, while they lie outside the scope of a study such as this, have crucial bearings upon the prospects for the establishment of an iron and steel industry. However, the major determinants of the industry's feasibility are isolated and the probable overall specifications for product-mix and markets are established.

5. See Appendix II for details of one such agreement.


7. Hancock, a millionaire as a result of his finds, has paid almost $1.5 million for the Wittenoon asbestos mine to prevent its closure and is trying to develop the area into a major industrial complex; Vincent Smith, "Hancock - the North's Mr Development", The Australian, Jan 28, 1967 p.7.
The chapter commences with a discussion of the key influences in the determination of competitive advantage in the modern steel industry. It moves on to consider possible markets - the Australian domestic market; the world steel market, together with the general magnitudes of world production and trade prospects and, the Afro-Asian regional market - the 'logical' export market for a Pilbara plant. The costs of production at a Pilbara location are considered relative to those of Japanese producers who will be major competitors. From this survey, the prospects for the industry are evaluated.

The later sections of the chapter turn to the problem of attempting to assess what a steel industry in the Pilbara would mean in terms of urban growth. The economic base theory is used and its shortcomings noted. A 'naive' concept of the urban growth process is developed and using available Australian data, the implications for urban growth noted. The conclusion reached is that an iron and steel industry in the Pilbara is feasible given adequate public sector assistance. It will almost certainly lead to the establishment of a major growth point although some further Governmental influence may be needed to ensure its emergence.

The approach adopted in this chapter is to consider the prospects of the industry under the assumption that public assistance will be available to assist in its development.

This chapter is divided into the following sections:

1. Competitive Advantage in the Steel Industry;
2. The Australian Domestic Market for Steel;
3. The World Steel Market;
4. The Magnitude of World Production and Trade;
5. The Logical Export Market for the Pilbara;
6. Costs at a Pilbara Location; and
7. Probable Urban Growth.
An epilogue rounds out and summarizes the chapter.

1. Competitive Advantage in the Steel Industry.

The concept of competitive advantage is well known. In this context, it is used to denote the ability of one producer, by virtue of more advantageous resource endowments, to produce steel at a lower cost than his competitors, thereby gaining a larger share of any common market. In the steel industry competitive advantage can best be discussed in international terms since, in so many cases, international trade is the major source of competition. Internal competition is muted by cartels and other trade agreements (legal or illegal) or non-existent because of the monopolistic structure, or state control, of the industry.

At the international level, there are three broad sources from which competitive advantage may spring:

A. In the costs of raw materials;
B. In production costs; and
C. In distribution costs.

A. The costs of raw materials
The major raw materials for steel production are iron ore, coal and, to a lesser extent, scrap. Because of changes in the sources of supply and the availability of these materials, there has been a radical change in competitive advantage in the steel industry in recent years. To trace it, a brief review of the history of the steel industry since its inception a century ago is in order.

8. A widespread practice in Europe, see Business Week, September 3, 1966, p.94.
9. e.g. Australia.
10. India treats steel as a State responsibility.
The original steel works were in Europe and the U.S.A. They were placed close to coal mining areas because early technology required more coal than iron ore per ton of pig iron (or steel) produced. As technology changed, less coal was required and new plants were built closer to the sources of iron ore. In Europe and U.S.A., these traditional steel mill districts are at inland locations.

The tremendous growth of the steel industry rapidly depleted local iron ore and coal reserves and lead to greater transport costs for each unit of input and to the use of leaner ores which reduced blast furnace efficiency. This stimulated a search for new, richer ore sources. European steel makers opened the mines of West Africa and the American industry opened mines in Canada and Latin America. As these areas grew to be significant suppliers of ore, new steel plants at tide-water sites were developed.

The initiative in seeking better and cheaper raw materials passed from the U.S. and European steel industries to the Japanese about ten years ago. Japan has virtually no local iron ore and only limited coal resources. To provide raw materials, the Japanese opened iron mines from Swaiziland to Brazil. They concentrated on obtaining ores of the highest grades. These activities lead to the so-called 'new geography of iron ore'.

Huge new deposits of ore have been discovered over the past few years in Brazil, Chile, Gabon, Mauratiania, Liberia, Tunisia and Australia. The ores are rich and can be mined by cheap, mechanical, open-cut methods. This reduced the price of ore but transportation costs posed a new problem. One estimate attributes 78% of the cost of West African ore landed in Europe to transportation - 65% to sea transport costs. The Japanese,

11. Miller, op cit, p.11.
12. J. Bes, Bulk Carriers (Amsterdam: n.a., 1966)
being the most remote from their raw material sources were worst affected. They responded by introducing huge bulk carriers which slashed the cost of transportation. Their success is reported by Norris — the freight component of ore costs c.i.f. Japan fell from 55% in 1955 to 35% in 1963.\(^{13}\)

The position with coal has been similar. The Japanese, for example, are buying more and more coal mined by open cut methods in Australia, their nearest source.\(^{14}\)

The introduction of bulk carriers favoured tide-water plants, particularly, those such as the Japanese plants, where large carriers can, in many cases, unload directly to plant stockpiles.\(^{15}\) As larger carriers come into operation, the capacities of harbours become a limiting factor. There is no apparent limit to the size of the carriers beyond that imposed by terminal facilities.\(^{16}\) To maximize its advantages a plant must now have a deep anchorage at its tide-water location.\(^{17}\) The Japanese have arranged their entire steel industry on tide-water locations. By this and by using high quality raw materials they have managed to offset their natural disadvantage of being remote from iron ore and


\(^{14}\) Norris, op cit, states that 23% of Japan's imports of coking coal came from Australia in 1963. In 1965, this had risen to 41.6%. Japan's Iron and Steel Handbook (Tokyo: Japan's Iron and Steel Exporter's Association, 1966).


\(^{16}\) Japanese shipbuilders are considering a 500,000 dwt carrier, news item The Nihon Keizai Shimbun January 3rd, 1967.

\(^{17}\) The British steel industry's development of Port Talbot is a case in point. Pilbara ore costs $4.50 to ship to Wales compared to $3.50 in Amsterdam because of the need for trans-shipment to smaller vessels at Amsterdam before delivery to Wales. Roland Bird, "Australian Prospects, A Special Survey" The Economist, Jan 28 - Feb 3, 1967.
coal supplies. Another marked outcome of the new geography of iron ore has been the severe disadvantages that older, inland plants have incurred, especially in Europe.

However, whilst mechanical loading and unloading may become more efficient and while still larger carriers may continue to cut transport costs, it seems improbable that these will ever dwindle to complete insignificance. Raw material costs are the largest single component of total production costs.18 While transport costs remain large in relation to the total costs of raw materials, any plant located at a source of ore must enjoy a moderate advantage.19 If terminal or trans-shipment costs have to be incurred, that advantage will be substantially reduced even if the distance the coal or ore is moved is relatively short.

B. Production Costs
It is not intended to embark on an extensive discussion of the various production processes now available.20 Suffice to note that certain new processes enable steel to be produced at a lower cost than traditional processes with a lower total capital investment. Production technology is developing rapidly as blast furnace capacities are enlarged, steel productions costs reduced and new finishing processes such as continuous casting remain to be fully evaluated.

However, three aspects of these costs should be examined in some detail. Table 3-1 is based on an analysis by the E.C.L.A. of processes in hypothetical steel mills. It is immediately

18. See Appendix VIII.


**TABLE 3-1**

Economies of Scale in Steel Production Processes based on Hypothetical Plants using Modern Technology.

<table>
<thead>
<tr>
<th>Annual Capacity of Plant (in '000 tons p.a.)</th>
<th>100</th>
<th>200</th>
<th>400</th>
<th>500</th>
<th>800</th>
<th>1000</th>
<th>1500</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a) In production of pig iron by coke blast furnace.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Indices of production costs per ton of output*</td>
<td>124</td>
<td>112</td>
<td>103</td>
<td>100</td>
<td>96</td>
<td>94</td>
<td>92</td>
</tr>
<tr>
<td>(b) In production of steel by open hearth and L.D. process</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Indices of production costs per ton of output**</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Open Hearth Furnace</td>
<td>142</td>
<td>130</td>
<td>118</td>
<td>112</td>
<td>107</td>
<td>104</td>
<td>100</td>
</tr>
<tr>
<td>L.D. Process</td>
<td>126</td>
<td>114</td>
<td>103</td>
<td>100</td>
<td>94</td>
<td>92</td>
<td>89</td>
</tr>
<tr>
<td>(c) In rolling flat products</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Indices of production costs per ton of output***</td>
<td>146</td>
<td>132</td>
<td>106</td>
<td>100</td>
<td>88</td>
<td>82</td>
<td>78</td>
</tr>
<tr>
<td>(d) In rolling merchant bars and light profiles</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Indices of production costs per ton of output****</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Open Hearth and Blooming mill</td>
<td>148</td>
<td>135</td>
<td>126</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>L.D. Process and cont. casting</td>
<td>119</td>
<td>106</td>
<td>100</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: ECLA: The Iron and Steel Industry of Latin America: Plans and Perspectives. A paper delivered at the U.N. Interregional Symposium, see ref. 49 p.113

*.,**,***, and **** based on Tables 16, 17, 19 and 20. Indices are based on plant and processes shown thus – 100.
apparent that there are substantial economies of scale in steel production. While the E.C.L.A. study only extends to plants of 1.5 million tons annual capacity, there is little doubt that these scale economies increase with further expansion of productive capacity.

It should also be noted that the new technology of steel making paradoxically permits smaller plants to operate competitively. Thus plants can now be built to serve small markets previously considered uneconomic. This has had the effect of permitting plant location to become more market oriented.

The second of these three aspects concerns labor - its costs, its productivity and its skill. As the E.C.L.A. study reveals labour costs are significant in total production costs. European and North American steel producers are finding high labour cost a decided disadvantage in competing with Japanese producers.21

Labour costs alone are not the most telling factor. Productivity is equally important and to some extent this relates to skill. If the cost of labour was an isolated consideration, low wage countries such as India should be able to swamp the world market. However, skill at all levels, is important to maximise efficiency.22 Productivity increases are essential to offset rising labour costs if competitive advantage is to be maintained. Thus Norris suggests that Japan's margin in labour costs will be partially offset by increasing wages but, in turn, productivity increases may retain the status quo.23

The final aspect to be considered is capital costs. These are


22. India's new steel plants are operating well below capacity because of mis-management and neglect, "Indian Steel - Vision in Threads", The Economist, Jan 28 - Feb 3, 1967 p.351.

decidedly affected by the scale and technology adopted but if these are assumed fixed, there are still marginal differences which can be telling in determining competitive advantage. Theoretically, the cost of equipping a steel plant of a given size and technology should not differ greatly anywhere in the world. However, machinery is only a portion of the costs. Local labour content and local construction materials probably amount to half or two-thirds of the total costs. They appreciably affect total plant construction costs and consequent annual capital costs.

Second, there is the problem of providing the array of facilities needed to support a steel plant - ranging from ports, water supply, housing and urban infrastructure down to relatively minor problems of plant maintenance and inventories of replacement parts. The giant among these is probably housing and urban infrastructure although, in arid regions, water supply could also pose huge expenditures. Appendix VIII examines some of the implications of these additional costs and their effects on production costs. It appears that urban infrastructure and housing for plant workers alone could double capital requirements.

Finally, there is the cost of capital. Appendix VIII has some calculations to reveal its effects - suffice to say they are considerable. A full discussion of this aspect is beyond the scope of the present study.

C. Distribution Costs
Steel products are distributed chiefly by rail or by sea. For the present study, which is concerned with an area devoid of rail connections, distribution by sea only is considered. Two methods can be employed in shipping steel products - the use of regular freight services or chartered vessels. In either case,

24. This is the case with projects in underdeveloped countries, see Kindleberger, op cit, p.323.
the freight costs between plant (assuming it is at a tide-water location) and market will vary directly with the distance involved. The terminal costs are relatively fixed and operate strongly against plants not located at tide-water. Furthermore, freight rates are relatively constant for all types of steel product. Thus on low-cost steel products, freight rates can represent a sizeable part of total costs at the markets. On high-value-to-weight-products, they are less significant. Moreover, low-cost steel tends to have a low labour input. Thus low-wage producers tend to lose much of their advantages in supplying distant markets with low-cost steels. However, most producers or producing regions tend to sell chiefly in the markets closest to them. (See Appendix IX).

From this brief foray into the economics of steel production, the following conclusions can be drawn:-

1. That a tide water location with a deep anchorage enables a steel plant to render insignificant many of the disabilities arising from its distance from sources of raw materials;

2. That despite this minimization of transport costs, there remains a margin which yields plants, located so as to remove the need to transport either ore or coal, additional advantages;

3. That the traditional European and American steel industries are increasingly disadvantaged by the new geography of iron ore and its concomitants;

25. Total transportation costs consist of terminal costs, i.e. those incurred during loading and unloading, plus the cost of actually transporting the goods over the intervening distance.

4. That technological change has been extensive even to the extent of rendering relatively new plants obsolescent; 27

5. Economies of scale are probably the most important source of competitive advantage in the individual plant;

6. Labour quality and costs are significant but as per capita incomes rise in steel producing countries they will lose their significance in determining competitive advantages;

7. Capital costs are significant sources of diseconomies and any plant called upon to provide housing and urban infrastructure (in any of the developed countries) would be intolerably disadvantaged; and

8. Distribution costs of finished products vary with distance to markets and are most significant in low-value-to-weigh steels.

2. The Australian Domestic Market for Steel

Steel production in Australia began in earnest during World War 1. By 1937, output had reached one million tons. In 1962, production of ingots stood at 4,062,000 tons. By 1966, total output approached six million tons. The major producing centres are Newcastle and Port Kembla, the latter being slightly the larger in recent years. A new steel plant at Whyalla has recently begun production. A blast furnace is currently under construction at Kwinana with a 450,000 ton per annum steel plant to follow before 1978.

In recent years, exports have played an increasing role in production although they have rarely, if ever, exceeded 5% of total production. The chief markets have been in New Zealand which is treated almost as a part of the domestic market, and in South East Asia when surpluses have been large. Shipments have also been made to the United Kingdom and the U.S.A. The Australian industry has displayed a competitive advantage in the export trade. At the same time, there has been a steady flow of imports to Australia as Figure 3-1 shows. However, in the last decade, these have shown signs of tapering off as more and more specialized products are produced by the local industry.

The decreasing significance of imports stems from the increasing economies of scale offered by the expanding local markets, the national autarchic trade and tariff policies which are used to protect 'infant industries', and the surprising fact that Australian steel has been among the cheapest in the world. Considering Australia's relatively high labour costs, and the dispersed sources of supply of raw materials (some iron ore is shipped about 3,000 miles around the continent) and the diseconomies created for the industry by State Governments bent on obtaining steelworks in their states, the low-cost structure of the industry can only be traced to its present monopolistic character. The Broken Hill Proprietary Company Limited (B.H.P.) is Australia's only producer of steel. Obviously economies

29. ibid, pp.362-4.
31. Both the South Australian and Western Australian State Governments have made the establishment of an iron and steel industry a condition for permitting exploitation of iron ore deposits in their states.
FIGURE 3 - 1.
Growth of Production and Apparent Consumption of Steel, Australia, 1947-65.

- Local Production in Long Tons for year ending June 30; (1)
- Local Production plus Imports; (1)
- Apparent Consumption; (1)
  (in terms of steel ingots and finished and semi-finished steels).
- Crude Steel Production in Short Tons. (2)

Sources:
of scale, tide-water plant locations and a high standard of efficiency contribute heavily to the company's ability to produce at low costs. Its highly integrated operation—it owns its own coal and iron ore mines, its own bulk carriers, and has forward linkages into many of the steel processing industries as well as diversifications into such fields as cement mills, natural gas production, manganese mining, etc.—contribute substantially to its over all position. It has also been in the happy position of being able to operate its plant at full capacity, allowing demand to lead supply.

The situation is changing. A small steel industry in being developed in New Zealand. The recent iron ore discoveries have destroyed B.H.P.'s assumed monopoly of Australian major iron ore reserves although the company has benefited substantially from them—it holds one lease in the Pilbara and is associated with the Mount Newman project, the largest of all present proposals. More significantly, the domestic market is expanding steadily and it is now sufficiently large to make the prospect for a second domestic producer entering the market much less forbidding.

Assuming per capita consumption of steel in Australia in 1963 was about 417 kilograms. Assuming that the average annual increase in G.N.P. per capita to 1975 is 2%, and that G.N.P. per capita

34. Hughes, op cit, refers to BHP's belated attention to consumer requirements. See also Figure 3-1.
35. 'Striking It Rich Down Under', op cit.
in Australia was $1,718 in 1963,\textsuperscript{38} by 1975, per capita consumption will probably exceed 500 kilograms.\textsuperscript{39} With an expected 1975 population of 14,840,000,\textsuperscript{40} total domestic consumption should approach 7,600,000 metric tons. This is probably a very conservative estimate in the light of recent growth.

Assuming that B.H.P's capacity is presently 6 million tons and that its Kwinana Plant comes into operation before 1975, there remains a gap of approximately 1 million tons to the domestic market requirements. There is little doubt that B.H.P. has an on-going expansion program at Port Kembla and Newcastle and it probably has the ability to bridge this gap.\textsuperscript{41}

However, given the present emphasis on the growth of manufactured goods and an aggressive selling campaign at home and overseas, this apparent one million ton capacity short-fall could well be greatly increased. This is the market which any new producer would presumably attempt to penetrate.

Who are the potential entrants to the market? At the present time there appear to be three potential contenders - Mount Newman and Hamersley in the Pilbara and the 'Savage River group' in Tasmania.


\textsuperscript{39} Based on the coefficients relating GNP per capita to apparent steel consumption per capita in high income nations derived by the Economic Commission for Europe, \textit{Long Term Trends and Problems of the European Steel Industry} (Geneva, 1959), p.121. See also Appendix XII.

\textsuperscript{40} Commonwealth of Australia, \textit{Projection of the Workforce}, A supplement to the \textit{Treasury Information Bulletin}, April, 1965.

\textsuperscript{41} It has reportedly agreed to take 2 to 3 million tons of ore per annum from the Mount Newman project. 'Striking It Rich Down Under', \textit{op cit.} This seems to indicate a major expansion of capacity.
The Hamersley Iron and the Savage River groups have announced intentions of establishing steel plants. One of the major issues will be the ability of the various contenders to raise the capital for the projects - bearing in mind that BHP, as Australia's largest public company, has ready access to reserves and to the stock market.\textsuperscript{42} Considerations of this aspect is beyond this study.

There are locational aspects of the issue which are within the study's ambit. The bulk of the Australian market for steel lies in Sydney and Melbourne and to a lesser extent, in Adelaide.\textsuperscript{43} BHP has plants close to Sydney and Adelaide. Its Kwinana plant will be able to meet the demands of the Western Australian market for the foreseeable future and it is located at the main market. The major market not close to an existing plant is Melbourne. Assuming that the entry of a second producer would promote competition and would result, at least, temporarily in the abolition of the uniform capital city price for steel, the Melbourne market appears to be BHP's most vulnerable spot.

In competition for the Melbourne market, a Tasmanian plant, either located in Tasmania using hydro-electric power or imported coal or char;\textsuperscript{44} or in Victoria using pellets and char or natural gas, would have substantial advantages over any plant in the Pilbara or anywhere else in Western Australia. BHP's existing plants would enjoy somewhat similar advantages.

\textsuperscript{42} ibid.


\textsuperscript{44} Char is almost pure carbon obtained by the enrichment of lignite. Victoria has huge reserves of lignite which will lose much of their present value as sources of electric power following recent discoveries of natural gas in the area.
This is not to say that a Pilbara plant could not achieve any penetration of the domestic market. Through a careful pricing strategy, it obviously could. But unless its costs were considerably below those enjoyed by other domestic producers, it would, in effect, be 'dumping' its products on the domestic market. This may be an effective strategy if it enables economies of scale in production to be increased. It would be, however, a significant departure from the present marketing strategies of the majority of steel producers.

3. The World Steel Market.

With the exception of producers in small states such as Luxembourg, steel producers have traditionally looked upon the domestic market as their major market. In some nations, colonies and former colonies have been regarded as extensions of the domestic market. Exports are regarded as a means of disposing of domestic surpluses. It behoves any nation to have excess capacity in steel production partly for strategic reasons and partly because of the long gestation period of investment in the industry compared to the volatility of domestic demand. As a result, world steel prices have tended to reflect the economic conditions in the major producing areas - the United States and Western Europe.

If a Pilbara industry is unable to find adequate outlets in the domestic market to enable it to produce with reasonable economies of scale, it must seek outlets in the international market. In doing so, it faces experiences novel to any steel maker. What conditions might exist in this market which so long has been regarded as a safety valve for major producers against over-production?

Studies of the world steel market are not common. The landmark study is that conducted by the United Nations Economic Commission for Europe in 1959.45

45. Long Term Trends and Problems of the European Steel Industry, op cit.
Among their findings, was the fact that the level of per capita consumption of steel in any country was closely correlated to such economic indicators as gross national product per capita. Moreover, their studies revealed that at very low levels of economic development, steel consumption appears to rise ahead of the level of economic welfare.\(^{46}\)

When this evidence is linked to the current attempts by the underdeveloped nations to improve their levels of welfare, the obvious inference is that there must be a tremendous rise in world steel consumption. However, continued imports of steel to aid economic development place a severe strain on the foreign exchange balances of these countries. Further, it is argued that to progress relative to the developed nations, these countries must industrialize rapidly.\(^{47}\) The development of local steel production thus appears a step towards the solution of both problems. The proliferation of steel producers amongst the developing nations in recent years is evidence of their endeavours in this field.\(^{48}\)

But the development of a local steel industry is not without problems. First, the total market is often small, so scattered and demands such a variety of products, that it is impossible to achieve any real economies of scale.\(^{49}\) Second, because of the lack of knowledge and skill, attributable to the dominance, until recently, of the traditional society, the steel produced

\(^{46}\) ibid, pp.118-124. \(^{47}\) Prebisch, op cit.


is often of poor quality and plant and machinery are often allowed to fall into disrepair, further impairing efficiency. Third, the very process of economic development which the local industry helps to bestir, creates demands for more, and a wider variety of steel products; overall consumption expands rapidly and imports expand rather than diminish. Fourth, despite technological changes favouring small plants, an integrated steel works still entails a substantial investment of capital, a large part of which must come from domestic savings even if aid is available. Poorer countries may often find this beyond their savings capacities.

The development of local steel industries has had the effect of reducing the export markets of the older producing areas. As Table 3-2 shows, despite rising consumption of steel in the developing areas, imports have remained stable. But the proliferation of new steel industries may be slowing. A recent survey of Asia and Africa reveals only one country, not now a producer, has given a high priority to local steel production. This may reflect the present falling world prices for steel due to overproduction in Europe and the U.S.A. as well as increasing competition from Japan in markets previously dominated by the U.S. and Europe. It may also be linked to the reduced scales of activity in aid-dispensing by the two major powers - the U.S.A. and U.S.S.R. Any changes in the priority of steel production are bound to be of growing significance in the ensuing decades

50. 'Indian Steel - Vision in Shreds', op cit.

51. A paper by the UNECE, 'Present and Future Trends of Production and Consumption of Pig-iron and Steel in Europe and the United States' delivered at the United Nations Interregional Symposium, op cit, refers to this effect, p.94.

### TABLE 3-2

Apparent Consumption of Steel by Developing Regions; 1950, 1957 and 1963. (In thousands of metric tons)

<table>
<thead>
<tr>
<th>Region</th>
<th>Imports</th>
<th>Production</th>
<th>Exports</th>
<th>Apparent Consumption</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1950</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Far East</td>
<td>1865</td>
<td>6231</td>
<td>271^a</td>
<td>7915</td>
</tr>
<tr>
<td>Middle East</td>
<td>970</td>
<td>-</td>
<td>-</td>
<td>970</td>
</tr>
<tr>
<td>Africa</td>
<td>1232</td>
<td>839</td>
<td>-</td>
<td>2071</td>
</tr>
<tr>
<td>Latin America</td>
<td>2143</td>
<td>1235</td>
<td>-</td>
<td>3378</td>
</tr>
<tr>
<td>Total</td>
<td>6210</td>
<td>8395</td>
<td>271</td>
<td>14334</td>
</tr>
<tr>
<td><strong>1957</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Far East</td>
<td>4796</td>
<td>20061</td>
<td>240^a</td>
<td>24617</td>
</tr>
<tr>
<td>Middle East</td>
<td>1128</td>
<td>-</td>
<td>-</td>
<td>1128</td>
</tr>
<tr>
<td>Africa</td>
<td>1735</td>
<td>1804</td>
<td>-</td>
<td>3539</td>
</tr>
<tr>
<td>Latin America</td>
<td>4109</td>
<td>2716</td>
<td>-</td>
<td>6825</td>
</tr>
<tr>
<td>Total</td>
<td>11768</td>
<td>24581</td>
<td>240</td>
<td>36109</td>
</tr>
<tr>
<td><strong>1963</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Far East</td>
<td>4173</td>
<td>50163</td>
<td>3458^a</td>
<td>51978</td>
</tr>
<tr>
<td>Middle East</td>
<td>1770</td>
<td>157</td>
<td>-</td>
<td>1827</td>
</tr>
<tr>
<td>Africa</td>
<td>1602</td>
<td>2884</td>
<td>171^b</td>
<td>4315</td>
</tr>
<tr>
<td>Latin America</td>
<td>2227</td>
<td>6622</td>
<td>-</td>
<td>8849</td>
</tr>
<tr>
<td>Total</td>
<td>11768</td>
<td>59826</td>
<td>3629</td>
<td>66969</td>
</tr>
</tbody>
</table>

^a Japanese exports to regions other than the Far East.

^b South African exports to regions other than Africa.

**Note:** Far Eastern apparent consumption excluding Japan rose from 12,690,000 tons in 1957 to 22,301,000 tons in 1963.

**Sources:** U.N. Statistics of World Trade in Steel, 1963; and Long term Trends and Problems of the European Steel Industry.
for, if economic progress is generated without local steel production or with limited steel production, the demand for steel imports can only be magnified.

While interregional trade between the developed and the developing regions is significant, it is the smallest of the three components of the world trade in steel. Intraregional trade dominates world trade in tonnages shipped whilst interregional trade between producing areas has been of steadily growing importance. Intraregional trade is largely confined to Europe and results from the tabulation of national trade data for what is virtually a single supra-national market. The flow of steel between the countries of the European Coal and Steel Community is not without significance. It reveals the high degree of specialization of process existing in the modern steel industry to enable economies of scale to be maximized. It also represents attempts to overcome the locational disabilities of the older steel plants with their massive capital value which prevents their abandonment. Thus steel plants at tide-water carry out the primary processing and ingots are shipped to areas such as the Ruhr for finishing.

Traditionally, European producers have been small companies but now governments are encouraging mergers so that greater economies of scale can be achieved. Despite the emergence of a number of large, new tide-water producers, the small plants continue to produce. As production has overran demand, plant

53. The regions adopted in this study are those used by the United Nations in reporting world trade in steel.

54. 'Trouble for Steel', op cit. p.64

utilization levels have plunged. The cartels and trade associations which formerly organized steel production at a world level have been badly shaken by the newer Japanese steel industry and by the growth of production in, what were once, export markets. Adding to the confusion is the tendency for these new producers to sell at low prices in the world market to sustain through-put in their plants at levels sufficient to maintain domestic prices.

British interests are currently seeking a world conference to rationalize steel production. The ECSC is attempting to gain powers to regulate European production while national interest groups are objecting, fearing for their own position. The American steel industry's reply to its loss of comparative advantage in the world export trade and in its own domestic market (to imports and to alternate materials) was, first, to set about an ambitious building program to modernise its equipment but, more recently, it has suggested that protective measures be extended to it against imports. The often-state-subsidized producers in the developing countries are immune to the crises behind their tariff walls. Meanwhile, the Japanese industry, with its government-guided voluntary cartel to plan investment in the industry, proceeds to shatter all plans and announces that output in 1975 will be up by 66% on 1966's record production of 48 million tons.

56. See news item, The Economist February 4-10, 1967.
57. 'The World Battle for Steel', op cit.
59. 'Steel is Rebuilding for a New Era', op cit.
60. A suggestion emanating from the American Iron and Steel Institute, in the last week January, 1967.
Many of the changes in the international market for steel can be traced to the Japanese industry's appearance as the world's third largest producer after U.S.A. and U.S.S.R. Nowhere is this more evident than in the interregional trade between the producing regions. The U.S.A. is the world's largest steel market. It is a high cost market. Following industrial disputes in the U.S.A. in 1958, imports from Japan and Europe increased markedly. Japan's increasing comparative advantage, in contrast to Europe's decreasing advantage, lead to a rapid expansion in Japan's exports to the U.S.A. In 1966, Japan supplied 4 million tons to the United States, comprising 44% of Japan's exports in 1966. In 1964, Japan supplied 38% of U.S. imports and this percentage has probably since increased.

This feat by Japan has realigned the whole pattern of world trade. It provides one indication for the future - provided the current conferences on the freeing of world trade are successful. Japan has shown that a comparative cost advantage is the key to success in the international market. However, this advantage is tempered by the distance between plant and market. Thus Japan has successfully achieved domination over the Far East and Oceania markets by virtue of lower production costs and proximity. It has successfully penetrated the American market on both coasts because its marginal advantage is sufficient to offset the transportation costs involved. It has achieved considerable success in the African market although European producers, who are closer and have traditional links, continue to dominate it.


63. 'Steel is Rebuilding for a New Era', op cit.

It has achieved an increasing share of the declining Latin American import markets. The only market where Japan has not recorded consistent success is in Europe. Apparently, its production cost advantages are not sufficient to offset the combined transportation costs incurred and European tariffs.

It would be naive to believe that the ability to market steel at lower prices is determined by costs alone or that price is the sole determinant of market penetration. There can be little doubt that export prices are designed to be what the market will bear rather than to cover costs incurred. Thus only in areas of intense competition will prices tend to approximate costs. Such conditions may prevail at the present time and it seems probable that they will continue. Matters such as the terms of credit, financing, reciprocal trade arrangements, traditional supply sources, common language and a host of other non-economic factors cloud the truly competitive situation. Despite these, it is evident that Japan has expanded its market in size and scope. It seems that once a market has been successfully breached, by exporters gaining a greater awareness of its needs and by importers finding reliable sources of supply, trade tends to expand. There is also the classical economic thesis that as prices fall, demand will increase thus expanding the market available.

How then might a Pilbara plant fare in the international market? Assuming it can achieve production costs as low as those in Japan (and on past performance of the Australian steel industry, this is not impossible) it might then be successful in competing with Japanese producers in those markets where it has a transport cost advantage. These might be called its 'logical' export markets and they clearly lie in South Asia and East Africa. Second, there is the possibility of a Pacific trading bloc being created and, within that, the Pilbara plant might be able to find markets in Japan for semi-finished products. This would arise partly
through the increasing size of the Japanese market attracting interregional trade and partly because the Japanese may choose to use their increasingly scarce labour resources in more productive processes.

Third, there is little doubt that sales could be made in the United States and possibly British markets. Fourth, there is the undeniable presence of 'random sales' in the international market which may favour a low cost Australian producer despite his comparative isolation.65

The conclusion must be reached that for a Pilbara steel industry to succeed in the international export market, it must be able to match Japanese production costs. If it can do so, it should be able to dominate the steel trade in those countries around the Indian Ocean in so far as their markets are responsive to price levels. Furthermore, it should be able to compete favourably in other world markets particularly as it may be able to offer long term contracts at fixed prices since its export capacity will not be seriously affected by domestic market fluctuations.

4. The Magnitude of World Production and Trade

World steel production has risen from 155 million metric tons in 1948 to approximately 455 million in 1965.66 The E.C.E. has offered projections of future growth of production.67 In 1959, they estimated that by the period 1972-75 (their computations were for 1972), world output would approach 630

65. Such as large shipments from Japan to Italy and Spain.


120.

million metric tons. This projection appears to have been conservative over the period 1957-1964. However, world output since 1964 has failed to increase at the previous rate. Preliminary estimates for 1966 show little increases in 1965 output.68

More recently, the ECE has returned to the study of future world production and have offered projections to 1970. Their most probable estimate for that year is 580 million metric tons with a range from 535 to 630 million tons depending upon world economic conditions.69 Extrapolating their projection, Miller has suggested world production in 1975 may be in the order of 750 million metric tons and 1000 million by 1980. However, by an alternate method, estimates of 690 and 630 million metric tons have been achieved.70

Accepting the lowest figure of 630 million tons by 1975, implies that world output will increase by 40% in less than ten years. Offsetting this increase is the alleged over-capacity in the world steel industry. One estimate places current world capacity at 530 million tons71 but, as the United States has not issued any figures on capacity for seven years at which time it had 70 million tons of overcapacity,72 it is probably much in excess of this. Mere capacity to produce is no longer a meaningful concept; obsolescence is a very real influence in the modern steel industry. Productive capacity should thus be replaced by some measure such as 'profitable' or 'competitive' capacity. In all probability, world 'competitive' capacity is below present world output.

70. ibid.
72. 'Steel is Rebuilding for a New Era', op cit.
World trade in steel has virtually tripled since 1950 (Table 3-3). However, it has remained comparatively small relative to world production - at about the 10% level. It seems probable that in the present oversupplied world market, tonnages shipped will rise to new high levels. It is mainly intraregional trade which is of little significance to any Australian producer. It is the growth of interregional trade which is important. This has been growing more slowly. Whilst it is impossible to make worthwhile projections of world trade, it appears likely that by and large it will increase due to increasing trade between producers and increasing demands from developing countries.

Figure 3-2, reproduced from the ECE study,73 illustrates the products involved in trade. When consumption levels are low, i.e. when incomes are low, the chief demand is for steel for investment purposes, i.e. permanent construction and production and transportation equipment. As incomes rise, demand for consumption and for production and transportation equipment purposes rises, whilst that for permanent construction materials falls until, at high levels of income, consumption demands exceed investment. Consumption steels are largely flat products used in manufacturing automobiles, appliances, cans, etc. whilst investment steels tend to be sections, railway track materials, etc.

In addition to this trade, as incomes rise, there is a sharp rise in the demand for special steels - alloy steels, coated steels, etc. Also as income rises and prices become relatively less important, quality standards rise. Concurrent with this, mass production leads to the production of special widths and thicknesses for specific purposes.74

73. Long Term Trends and Problems of the European Steel Industry, op cit.

74. "Steel is Rebuilding for a New Era", op cit.
### TABLE 3-3


<table>
<thead>
<tr>
<th>Importing Regions</th>
<th>Exporting Regions</th>
<th>West Europe</th>
<th>East Europe</th>
<th>North America</th>
<th>Japan</th>
<th>Australia</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1950</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oceania</td>
<td></td>
<td>794</td>
<td>-</td>
<td>96</td>
<td>83</td>
<td>41</td>
<td>1014</td>
</tr>
<tr>
<td>Far East</td>
<td></td>
<td>996</td>
<td>427</td>
<td>169</td>
<td>271</td>
<td>2</td>
<td>1865</td>
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<td></td>
<td>722</td>
<td>3</td>
<td>244</td>
<td>1</td>
<td>-</td>
<td>970</td>
</tr>
<tr>
<td>Africa</td>
<td></td>
<td>1112</td>
<td>-</td>
<td>99</td>
<td>22</td>
<td>-</td>
<td>1233</td>
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<tr>
<td>North America</td>
<td></td>
<td>1232</td>
<td>-</td>
<td>937</td>
<td>24</td>
<td>-</td>
<td>2193</td>
</tr>
<tr>
<td>Latin America</td>
<td></td>
<td>1345</td>
<td>10</td>
<td>644</td>
<td>144</td>
<td>-</td>
<td>2143</td>
</tr>
<tr>
<td>West Europe</td>
<td></td>
<td>4849</td>
<td>143</td>
<td>588</td>
<td>-</td>
<td>3</td>
<td>5553</td>
</tr>
<tr>
<td>E. Europe &amp; USSR</td>
<td></td>
<td>209</td>
<td>495</td>
<td>4</td>
<td>-</td>
<td>-</td>
<td>708</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td>11259</td>
<td>1078</td>
<td>2751</td>
<td>545</td>
<td>46</td>
<td>15678*</td>
</tr>
</tbody>
</table>
*Excludes 171200 tons of unallocated world trade.

| **1957**          |                   |             |             |               |       |           |       |
| Oceania           |                   | 440         | -           | 35            | 8     | 98        | 581   |
| Far East          |                   | 2316        | 721         | 937           | 644   | 178       | 4796  |
| Middle East       |                   | 932         | 78          | 99            | 19    | -         | 1128  |
| Africa            |                   | 1599        | 10          | 88            | 37    | -         | 1734  |
| North America     |                   | 1296        | -           | 1513          | 48    | 32        | 2889  |
| Latin America     |                   | 2440        | 101         | 1539          | 30    | -         | 4110  |
| West Europe       |                   | 10450       | 425         | 857           | 21    | 9         | 11762 |
| E. Europe & USSR  |                   | 1179        | 2080        | 25            | 13    | -         | 3297  |
| **Total**         |                   | 20652       | 3415        | 5093          | 820   | 317       | 30297*|
*Excludes 470,000 tons of unallocated world trade.
## Exporting Regions

<table>
<thead>
<tr>
<th>Importing Regions</th>
<th>West Europe</th>
<th>East Europe</th>
<th>North America</th>
<th>Japan</th>
<th>Australia</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1963</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oceania</td>
<td>238</td>
<td>-</td>
<td>27</td>
<td>222</td>
<td>166</td>
<td>653</td>
</tr>
<tr>
<td>Far East</td>
<td>868</td>
<td>386</td>
<td>1047</td>
<td>1824</td>
<td>48</td>
<td>4173</td>
</tr>
<tr>
<td>Middle East</td>
<td>1193</td>
<td>300</td>
<td>90</td>
<td>87</td>
<td>-</td>
<td>1670</td>
</tr>
<tr>
<td>Africa</td>
<td>1323</td>
<td>60</td>
<td>62</td>
<td>152</td>
<td>5</td>
<td>1602</td>
</tr>
<tr>
<td>North America</td>
<td>2645</td>
<td>7</td>
<td>861</td>
<td>1623</td>
<td>30</td>
<td>5166</td>
</tr>
<tr>
<td>Latin America</td>
<td>1168</td>
<td>198</td>
<td>438</td>
<td>411</td>
<td>12</td>
<td>2227</td>
</tr>
<tr>
<td>West Europe</td>
<td>19328</td>
<td>1333</td>
<td>461</td>
<td>618</td>
<td>48</td>
<td>21788</td>
</tr>
<tr>
<td>E. Europe &amp; USSR</td>
<td>1586</td>
<td>5102</td>
<td>-</td>
<td>345</td>
<td>-</td>
<td>7033</td>
</tr>
<tr>
<td>Total</td>
<td>28349</td>
<td>7386</td>
<td>2986</td>
<td>5282</td>
<td>309</td>
<td>44312*</td>
</tr>
</tbody>
</table>

*Excludes exports of 273,000 tons from South Africa.
FIGURE 3 - 2.

The relationship between the percentage share of consuming sectors in total apparent steel consumption and total per capita consumption of steel.

The low income countries of the Indian Ocean area will be seeking non-flat products. These are also the low-value steel products and are the ones most likely to be sought by the Japanese if they should decide to concentrate on more productive types of manufacture. Second, these low-value steels require fewer man-hours per ton of product and less capital input than do flat products. Third, their delivered prices are the most sensitive to freight differentials. By concentrating on the production of non-flats in its early stages, a Pilbara industry would be tending to minimize its potential cost disabilities. However, the market for these products is limited, vis-a-vis that for flat products and, ultimately, a switch to production of both would be desirable.

5. The 'Logical' Export Market for the Pilbara

The logical market areas for a Pilbara industry would be in South Asia and East Africa. The Japanese are the strongest potential competitors. It would be naive to think that any market area is thoroughly protected because the supplier has advantages of proximity. The principle of least effort75 does tend to apply to market areas,76 but, rather than enunciating specific boundaries, it indicates the probabilities of one or the other supplier being chosen by any customer. Market areas are a continuum. Appendix X sets out a mathematical formulation which would determine how a Pilbara steel industry might fare in the face of competition from Japan assuming that production costs are equal and potential markets known and that the exogenous variables are the costs of transportation.

Assuming that proximity does offer some marginal advantages and that the costs of production in the Pilbara can match Japanese

costs, what is the extent of the market in the Indian Ocean area? How large is it? What competition is probable? What growth prospects does it offer?

A Pilbara plant would be a closer source of supply than Japan to Malaya and Indonesia and to all markets west of these in the Indian Ocean. Because of the growing South African steel industry which is supplying the white-dominated enclave in southern Africa, Mozambique should probably be considered the westernmost extent of the market. Beyond the Cape of Good Hope, European suppliers tend to gain the advantages of proximity in the Congo and points further North. In the Red Sea area, Italian producers have a clear transport-cost advantage; although the industries of north-western Europe have no such clear advantage. Japan has penetrated the markets of Ethiopia (where Japan is installing a steel rolling plant) and of Saudi Arabia.

In 1963, imports of finished and semi-finished steel products into this area amounted to 3.5 million tons. Japan's share of this market comprised some 760,000 tons, or roughly 20%. In 1958, Japan exported over 600,000 tons to the area. In 1959, this fell to under 400,000 tons but climbed again to over 600,000 tons in 1960. In 1965, exports appear to have exceeded 500,000 tons.

The largest markets in the area are those of India, Pakistan and Iran. Indian and Pakistani imports are largely composed of shipments from the U.S.A. under tied aid agreements.77 No other markets in the area are rigidly tied to any source. The oil producing countries of the Middle East have heavy requirements for tubes which limit possible suppliers.

77. Norris, op cit.
Within the market area only India possesses a substantial domestic steel industry. Indian production is in the order of six million tons annually. Under India's planned economy, steel is a public sector industry and the Second and Third Plans placed great emphasis upon the expansion of the industry. In 1963, production targets for 1966 were about 10.2 million tons, for 1970 at 18 million tons and for 1980, 50 million tons. The current food crises and the need to place greater emphasis on food production, aid and internal financing difficulties, inefficiency and shortages of coal have resulted in present estimates of 8.9 million tons output in 1968 and 14.8 tons in 1970-1. With these revised estimates, India's per capita consumption of steel may be well above that normally associated with its income level, but it will still be tiny compared to the major industrial countries at about 30 kilos per head. India had anticipated that steel would become an export but this does not now appear probable. However, pig iron and ore are being shipped to Japan.

In contrast to India, Japan has constantly exceeded its production targets. Thus in 1962, output in 1970 was estimated at 48 million tons. By 1963, this had been brought forward to 1968 but this production was reached in 1966. Present projections suggest an output of 80 million tons in 1975. This rapid growth has


79. 'Indian Steel - Vision in Shreds', op cit.


82. 'Review of the Iron and Steel Industry in the ECAFE Region', op cit.

been spurred mainly by a booming domestic economy and the rising success of Japanese manufactured goods in export markets. As Table 3-4 indicates, exports of steel have been increasing substantially but the greater part of this growth has accrued in the United States trade.

The only other major competitor in the region is South Africa where a 1963 output of 2.8 million tons is expected to swell to 5 million tons by 1970. South Africa's racial policies appear an impediment to the expansion of its trade beyond Rhodesia and Mozambique. In addition, South Africa is already an importer of Japanese steel. Various other countries in the area are steel producers but their production is limited to scrap recovery operations. Almost all have plans for integrated steel works but there is a great difference between having plans and being a producer. In any case, few of the announced plans (see Appendix XI) involve plants likely to enter export markets and most are of the size that will tend to stimulate local demand rather than obviate the need for imports.

In Appendix XII, an attempt is made to forecast future growth of these markets. The results suffice to show that the indiginous market in this area is unlikely to grow substantially over the next decade. Assuming increasing local production, it may be advisable to base future market estimates for the area on current levels.

If the region can presently sustain imports in the order of 3.5 million tons per annum and if Japan can supply 20% of these markets, a Pilbara plant with similar production costs should be able to capture at least an equal share of the market from more distant suppliers and from Japan.

---

84. 'The World Battle for Steel', *op cit.*
## TABLE 3-4

Crude steel production and steel products exported, Japan.

<table>
<thead>
<tr>
<th>Year</th>
<th>Production in millions of metric tons</th>
<th>Exports in millions of metric tons</th>
<th>Percent Exported</th>
</tr>
</thead>
<tbody>
<tr>
<td>1956</td>
<td>11.160</td>
<td>1.372</td>
<td>12</td>
</tr>
<tr>
<td>1957</td>
<td>12.507</td>
<td>1.059</td>
<td>8</td>
</tr>
<tr>
<td>1958</td>
<td>12.181</td>
<td>1.837</td>
<td>15</td>
</tr>
<tr>
<td>1959</td>
<td>16.692</td>
<td>1.807</td>
<td>11</td>
</tr>
<tr>
<td>1960</td>
<td>22.183</td>
<td>2.507</td>
<td>11</td>
</tr>
<tr>
<td>1961</td>
<td>28.286</td>
<td>2.513</td>
<td>9</td>
</tr>
<tr>
<td>1962</td>
<td>27.564</td>
<td>4.132</td>
<td>15</td>
</tr>
<tr>
<td>1963</td>
<td>31.510</td>
<td>5.638</td>
<td>18</td>
</tr>
<tr>
<td>1964</td>
<td>39.799</td>
<td>6.930</td>
<td>17</td>
</tr>
<tr>
<td>1965</td>
<td>41.116</td>
<td>9.909</td>
<td>24</td>
</tr>
<tr>
<td>1966</td>
<td>48*</td>
<td>8.909**</td>
<td>-</td>
</tr>
</tbody>
</table>


**Estimate for the period January to November inclusive. Source: as above.

From this survey of markets, no firm conclusion can be drawn about the size of the market available to a Pilbara-based steel industry. It does not seem unrealistic to think of a plant of one million ton capacity operating in the Pilbara. Since scale is the key factor in cost structure, any plant of lesser capacity would be severely handicapped. A division of output of, say, 200,000 tons to the local domestic market, 500,000 tons to the Indian Ocean market and 300,000 tons of random sales (including those to the U.S. and U.K.) might be a reasonable first estimate of the markets to be sought by a million tons annual capacity plant in the middle of the next decade. The ability of the plant to compete in the export market hangs on one point—and on one point only—that it can achieve production costs equal to or less than those prevailing in the Japanese steel industry.

Moreover, in suggesting that a plant might begin to operate in the mid-seventies, the growth of the market has not been treated as the limiting factor. There is little doubt that a Pilbara plant with sufficiently low production costs would find outlets for its products in present markets just as satisfactorily as in any future market. In suggesting the mid-seventies as a target date, the physical limitations upon building such a plant and on getting it into efficient production within 8 or 10 years have been taken as the limiting factor. If intensive research and design began in 1967, the plant could be processing by, say, 1974 but to reach maximum capacity would probably take another 3 to 5 years. Thus the mid to late seventies are about the earliest possible date at which a steel industry in the Pilbara could be expected to be producing efficiently.

6. Costs at a Pilbara Location

Some comments may be made on the validity of the assumption that
a plant located in the Pilbara would be able to produce steel at a cost competitive with Japanese producers. The variables which could influence costs should be isolated and the contribution of public policies towards the minimization of any adverse effects they may have should be examined.

In the first section of this chapter, a series of factors which appear to be the most influential in determining competitive advantage in the steel industry, were discussed. The discussion returns to these factors and considers their probable effects upon a Pilbara steel industry. Since these factors tend to operate at the plant level, the following discussion centres around a hypothetical plant of one million tons annual capacity and involves a comparison of the relative costs incurred by a Pilbara plant and by a Japanese plant, both plants being at tide-water locations. It is assumed throughout the discussion that the Japanese plant will be drawing its ore and coal requirements from the same Australian sources as the Pilbara plant. This assumption is justified by the tendency for Australia to become one of Japan's major sources of these raw materials. 85

A. Raw Materials Costs.

Ore: The Pilbara plant would enjoy a substantial advantage in ore costs. It would avoid sea-borne transportation costs and because of the integration of the mining and steel-producing operations, the profit margin on ore sold to foreign producers could be eliminated. Pilbara ore costs about $8.20 per ton f.o.b. 86 It costs in the vicinity of $2.00 per ton to

85. Australia supplied 45.1% of the imports of coking coal in the Jan-Aug. period of 1966 and with ore shipments of about 400,000 tons per month, Australia ranks about fourth as a supplier (after India, Chile and Malaya). Items in Japan Iron and Steel Monthly, No. 144, January, 1967.

86. Based on 65.5 million tons to be supplied by Hamersley Iron being worth $540 million (Appendix II). Ore prices vary with the quality and size of ore. Prices are falling slightly.
transport it to Japan. Therefore transport costs are about 20% of the total cost landed in Japan. A Pilbara plant would presumably gain by avoiding costs of loading (presently in the cost of ore) and unloading in Japan. Estimates of costs of production for Pilbara ore are not available but it appears that a Pilbara plant may enjoy a cost advantage of from 25% to over 30% over Japanese consumers of ore.

Coal: The closest known major sources of coking coal to Pilbara lie in Central Queensland. At Gladstone and at St. Lawrence, facilities are in operation, or being erected, to handle high volume exports of coal to the Japanese markets. Gladstone will be the main port. If it is assumed that the price of coal f.o.b. Gladstone is the same to each buyer, transportation costs then become the key to low assembly costs. One estimate suggests that coal could be shipped from Gladstone to Port Hedland at less than $4.00 per ton for the 2600 mile trip. (No specification of size of carrier or whether backloading was included is available).

Coastal shipping in Australia is costly because of the use of Australian-built ships manned by Australian crews. Currently, the bulk carriers used on coastal shipping services are in the 10-15,000 ton class - a far cry from the 50-100,000 ton ships being used in the international bulk shipping trade. Since unit cargo costs fall as size increases, the use of larger vessels might well cut the cost of shipping coal to the Pilbara. Moreover, modern vessels require much smaller crews than those

87. Roland Bird, op cit.

88. Information in a personal communication from the Director of Technical Services, Queensland Department of Industrial Development.
now in service so that the introduction of new ships to the trade would substantially reduce operating costs by reducing labour costs.

In addition, since Gladstone possesses considerable potential as a major industrial centre and has large coal reserves and the potential for large quantities of thermal power, it may be possible to develop either a second steel plant at Gladstone or to locate plants there to produce special steels, etc. By doing so, the freight costs would be further reduced because the vessels would be travelling laden over both legs of the round trip. This will probably have to be a long-term project because of Gladstone's decided disadvantages in proximity to markets when compared to a Japanese or Pilbara location. By establishing a small plant at Gladstone, the Pilbara companies would be better located to take advantage of the main Australian market. 89

Recent costs of shipping coal to Japan have been in the order of $4.00 per ton. 90

**Scrap:** Australia is a net exporter of scrap so that some of the plant's requirements could be met from this source although freight costs could be substantial. Alternatively, local ore could be pre-reduced to feed to the converters as sponge iron.

**Limestone:** Limited amounts of limestone are available in the Pilbara and larger deposits are being investigated at North West Cape, some 200-300 miles west of the iron mining region.

89. Since BHP has a 30% share in the Mount Newman project, presumably only Hamersley Iron would be interested in such a venture.

90. Personal communications from Mr Gerald Manners, who undertook a study of bulk shipping costs for the Resources for the Future, Inc. in 1966.
To summarize, a Pilbara plant would enjoy advantages in assembly cost of ore but may be at a slight disadvantage in relation to the landed cost of coal (provided modern large carriers are engaged in the trade). Since increased throughput of ore would add economies of scale to the mining operations, the marginal costs of the additional ore needed for local production could be sufficiently low to offset the disabilities incurred in coal costs.

The conclusion drawn is that the Pilbara plant would be competitive with a Japanese plant in assembly costs of raw materials.

B. Production Costs:

**Scale:** A million ton plant would offer reasonable economies of scale in production and they should be the same in plants of equal size. However, the Japanese are tending to build bigger and bigger plants - the latest to be announced is of 10 million tons capacity. Such plants may enjoy substantially greater economies of scale than a one million ton plant. This mammoth plant is to be built over a fifteen year period from 1971. If the world market continues to expand and to favour producers at ore sources, there is no reason why any Pilbara plant could not be part of such a long-term expansion program.

**Technology:** It must be assumed that either plant would seek the most advantageous technology available to suit its particular conditions.

**Labour:** The Pilbara plant will inevitably encounter higher labour costs than its Japanese counterpart. Isolation and a rigorous climate would add to this higher cost of labour. Australian

productivity per worker may not equal that of Japanese workers because of shorter working hours, etc. and the hot climate may detract from productivity.

Two factors would tend to mitigate these disabilities of a Pilbara plant. One is the increasing level of automation in the steel industry which may cut the size of the labour force but may increase average wages. The second would be the establishment of a major urban centre about the plant so that the effects of isolation would be minimized. In the Pilbara this feature is important because Perth, the next largest centre is one thousand miles away.

Capital: Appendix VIII outlines some of the effects of variations in capital investment requirements and capital costs. They are of crucial importance in determining the viability or otherwise of a project. The availability of capital is beyond the scope of this study. However, Australian capital resources are limited and, as total costs of the plant and associated works rise, the ability to meet the capital requirements from domestic capital formation declines. Thus more and more of the project depends on foreign capital sources.

The solutions offered to reduce labour costs are capital consuming. Hence the project's feasibility will be sensitive to any variations in public policy towards investment in the new towns. Compensating for the probable total capital-needs disadvantage of the Pilbara plant would be the tendency for Japanese steel-makers to use external funds for financing and the high interest rates these expenditures incur. 92

92. Norris, _op. cit._
Summarizing, it appears that the Japanese plant may have advantages in production costs due to economies of scale and cheaper labour. Provided it could obtain relief from the bulk of the capital requirements for the provision of public goods, urban infrastructure and housing, a Pilbara plant might find its investment reduced sufficiently to enable its capital costs per ton to fall to the Japanese level. Without such relief, it would be severely handicapped in its endeavours to produce competitively.

C. Distribution Costs:
Regular shipping services from Australia to overseas ports do not pass near the north-west coast of Australia. If a plant in the Pilbara sought to use regular shipping services to carry its products to foreign markets, there would have to be an extensive rearrangement of such routes. It is doubtful if the additional mileage incurred could be justified by the cargo to be lifted. The plant may be forced to operate its own services or to depend upon chartered vessels. Because of the probability of the plant's markets being fragmented and of discontinuous demand in each market, shipments may be small and irregular; conditions ill suited to charter voyages.

In contrast, the Japanese plant would enjoy the benefits of being at a virtual terminal for world shipping services. Regular service would be available to most markets. It may thus be able to obtain cheaper freight rates and faster deliveries. Again, this is a matter beyond the scope of this study but it is one more factor clouding the feasibility of the Pilbara project.

From this cursory overview of the influences which will affect the development of a steel industry in the Pilbara, the general conclusion appears to be that the establishment is feasible provided:-
1. Every possible economy of scale is exploited;

2. The use of modern cost reducing and labour saving technology is maximized;

3. The plant is not burdened by the need to finance the provision of public goods, infrastructure and worker housing from internal funds; and

4. The plant should become the centrepiece in a joint private/public sector effort to create a viable growth point with the aim of producing a modern metropolitan area in the minimum time possible.

Moreover, it appears that the plant's competitive position is unlikely to improve as time passes. Its greatest handicap lies in its isolation and in the lack of infrastructure upon which to build an urban economy. Given present trends in the distribution of population in Australia continuing, these disadvantages may well increase in the future.

If these are the main disabilities of an export steel industry, would an alternate location, where isolation and infrastructure problems could be reduced, offer any advantages? There is only one location in Western Australia where the problems of provision of public goods and housing would not arise. That is at Kwinana. From the steel producer's viewpoint, such a location would immediately divest their plant of the key advantage of low assembly costs. Their major savings would be the availability of power and water supply, housing and the like. They may gain some agglomeration economies from proximity to BHP's steel-works. Labour costs and turnover rates would be lower, but the plant would be a thousand miles further from the
Malayan, Indonesian and Singapore markets - enough to offset any freight advantages they enjoyed over the Japanese in that area.

From the public viewpoint, adding another steel-works to Perth would undoubtedly spur its growth. However, Perth enjoys such a degree of primacy in the million square miles of Western Australia that this is scarcely a major goal. Besides the metropolis is growing quite rapidly already and would still benefit to a considerable degree if the plant were located elsewhere in the State. To attempt to estimate which location would place the greater strain on the public purse is to enter the realm of discussions of economic size of cities - a matter far from resolved.

If the steel plant is to be located in Perth rather than the Pilbara, it appears that most of the locational advantages accruing to a Western Australian steel industry will be lost and with them, the ability to maximize export sales and national economic growth; and Western Australia will have lost its best prospect for developing the north of the State.

7. Probable Urban Growth.

If a steel industry producing one million tons of steel per annum were to be established in the Pilbara, and if it is to fulfil the roles outlined in Chapter 1, viz, by achieving self-generative growth, provide a better location for the steel industry; provide a dynamic urban core for further regional development; and play a meaningful role in a national strategy pursuing depolarization: it must be large and grow rapidly. Unless the centre offers prospects of being able to fulfil these roles, it may not merit special public sector assistance.

How can the steel industry's potential to generate urban growth
be estimated? Can any realistic estimate be made of the size of the new town, ten, fifteen, or twenty years hence? What might its growth prospects beyond that period be? If it is assumed that a steel works was built on a virgin site, beginning in, say, 1970, to be operational in 1975, and employing 10,000 permanent employees in that year, can an estimate be made of the course of the new town's growth?

The only rule-of-thumb method of calculating future growth stems from the economic base theory. Put in its crudest terms, this theory would suggest that as 10,000 steel workers were engaged in 'export' activities, a further 10,000 would be engaged in the 'service' sector in supplying their needs. Assuming a 40% workforce participation rate, this would yield a population estimate of 50,000 persons. However, this does not answer the questions posed above.

The problem can be expressed graphically as in Figure 3-3. OAL is the curve relating the annual increase in population to time. The plant opens at time, B. The area under the curve OAB thus represents the population in the town at time, B. In the Pilbara case, this is estimated to be made up of 10,000 workers, some of their dependents and an unknown number of service sector workers and their dependents. The difficulty arises in attempting to determine the shape of the curve OAL. Which of the shapes shown might it adopt? Need it conform to any of these?

An Alternate Approach
Suppose a leading sector in a new town employed $X_1$ permanent

Hypothetical growth patterns of an urban area created by a single plant, construction of which begins at time 0 and which is opened at time B. The stippled area represents the growth over time of the plant's operational workforce. The area under that curve represents the magnitude of the plant's workforce.

Which of the growth patterns will the town follow? Until this can be determined, it is impossible to estimate flows of funds, capital requirements, or the long-term prospects of the town.
workers. There were no other workers in the town, which had a population, entirely dependent upon the leading sector of $Z_1$. This population would demand various goods and services and entrepreneurs would move to the town to establish businesses to meet these demands if they were considered sufficient to support a profitable venture. Suppose there were 'n' categories of goods and services which could be demanded. Each of these activities, $a_1$, $a_2$, $a_3$, ......... $a_n$, requires a minimum market of $A_1$, $A_2$, $A_3$, ......... $A_n$, before it can be operated at an economic scale. This minimum economic scale may be called the threshold market level. \textsuperscript{94}

Assuming an entirely homogenous population, these thresholds can be measured in terms of population. At its threshold level, each activity will need a minimum workforce for its operation. Let these be $T_1$, $T_2$, $T_3$, ......... $T_n$. Then if $Z_1$ exceeds $A_1$, activity $a_1$ becomes economically feasible in the town. Suppose all such opportunities are acted upon.

Let $E_1$, $E_2$, $E_3$, ......... $E_n$, be the actual employment in activities $a_1$, $a_2$, $a_3$, ......... $a_n$. Then

$$E_1 = f_1(Z_1 - A_1) + T_1,$$

where $f_1$ is a function relating employment in activity $a_1$ to the market available in excess of the threshold level, $A_1$.

Let $\phi = Z_1/X_1$. Then $z_1 = \phi E_1$, where $z_1$ is the additional population created by the entry of activity $a_1$ to the town.

\textsuperscript{94} Wilbur Thompson, \textit{op cit.}, pp.66-67, comments on the 'threshold of economic local production'. The present author has attempted to define threshold levels through central place analysis, see Murrumbidgee Shire Planning Scheme, \textit{op cit.} Part II.
If $E_1, E_2, E_3, \ldots, E_n$ are computed for a market, $Z_1$ (many of them will be of zero value because $Z_1$ lies below their threshold level), they can be added to $X_1$, and the sum multiplied by $\emptyset$ to yield $Z_2$. In turn, $Z_2$ can be tested as the new total market. The process can be repeated until $Z_n = Z_{n+1}$, when no further growth is possible.

Since $X_1$ has remained constant, the ratios, $Z_1/X_1, \ldots, Z_n/X_1$, have increased towards a limit. (If they do not, i.e. successive iterations produce larger increases in population, 'self-generative' growth has been achieved). The limiting value may be called the 'leading sector multiplier'. As $X_1$ increases, this multiplier should increase since more threshold levels will be crossed.

There are a large number of over simplifications in this approach. For example, $f_1$ cannot be a simple parameter and $T_1$ cannot be a constant. Economies of scale are possible in all activities so that as the margin $(Z_1 - A_1)$ increases, $f_1$ will decline. That is to say, the larger the town, the lower the marginal rate of increase of the employment in any one activity. At the same time, $T_1$ will tend to be a function of the rate of growth and will fall as the rate of growth increases. This will occur because of the tendency for entrepreneurs to invest in expectation of further growth in rapidly developing markets. For a crude, rule-of-thumb, these two influences can be considered as cancelling out provided the town is small. Other serious defects are the implicit assumptions:

(a) that location does not influence growth;
(b) that the population is homogeneous; and
(c) that intermediate demand is an insignificant source of growth.

95. That is until the economies of scale become large, say, under 100,000 persons.
There is no provision in this approach for time as a variable in the computation of $Z$ - the analysis is a static cross-sectional one similar to the base theory approach. Assuming that the projection of probable growth in the new town will be based on an examination of existing similar centres, the issue can be resolved somewhat more readily than with the base theory. Whereas it requires detailed analyses to compute the trends in the base ratio over time, in this approach, they can be read almost directly from empirical observations.

The leading sector multipliers of ten towns in Australia where the leading sectors are clearly identifiable, have been computed from the Censuses of 1961 and 1954 and, where data was available, from that of 1947. Using the multiplier as the independent variable, Figure 3-4 has been plotted. It is a time series analysis of the behavior of the multipliers.

As anticipated, the multiplier shows a clear trend to increase with the size of the leading sector's workforce. Three of the towns have experienced declines in the multiplier but this can generally be associated with periods of rapid expansion of the leading sector workforce.\(^96\) Where towns have experienced rapid growth in the leading sector industry in one intercensal period, it has been followed by a rapid increase in the multiplier in the following period.\(^97\) This has occurred even in towns which have experienced a decline in the leading sector's employment during the period. Canberra exhibits this

\(^{96}\) Compare the decline in the multiplier in Newcastle and Woolongong in the 1947-54 intercensal period with the great expansion of steel production in Australia in that period shown in Figure 3-1.

\(^{97}\) Mount Isa appears to be an exception. At the time of the 1961 Census, the mines were launched upon another massive expansion program which probably dampened the effect.
FIGURE 3-4.

1. Mt Isa: mining community.
2. Yallourn Works Area: electric power station.
7. Port Pirie: lead smelting.
8. Latrobe Valley Urban Area: electric power.
10. Newcastle: steel works. (city only).
lag effect very clearly as does the Latrobe Valley. Both of these areas have had the benefits of large governmental expenditures on urban facilities during the period covered. It might be said that they escaped the worst effects of the 'friction of growth'—severe housing shortages and lack of urban facilities. Other towns have had to exhibit a marked demand for these facilities before they have attracted large public expenditures on such facilities as water supply, sewerage, housing, roads and parks and playground.

Since a new town in the Pilbara might be developed in about seven years or less (i.e. to the opening of the plant), about the same time interval as shown on Figure 3-4, it seems that within that period a minimum multiplier around 3 to 3.5 could be expected. A town with 10,000 workers in the leading sector and a multiplier as low as 3.5 would seem to occupy an unstable position on the chart. Over the next seven year interval, growth should increase the multiplier substantially. The limiting factor could well be the ability of the local economy to provide the services needed by the influx.

Assuming that the new town also received assistance to escape friction of growth, the multiplier should expand to 6 or 7. However, even smaller areas, e.g. the Latrobe Valley, are displaying higher multipliers than this. Consequently, growth seems probable in the third, seven year period also when the multiplier should reach the order of 9 or more.

Thus if the steel industry was established and did employ 10,000 workers, a growth pattern as follows might be accepted as a first estimate:

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98. The Latrobe Valley experienced the beginnings of sustained industrial development (power generation from brown coal) in the late 1940's. Data for 1947 is not available but a rapid increase in employment with little change in multiplier seems evident. Note: Yallourn is virtually a company town within the Latrobe Valley area.
1982/4 - Population - 60-70,000
1990/2 - Population - 90,000.

These estimates ignore the effects of any existing population. It also ignores the effects of any other export industries which might be established in the fifteen years after the plant is opened or the effects of internal plant expansion. It does begin to give some impression of the rapidity of growth and may serve as a reasonable indication of the growth that a steel industry might generate. It would appear that such an urban growth point would be destined for self-generative growth. It has both size and rapidity of growth in its favour. The achievement of this status could be assured if a second steel industry of the same capacity was to be erected in the vicinity. The addition of any other major elements of an industrial complex would also ensure this.

**Epilogue**

The conclusions reached in this chapter can be summarised as follows:- If a viable steel industry is to be established in the Pilbara, it must be able to achieve costs of production equal to or lower than those prevailing in the Japanese steel industry. The major impediments to achieving this goal, appear to be the availability and costs of modern technological processes and the provision of adequate urban facilities (including housing) at little or no cost to the steel industry. If these conditions can be fulfilled, a steel industry could be operating in the area by the middle of the next decade and, by the end of the present century, Australia could have a rapidly developing new metropolitan area on its north-western coast.

Whether or not this comes to pass depends to a large extent upon
the policies adopted by the Federal and State Governments towards the provision of urban facilities. Before committing themselves to assist in the development of the town, the Government would need to assure themselves of its viability, of the extent of their commitments and the rate at which the town might absorb public funds. By checking against the criteria established in Chapter 1, and bearing in mind the limitations upon their use, it appears that the project is worthy of further research. Definitive answers about the data needed for a complete evaluation cannot be obtained from this study.

On Criterion 1, the export value of the raw materials needed to produce one million tons of steel is in the vicinity of $20-25 million. One million tons of steel is worth from $100-200 million depending upon the product-mix. This appears a 'substantial' potential increase in export earnings. The project's performance under Criterion 2 cannot be assessed. It seems probable that it could meet the requirements. The same applies to Criterion 3. Criteria 4, 5, 6, 7, and 8 appear to be met satisfactorily. Criteria 9 and 10 require more research to provide definitive answers.

From the Government's point of view, the major issue about assisting the new town is simply its cost - how much, when and at what rate will it be required? They could adopt the policy of allocating a fixed sum to the project, but there would be no guarantee that it would be enough to achieve the goals desired or that the amount was not excessive for the goals. Moreover, they would be entitled to some assurance that the funds were being spent wisely and that unnecessary expenditures were being avoided. No attempts to devise methods of
achieving this have been reported. (The British New Towns and similar projects present a different case for there the public sector was guiding the development.) The most closely comparable case appears to be the Cuidad Guyana project in Venezuela. However, it suffered from the fact that the planning of investments had to proceed concurrently with the rapid growth of a major urban centre. It would be advantageous to be able to examine the growth processes and prospects of a new centre before construction began so that an optimal strategy for the disbursement of funds to maximize progress towards selected goals could be developed. The techniques of computer simulation and simulation models appear to offer the possibility of this being an attainable goal.

The following Chapter returns to the problem of attempting to estimate future growth in a new town. It sets out the desirable characteristics of a model of urban growth and makes a first pass at listing the data and techniques that could be used in its derivation.
CHAPTER 4  TOWARDS AN EVALUATION OF GROWTH PROSPECTS.

Prologue

Over the past decade, many 'models' of urban or regional growth have appeared. They are basically of two types - land use or spatial models and growth models. The former set out to generate the pattern of land uses in an urban area (usually a metropolitan area)\(^1\) whilst the latter are concerned with forecasting the growth of the urban economy or the urban area's population.\(^2\) A review shows that the bulk of the growth models deal with large urban areas or regions.\(^3\) Almost all exhibit approaches which assume either that growth will continue as in the past or that growth will tend to produce similar conditions to that evidenced by the nation as a whole or some lesser universe of selected comparable urban or regional areas.\(^4\) None appear able to deal explicitly with the growth of small towns.\(^5\)

1. For examples of 'land use models', see the Journal of the American Institute of Planners, (May, 1965) or Ira Lowry, Model of Metropolis (Santa Monica: Rand Corp., 1964).
4. Bell, op cit, projects towards a national average: Neidercorn and Kain, op cit, employ a larger universe of metropolitan areas.
5. Bagby, op cit, is an exception.
Most of the models employ the base theory concept of urban growth: some basic industry develops and this induces non-basic industries to grow. No attempts have been made to examine the time span over which this induction takes place. The models assume instantaneous generation of growth. To traverse future time, a series of instantaneous cross-sections are made based on anticipated future employment in the basic industries. Assuming that the base theory offers a reasonable explanation of urban growth, it seems clear that the population or economic growth projected at any future time by such models must be in error. Nowhere is the need for an appreciation of the time dimension more important than in the growth of rapidly developing communities. To understand the growth of a new town (produced by private endeavours and not spawned by governmental direction of economic activities), it is necessary to return to first principles, and to take account of the locational advantages and disadvantages of the site, of the reasons for the town's existence, and of the motivations of private enterprise.

The ensuing chapter seeks to establish the characteristics of a 'model' which would be useful in studying the growth prospects of new towns - a 'model' which could be used to test the effects of alternate developmental strategies to yield data on rates of growth and investment requirements. It proceeds to list the data and techniques which should prove useful in developing such a 'model'. No attempt is made to construct the 'model': the discussion is intended as a survey of how it might be constructed. It includes a discussion of the problems of data availability and some of the shortcomings and advantages anticipated in the

6. The effects noted in Figure 3-3 cannot be estimated.
7. The models using the base theory cannot operate unless there is growth in the export sector. They cannot deal with the situation outlined previously.
when it is formulated. It is not suggested that the 'model's' construction will explicitly follow the lines laid down in the following discussion: there undoubtedly will be deficiencies in some data or techniques which will only be revealed when detailed investigations are underway. The intention of the discussion is to chart a broad path for further work.

1. The Characteristics to be Sought in the 'Model'.

The only data available about the growth of a new town of the type considered in this thesis may be a single statement that a plant to produce a certain amount of a certain commodity and employing a specified number of workers will be established. Production levels may initially be expected to be constant by the investors and no further expansion foreseen. The new town which grows up around the plant will do so over a finite period of time. Thus the 'model' should be able to simulate its growth pattern over time. It must do so with a minimum of exogenous inputs. Time, initially introduced by way of the plant construction schedule, must be specifically included in the 'model'. The application of the 'model' must refer to a finite interval of time. With the exceptions of:

(a) changes, if any, in the 'export' production levels of the leading sector and any other export industries;

(b) changes in investment levels arising from these; and

(c) changes in the level of public expenditures in the new town resulting from deliberate policy changes;

all inputs to the 'model' in one time period must be generated in the previous time period. (In the initial period all inputs
will be exogenously supplied or may be set at zero value.) Because of this need to generate inputs within the 'model' sought, it may be said to be dynamic.

It should display the following characteristics:

1. Its basic structuring should enable it to be applicable, in theory at least, to any and all urban areas but, in particular, to small urban areas experiencing rapid growth;

2. It should be able to cope with the effects of large exogenous impulses upon the urban economy and with the effects of small endogenous regular or periodic impulses;

3. It should be able to explore the growth of an urban economy through its transition from an economy capable only of limited growth to one exhibiting self-generative growth; and

4. It should be able to assess the differing effects of differing impulses to economic growth, which vary in size, timing, nature and point of application within the economy.

2. Basic Assumptions

Because it offers the simplest urban situation and because of the interest of this study, the present description is couched in terms of the growth of a new town. To further simplify the situation, the following assumptions are made:
1. That a new town is to be located in a remote, uninhabited part of a nation which has achieved a high level of economic development;

2. That the initial purpose of the town is to house and to provide amenities for workers engaged in the exploitation and processing of a natural resource;

3. That persons, companies and activities have unrestricted entry to the town;

4. That long range forecasts (or contracts) are available to estimate long-term output or employment by the founding industry;

5. That the nation is experiencing stable economic growth and that cyclical variations are not intense;

6. That the nation as a whole experiences a high standard of living and that unemployment is low;

7. That capital resources are limited in all sectors of the economy so that capital rationing will be practiced; and

8. That prices and technology remain constant in the economy as a whole.

3. The Component Parts

A 'model' which could display the characteristics set out above should have the following components:-

1. It should have the ability to generate local levels of demand, i.e. those stimulated by export activities,
public and private capital expenditures, intermediate transactions made in the local economy and the final demands of residents of the town and, if applicable, those persons living within its trading hinterland. Since the study is limited to the local urban economy, only those demands which may be met within that economy should be considered. For example, a resident may purchase a motor vehicle but the only part of that transaction which adds to the local economy is the commission paid to the local agent. (The effects of substitutability in consumer demand are ignored.);

2. It must be able to determine whether or not any particular activity will exist in the local urban economy;

3. It must be able to determine the rate at which such activities will appear in the local economy since this is the key factor in determining the rate of growth of the new town;

4. It must incorporate a technique for translating economic growth into job-opportunities;

5. It must incorporate a population projection technique which will yield estimates of the availability of local job-seekers as well as total population growth by age-groups. From the rate of creation of job-opportunities and the rate at which local residents are entering the job-market, estimates can be made of the net immigration; and
6. Ideally, it would incorporate some technique whereby the changing structure of consumer demand due to changes in age structure, income and isolation could be introduced into the final demand estimates of the first requirement listed above.

4. The Ability to Generate Local Levels of Demand

At its birth, the new town's population will be completely composed of workers, probably engaged in construction, who have one specific task to perform. Everything required in the town is imported. Provided their employer does not supply them, the workers will have needs for certain goods and services for their total incomes will be divided between savings and disposable income. Their disposable income will be available for expenditure over the range of needs they evidence. Their pattern of final demand will probably deviate from the national pattern but, if no specific data is available on their probable pattern of demands, the national composition of demands must suffice.\(^8\) This is available from national input-output tables.\(^9\)

Because it permits the effects of changes in final demand to be traced through the local economy, an input-output tableau seems a logical choice for the technique for generating local levels of demand. An input-output table may be written in the form of cents of direct input per activity per dollar final demand. By knowing the total disposable income available to workers in

\(^8\) The composition of final demand by households will vary with age, income and family composition. In an isolated town, partly because of skewed sex and age distribution, and partly, because of the limitations on the goods and services available, the composition of the household final demand must vary from the national pattern.

\(^9\) For a concise summary of input-output techniques and further reference to the extensive literature available, see William H. Miernyk, The Elements of Input-Output Analysis (New York: Random House, 1965)
the leading sector plus any other final demands which can be met within the local economy, the direct inputs required of each sector to meet this total local demand can be calculated. Initially, these are the locally made payments of the export activity. Thus the initial entry in the table can be in terms of exports from which payments to labour and any other possible intermediate payments to local activities can be deduced. Each entry in this 'multiplied' matrix represents the dollar sales involved in the direct intersectoral transactions required to provide the needs evidenced by the local demands. If these dollar sales are above the 'threshold level' of the activities represented, there is a possibility that a local enterprise might be established to cater for these sales. Each entry in the table can be examined to determine if this is probable. Any transactions involving sales below the required threshold level can be deleted from the local economy and they become part of the value of imports.

From this a new matrix of the processing activities which may be able to be established in the town, emerges. This is square and its inverse can be computed. The inverse shows the total intersectoral transactions stimulated by the direct transactions in the local economy. Again some of these will fall below the threshold level required for economic operation. They will thus be deleted. There is a degree of error in this procedure as some transactions included in the local economy would be carried out elsewhere in the course of operations which are economically infeasible in the new town. This might be over-come by an iterative computation of the inverse so that infeasible transactions might be removed as they occurred. Using the coefficients of the national table, the payments to households, taxes and depreciation can be computed.

If there are now new activities, i.e. other than the leading sector, which support employment, the total final demand will
have increased by an amount equal to the payments made to households plus any additional, intermediate transactions within the local economy. The whole procedure can now be repeated. The volumes of interindustry sales between each sector are recomputed and rescreened against threshold levels; a new interindustry matrix of the local economy derived; and so on as before.

The process proceeds by such iterations until the payments to households remain unchanged after successive iterations. The local economy has then reached its maximum extent under the given set of exogenous conditions.10

The total final demand will refer to a specific time period, e.g. a month or a year. Throughout this discussion, the input-output tableau must be regarded as referring to some time span which shall be called the 'temporal increment'. Conditions in the local economy will change over time as new workers are added to the leading sectors employment, and as the local economy expands and 'lags' are overcome. Because of this, the input-output tableau may be applied at each 'temporal increment' in periods of rapid change or at every fifth or tenth temporal increment in periods of slow change (provided some modifications are made to the inputs, etc.).

5. Of Thresholds and Investment Decisions

By definition, the threshold is the minimum level of operation at which an enterprise in any activity can economically survive. However, the survival of an enterprise depends upon its ability to provide the investor with adequate returns to capital. If

10. i.e. a given level of production in the leading sector industry and a given set of public policies towards the development of the new town.
the capital requirements of enterprises within the one activity vary, so will their threshold levels of operation.

Some method is needed to ascertain whether or not any market opportunity available in the local economy is likely to attract entrepreneurs to take advantage of it. Very little information appears to be available about the way in which small or unincorporated firms set about making investment decisions, especially in areas of high risk and where their investment may have to capture the major part of the total available market to be successful. Three factors - the total annual volume of sales, the capital investment required and the rate of return expected on capital - must play a significant part in this decision making.

The input-output tableau yields an estimate of the demand existing for each activity. However, investment decisions are not based wholly on existing demands. Expectations about the future and competition must play a role. In a 'first round' application, it maybe sufficient to assume a

11. See Z.S. Malmowski and W.M. Kinard Jr, 'Personal Factors Influencing Small Manufacturing Plant Location', a report prepared by the University of Connecticut under the Small Business Administration Grant Programs, 1961; and James H. Thompson, 'Methods of Site Selection Available to Small Manufacturing Firms; a report under similar auspices by the West Virginia University, 1961.


constant annual rate of growth of markets. Within the growth of the market so indicated, a technique is required to simulate the investor's endeavours to optimize on the investment he proposes. Expected growth of profits should be discounted and the level of investment accepted which maximizes these returns to capital. This strategy involves the 'trade-off', in the short term, of low returns on capital (in the case of investment in excess of that required by present potential sales levels) against the ability of that investment to capture a larger share of a future market with consequent higher returns.

This problem might be resolved in two steps. The first involves an application of locational analysis.\(^{14}\) Suppose the objective is to estimate growth over 20 years. For each quinquennium, a hypothetical set of transport linkages between the new town and the existing centres can be proposed. Freight costs over this network, based on the prevailing costs of similar networks in the nation, may be estimated. Location analysis may then be applied to determine the costs that might be incurred by an activity in the new town in meeting any level of trading volume assuming constant or variable wholesale prices. Profits will then be the difference between these costs and the total return from sales. Actual sale prices will be limited by the prices at which residents in the new town may obtain the same (or substitutable) goods or services from alternate sources plus the costs they attach to their own personal inconvenience in so doing.\(^{15}\)

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14. Locational analysis is discussed in broad terms by E.M. Hoover - *The Location of Economic Activity* (New York: McGraw Hill and Co., 1948) and has been adapted to a more rigorous mathematical analysis by Walter Isard, e.g. see *Location and the Space Economy* (Cambridge: M.I.T. Press, 1965) and *Methods of Regional Analysis*, op cit.

15. Rigorous application of locational analysis may not yield these data. It may be more profitable to use an inductive process rather than a deductive one. Thus retail prices could be set at wholesale prices plus transport costs plus a sales mark-up appropriate. The return on investment could be calculated and the mark-up and sales volume adjusted accordingly to achieve a desirable level of return. In manufacturing, the problem is probably simpler because of large discontinuities in unit plant costs.
It should be noted that any locational analysis of any activity which is aimed at meeting local demand only will not fully account for the growth that may possibly occur. The new town may be chosen as the location for activities to meet the demands of larger markets, i.e. export activities in the traditional sense of the base theory may develop. Such activities cannot be predicted by the input-output tableau, and must be considered separately. However, their impact upon the local economy can be incorporated - they become an additional 'leading' sector' in the inter-industry sub-model.

Since estimation of costs must entail estimating capital investment, the analysis relates rate of return to approximate levels of demand and to capital investment. However, there can be no guarantee that, because a certain investment in a certain activity may yield a certain rate of return, an entrepreneur will appear to take advantage of the opportunity. To resolve this, an empirical rule to test the probability of any opportunity being accepted by an entrepreneur is suggested.

Two measures could be used to construct this rule - the frequency distribution of sales levels among existing enterprises in each activity and the rate of return associated with each. By stratifying a sample of such data, separate rules could be made describing conditions in various types and sizes of markets. From each such stratified set of data, a frequency distribution surface might be constructed. This would enable the probability of an entrepreneur accepting any level of sales offering any rate of return to be tested. The test could be made by generating random numbers.

If the location analysis is sufficiently sensitive, it may be possible to determine that a level of sales above or below that indicated by the demand would offer a more profitable scale of
operations. If this is so, this situation is the appropriate one to test against the probability rule.

This would yield:

1. In respect to the total demand for goods and services available to enterprises in any activity, a 'yes/no' answer to the question of whether or not any investor will emerge to meet the demand; and

2. A determination whether or not that investor will choose to optimize by catering for a sales volume (i.e. demand) above or below that currently available.

These are the thresholds to be used in the input-output tableau. If the level of sales accepted is less than demand, the unmet demand should be transferred out of the local economy in the input-output tableau, but only after the probability of a second entrepreneur entering the local market to meet the remaining demand has been tried and found to yield a negative answer.

This discussion of market opportunities has thus far dealt with the entrance of the initial enterprise only. A second enterprise in any activity may be established when the margin between the demand and the existing level of sales becomes sufficient to sustain it. Since the entrance of an enterprise is established by a probability technique, and since every sale and rate of return combination may be tested, enterprises with any level of sales and any rate of return might be found willing to enter the market.

The productivity of labour and the return to labour are assumed

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16. i.e. it is believed that the sales/investment ratio may be a discontinuous (step) function.
to be constant throughout enterprises of the same general style. Because the 'model' is based on national coefficients, it would be presumptuous to seek finer relationships. There may, however, be some case for investigating the effects of economies of scale amongst enterprises within one activity - e.g. the 'succession' of small general stores by larger supermarkets. Otherwise, the second round of growth in any activity is induced by the 'vacuum' in the local economy created by 'escape expenditure'.

6. Investment Lags

'For dynamic theory, a key element is a time interval between moves and responses, or a time distribution of responses; and this time factor is typically essential to give firms an incentive to make competitive moves, by giving them a chance for a temporary gain before their moves are neutralized by the defensive, or counter-offensive, responses of rivals.' 17

The market opportunity phase above can establish whether or not any activity will be established. It remains to determine the time which will elapse between the emergence of an acceptable level of demand in the local economy and the establishment of the activity as a functioning part of that economy. This time lapse is the 'investment lag'. No relevant work in evaluating lags has been identified. A system of evaluation is built up from apparent first principles.

The 'lag' may be defined as the total time which elapses between the temporal increment when unmet local demand passes the threshold in any activity until the temporal period when that demand is being effectively met by an enterprise operating in the local market. The lag may be positive or negative and will be measured in temporal increments. The components of the lag

are discussed in Appendix XIII.

Four variables apparently govern the magnitude of the lag; they are:

A. The capital investment involved;
B. The size of the town at the time of the investment decision;
C. The long term growth prospects; and
D. The rate of growth at the time of making the investment decision.

The lag varies directly with the capital investment but indirectly with the other three variables.

The rate of return on capital might be substituted for rate of growth exhibited at the time of investment. However, the latter is more readily available for use in establishing lags. Probable lags in the new town may be determined from a comparison with the lags which were exhibited by existing enterprises. This assumes that the four variables listed can be obtained from histories of existing investments. For any particular application a sample for rule derivation need display only one set of growth prospects. Similarly, the range of sizes of towns investigated could be greatly reduced. From case studies, lags can be linked to investment and rate of growth. When the size of investment is specified, a cumulative frequency distribution surface relating lags experienced to rates of growth could be constructed. (Experience may indicate that one of the other variables may be better adapted for selection as the final continuous variable.) The probability of any enterprise experiencing any lag may then be tested, by using a random number generator. The procedure would begin by testing whether or not the enterprise would encounter a lag falling within the temporal increment in which the enterprise became possible. If this does not occur, the test for it would
be repeated in the next increment and so on. Lags may vary by sector but it seems probable that some grouping by sectors will occur. This may not be so and a further stratification by sector may be necessary in the case histories.

7. A Review of the Approach to Growth of the Economy

A system has now been suggested by which the growth of the local economy might be simulated. The input-output tableau generates growth. At each iteration of direct and total requirements of the local processing sectors needed to meet total local final demand; and the probability of an entrepreneur finding an acceptable investment opportunity in any particular industry is tested. If the market opportunity test indicates that an entrepreneur will respond, the lag test is then applied to check the probability of the specific enterprise entering the local economy in that temporal increment, or the next and so on. If the lag test indicates an elapse of several increments, the effects of the enterprise on the local economy cannot be included until that lag has elapsed. However, if total requirements exceed direct requirements in the interindustry sub-model, or if there is growth in the economy due to other activities entering the new town, the probability of a similar enterprise emerging at an earlier increment under the new conditions should be tested, i.e. until an enterprise is actually functioning, there is always the possibility of a competitor capturing the market.

If the local demand does not pass any threshold level on the first iteration, the town will not attract entrepreneurs and will remain a subsidised company town. If the number of thresholds crossed is very small in the early iterations, growth will be slow and lags long because of lack of internal multiplier effects. However, if many thresholds are exceeded in early iterations, i.e. there is a large local demand, a well-developed rapidly expanding economy should result.
If the employment in the leading sector builds up over a period, it can be treated as a series of exogenous additions to the final demand of the household sector, or more correctly, the situation is that leading sector production increases which makes greater claims on all sectors including households, i.e. both household final demand and intermediate demand will expand. Investment can be treated similarly. Thus growth may come from the expansion of one sector or by diversification across sectors. In the basic case of a single exogenous impulse to final demand, the model should be able to trace out the resulting growth of the economy.

8. Population Growth

Whilst the growth of the local economy is significant, for physical planning major interest lies in the population growth it will stimulate. Moreover, there are feed-backs from one to the other. The population growth phase of the model should consist of three parts. The first would convert economic growth into job opportunities. The second would convert job opportunities into migration. The third would project population growth. Since constant productivity of labour is assumed in each sector, the number of job opportunities in any activity can be obtained by dividing total payment to households by the average payment to employees in that activity.

In the early stages of growth, every new job-opportunity will result in immigration to the town. However, after some time, there may be local residents who could fill certain job opportunities. Thus the projection of population growth and the estimation of immigration must proceed simultaneously. A number of assumptions are required. The inflow of immigrants must be assumed to display a known distribution in its composition in terms of sex, age, and family structure. Appropriate birth and death rates must be assumed. The composition of the workforce in any activity must be assumed
(e.g. to parallel the national average) in terms of its division between senior (heads of households) and junior employees and between the sexes. Workforce participation rates must be assumed.

The procedure begins with the population engendered by the leading sector employment in the first temporal increment. This population will expand due to natural increase. As the economy expands, more families will move to town; but if the existing population contains a surplus of potential employees considering its sex and age composition, these should be accepted for employment in preference to immigrants. The procedure involves a cohort-survival population projection by temporal increments. The potential workforce in the local population is scanned during each increment and compared to the demand for workers evidenced by the incoming enterprises. Any unfilled positions attract immigrants.

For long range projections, it will be necessary to introduce factors which will take account of the period which adolescents spend in school so that a more realistic concept of the growth of the local workforce can be derived. It is at this time that the feedback to the economic growth model becomes important. If the expansion of the economy does not produce enough jobs to meet the expansion of the local workforce, outmigration begins and the rate of expansion of the local economy will decline since it is now catering to a diminishing, rather than an expanding, market. For this reason, it would be desirable to have data on the change in the pattern of final demand caused by the ageing of consumers. However, it is believed that a negative response could occur without this data.

18. See Bagby, op cit, for a computational cohort-survival technique; other references may be found in Isard, et al, op cit.
Outmigration would cause a fall in the demand for new construction and, consequently, a decline in employment in building. Just as multiplier effects build up the local economy, they would then act to disintegrate it.

9. Outputs and Performance

In application, an iterative approach should be adopted. The market opportunity test in the first round assumes a constant rate of market expansion as a basis for discounting future demand. The growth of the town established in the first round can then be substituted for this input in the second round and so on. If over a given period, successive iterations all tend towards an upper limit of population growth, the new town, under the assumed set of exogenous stimulants, will not achieve self-generative growth. If, on the other hand, successive iterations produce increasingly higher populations, there is every reason to believe self-generative growth has been achieved.

The output of the model will yield the following data for each temporal increment considered:–

1. The value of each intersectoral transaction within the local economy;
2. The growth of the local economy;
3. The growth of final demands of households (other final demands are exogenous);
4. The growth of employment, by sector;
5. The growth of population;
6. Net migration; and
7. Private capital investment levels.

If employed to construct a 'model', it appears that the approach could imbue it with the characteristics stipulated. It is
dynamic in that the growth of the economy is generated over time. It is self-generative in so far as the growth of the locally-induced economy is concerned. The only exogenous inputs required are public policies and the demands generated by export markets. It is applicable to small urban economies and, theoretically, to larger metropolitan ones but the computational problems may become so numerous as to negate the value of the approach. It appears able to cope with any investment in any sector of the economy. It should trace the growth of an urban economy through the transition period to self-generative growth. The 'model' does not restrict the growth of the internal urban economy to a subservient (service) position in the total urban economy. The major stimulants to growth need not be the exogenously determined export sectors. However, the sources of investment capital are not traced and no attempt is made to link local savings with investment, i.e. it cannot be used to test the validity of the base theory.

10. Pros and Cons

It is believed that all data needed to establish the empirical rules outlined can be obtained. However, it may be too complicated and, perhaps, too cumbersome for computation. The search should now be for simplifications which can be made without impairing sensitivity. Undoubtedly, some could be found but it would be unwise to be over-optimistic about simplifications: urban growth is a complex phenomenon and to seek to describe it adequately by a simple rule is to attempt the improbable.

Assuming for the moment, that a 'model' employing this approach could be constructed, it does offer a substantial advance on most existing urban growth models which are essentially static and which assume growth occurs instantaneously once there has been an increase in 'basic' activities, and which make no allowances for size, rate of growth or locational advantages
of the urban centre under study.

The major difficulty in constructing such a 'model' would lie in obtaining the data required, and in the three areas where present techniques may be deficient. The first of these is the limited scope of national input-output tables. These rarely deal, in any appreciable level of disaggregation, with the urban 'services' sectors - the so-called tertiary and quaternary industries. This deficiency might be overcome if the detailed tabulations upon which the input-output table was constructed, could be re-examined.

The second area where existing techniques may be inadequate is in the locational analysis proposed under the market opportunity test. It may not be possible to achieve sufficient accuracy to enable the analysis to proceed as outlined in this discussion. Any decision on the level of accuracy acceptable on this point in the model, must depend on the levels of accuracy which can be obtained in all other parts of the model. This may depend upon whether or not the rules outlined in the various tests reveal central tendencies. If the relationships reveal completely random patterns of behavior, this whole hypothesis may have to be re-examined. At this point in time, it appears a rational approach. Only experimentation will prove or disprove its basic assumptions about the significance of various factors in urban growth. The third area concerns the causes and magnitude of lags in urban growth. These need a great deal of further study.

The other data required to formulate the rules may be difficult to collect but should be available. They are dealt with below in order of their appearance in the description.
1. The employment in the leading sector is assumed to be available from long-range production targets or a long-range investment program so that the initial, and any additional, employment will be known in terms of number of employees, wages, and of date of employment.

2. To determine which activities may be represented in the infant economy, reference could be made to central place studies which relate the number and type of functions to population size of towns. (A better indication of the towns rank in this instance might be reported retail sales.)

3. The distribution of sales levels in existing enterprises could be derived from sources such as Censuses of Retailing, Manufacturing, etc. For some industries in the tertiary group, professional associations and like bodies may have data on probable income distributions. Other data could be collected on a field survey basis. Official statistics may have to be reprocessed to reveal the sales level distribution.

4. Rates of return can probably be found by an examination of company reports or of listings of sales with real estate agents.

5. Investment histories may be available from field study only. Bankers, investors, local government records of building applications and completions could all contribute.

6. Labour participation rates, and other demographic data can be based upon, or listed directly from, official statistics.

7. Actual consumer final demand patterns must be derived from field survey although, in some countries, published data may be available.
Among the other shortcomings of such an approach are the problems of constancy of coefficients in all phases of the 'model', and the naive approach to investment. The 'model' neglects the role of various types of mortgage, stock and bond financing which may be used to offset some of the hazards and difficulties involved for a private entrepreneur investing in a new project. It neglects bankruptcy and all non-economic stimulants of urban growth except those accruing from public sector policy decisions, e.g. the addition of a major defense base could be incorporated as an additional exogenous demand.

11. An Aid to Public Policy

The approach, as outlined, tends to imply that the entire town is created as a result of private investment activities since public sector expenditures are exogenously determined. This does not imply that the 'model' cannot be used to design public investment programs.

There are, at least, three ways whereby the effects of various public policies could be tested. They are through:-

1. The type of investment program undertaken, i.e. by sectoral differentials;
2. The magnitude of the investments; and
3. The timing of the investments.

Largely through the locational analysis phase, the effects of programs that would result (a) in better transportation links between the new town and other centres; (b) in the availability of low-interest housing finance for long term mortgages; (c) in subsidies towards urban infrastructure expenditures; or (d) in loans to assist small business, etc. could be incorporated. More direct involvement such as the provision of regional administration, health or educational facilities
could be recorded as an exogenous addition to investment and final demand. The approach might also be used to test the vulnerability of any new town as a growth point: to seek the effects of sudden changes in the plans of the leading sector industries.

This listing of ideas will require substantial research to translate it into a 'model'. If such a 'model' was calibrated to Australian conditions at the present time, it could be used with marginal variations to test the growth prospects of any, or all, of the new towns now being developed. The variable portion of the model would be the location studies. On this basis, and bearing in mind the magnitudes of the investment involved, it may not be an excessively expensive tool to develop.
CHAPTER 5  CONCLUSIONS.

In Chapter 1, five objectives were established for this study. In so far as data, time and funds permit, these have been achieved. The first objective was to examine the possibilities of the Pilbara iron ore discoveries stimulating the formation of a major urban growth point. The conclusion drawn from Chapter 3 is that this is definitely possible if a million tpy. steel industry were to be established. The constraints upon such an industry are that it must be able to achieve costs of production equal to those in the Japanese steel industry. These appear possible provided public assistance is available to finance the development of the urban facilities required.

The second objective was to determine the contribution which the new towns in northern Australia might make towards the achievement of national goals. Their development would, where they can achieve self-generative growth, increase export earnings and stimulate economic growth; provide dynamic urban cores which would offer a new approach to the development of northern Australia; and achieve an excellent opportunity for achieving depolarization.

The third objective was to evaluate the feasibility of various strategies which might be used to achieve a national goal of depolarization. The rank order of feasibility of the six strategies suggested tested by (a) their ability to divert significant numbers of people from the metropolitan areas, (b) their probable voter acceptance and (c) their contribution to other national goals, is:
1. The mixed economy growth point, (F);
2. The public sector/leading sector growth point, (D);
3. The private sector/leading sector growth point, (E);
4. Rural settlement, (A);
5. The present policy of industrial dispersal, (B); and
6. The subsidized, incremental growth point, (C).

On the fourth objective, the formulation of criteria to guide public investment in the development of the new town, ten criteria are advanced. The value of cost/benefit studies in this connection was examined and found to be limited.

An outline of a more comprehensive method of evaluating urban growth, the fifth objective, is offered in Chapter 4. It will need more refinement before it might be said to be a 'model' of urban growth but it does indicate how the problem of estimating growth in a new town might be attacked. Throughout the thesis a great deal of emphasis is placed upon the need for the new town to gain self-generative growth. This status is considered necessary to (a) reduce the high costs of labour and goods in isolated locations; (b) to contribute to regional development; and (c) to make any meaningful contribution to achieving depolarization. It is believed that a million tpy. steel industry could launch a town into self-generative growth through the rapidity of growth. However, this is by no means certain. Diversification of the industrial base of the new town should be a major goal in developing the town.

The public sector may have to provide assistance to the town to enable it to gain external economies necessary to attract other industries. A crude estimate of the growth of the town based on such a steel works employing in the order of 10,000 workers suggests that, if the decision to build the plant were made now, in 20-25 years hence a city of 80-90,000 persons could exist in the Pilbara. However, more thorough
investigations of the mechanisms of urban growth will be needed to confirm this estimate.

It is not claimed that the conclusions reached in this thesis are definitive either in their interpretation of growth prospects or of the policy requirements needed to ensure their emergence. No projection of possible events can be: the planner must always operate very much on his own intuition. It is, however, contended that this study has provided a substantial first step towards the evaluation of the future role of new towns in northern Australia. As such it is a meaningful study despite its many limitations.

Further research
The avenues for further research indicated by this study are numerous. They may be broadly classified into theoretical or practical aspects of the issues discussed. The development of an adequate urban growth model to deal with the problems of new towns must inevitably gain highest ranking amongst further theoretical studies. Both the private and the public sector would benefit from its availability. Another major area requiring further research is an explanation of the whole issue of decentralization: is it a desirable national goal? A further evaluation of the strategies for achieving depolarization against other possible criteria would be useful. Studies of the effectiveness of present policies of assisting decentralized industries, of trends in rural/urban migration, of attitudes of such migrants towards provincial centres, and the like could all further the planner's (and the politician's) ability to devise new strategies for national development.

The more practical aspects of the study include the need for a closer evaluation of the feasibility of a Pilbara steel industry: an in-depth study appears warranted by the factors examined here. In view of the possible emergence of a major
growth point in the Pilbara, there is the need to assess the best location for such a centre bearing in mind that it may become a major metropolis. One of the most basic questions is whether or not the area has an adequate water supply for such a centre. Because of the advantages such a centre would offer private investors in the Pilbara, it might be in the interests for both the public and private sectors to form a Pilbara Development Council with joint representation and financing, to act as a forum for discussions on the development of the area and to sponsor planning and research studies of its future development.
APPENDICES
AND
SELECTED
BIBLIOGRAPHY
AUSTRALIA - Major Development Projects in tropical areas.
APPENDIX I

Major Mineral Discoveries in Northern Australia

The following is a list of the major discoveries of minerals in Northern Australia made in the last ten to fifteen years. Some were reported earlier than that but are included because they are currently being developed. All of the discoveries lie within, or close to, the tropics. The listing runs from east to west and numbers refer to Map A-I. (N.T. - new town).

1. Moura - Kainga coal field, a major open cut and underground field being developed to supply 5 million tons per annum to the Japanese steel industry.
2. Blackheath, another open cut coal field being opened to supply Japanese markets.
3. Weipa, world's largest commercial bauxite deposits being developed to supply the Japanese and other world markets and also a major alumina refinery at Gladstone, Qld. (N.T.).
4. Duchess, rock phosphate deposits are currently being explored - the first such discovery in Australia.
5. Mary Kathleen, uranium mine, now on maintenance basis only. (N.T.).
6. Mount Isa, Australia's largest copper mine, also produces lead and zinc. Town now contains upwards of 15,000 persons and is growing rapidly as a result of a major mine development program which has recently been completed.
7. MacArthur River, extensive lead deposits under investigation (N.T. proposed).
10. Rum Jungle, originally a uranium mine, but deposits of copper and phosphates also occur (N.T.).
11. Burrundie, iron ore, supplying 3 million tons of ore to Japan over eight years.
12. Admiralty Gulf, bauxite under investigation.
13. Fitzroy River, lease granted for investigation of coal deposits.
14. Mount Goldsworthy, iron ore, supplying 16.5 million tons to Japan over seven years (N.T.).
15. Mount Newman, iron ore, to supply 100 million tons to Japan over 15 years (N.T.).
16. Hamersley Iron, iron ore, supplying 86 million tons to Japan over 16 years, also shipments to U.K. and Europe (two N.T.).
17. Dampier Mining, iron ore, no contract.
18. Cliffs Mining, iron ore, to supply 71.4 million tons to Japan over 21 years.
19. Sentinel Mining, manganese and iron ore under investigation.
20. Barrow Island, oil and natural gas, field declared commerical, under construction.
APPENDIX II

Iron Ore Agreement and Controls

The following summary of the Hamersley Iron Agreement and of the group's present contracts is from 'Australian Mining' Vol. 58, No. 11, 15th November, 1966.

Agreement: On 30th July, 1963 Hamersley Iron signed an agreement with the government of W.A. under which it undertook to develop its iron ore holdings in four linked stages, in return for iron ore search rights, mineral leases, and land grants as required in each stage. The four stages and the company's obligations are:

1. Investigation: The company to spend not less than $1,000,000 on preliminary investigation of the iron ore deposits, and on proposed railway, port, water supplies and town sites necessary for the development of the deposits.

2. Export: The company to spend not less than $60,000,000 within three years of the date of the agreement on mining, transport, wharf facilities, etc. to enable the shipment of ore to begin at an annual rate of not less than 1,000,000 tons. The company to construct the railway and necessary roads, the wharf and shipping channels, and to provide housing, recreational facilities and services, schools and airstrips.

3. Processing: The company to submit proposals within ten years of beginning exports for the investment of at least $16,000,000 on a secondary processing plant with a capacity of 2 million tons a year within seven years.

4. Steel: The company to submit complete plans within 20 years of beginning iron ore exports for an integrated iron and steel industry requiring an investment of at least $80,000,000 with
production to begin within five years of submitting plans. The initial capacity to be 500,000 tons of pig iron, foundry iron or steel, of which not less than half is to be steel, rising to a capacity of not less than 1,000,000 tons of steel within six years of beginning production.

Reasonable extensions of time are permitted to the company at all stages of the agreement. If it fails to reach stage 3 or 4 after extensions, the Government has the right to seek other companies to take over on the same terms and then to terminate the agreement.

On direct shipping of ores not used locally (i.e. in a steel plant) the company will pay a royalty of \(7\frac{1}{2}\%\) of the f.o.b. value or 60 cents a ton, whichever is the greater. On iron ore concentrates (i.e. pellets) and on locally used ore, the royalty is 15 cents a ton. On fine ore, it is 3.75% of the f.o.b. value or 30 cents a ton, whichever is the greater, and on fines for export it is 15 cents a ton.

Contracts: Hamersley Iron Pty Ltd undertook to explore and study the feasibility of bringing the Mount Tom Price deposit into production with a view to establishing a long term market in Japan, which has recently emerged as the third biggest steel producer in the world. On 18 December, 1964, after preliminary discussions spread over two years, major Japanese steel manufacturers signed letters of intent to buy 65.5 million long tons of lump ore from the company over 16 years, with deliveries beginning in August 1966.

The sale was, at the time, the largest ever written by any company operating in Australia. The maximum rate of delivery was to be 4.5 million tons a year and the sale was worth about $540,000,000 on an f.o.b. basis.
Sales made subsequently are: Pellets - 17.9 million tons to be supplied to the Japanese steel mills over ten years with deliveries beginning in 1968; Low grade ore - five million tons to be supplied to a Japanese buyer over ten years with deliveries beginning 1967.

Europe - 875,000 tons of lump ore to be supplied to the Steel Company of Wales, with deliveries beginning in 1967. 600,000 tons to be supplied to steel mills on the Continent, mainly in Belgium and West Germany, as test shipments.
APPENDIX III

Single-Enterprise New Towns

From a planning viewpoint, one of the most difficult problems to overcome relative to single enterprise new towns is the estimation of growth. It is important to have some concepts of the size to which the town might grow and of the rate of growth. This is particularly so for planning water supply and other public services where the cost of headworks required to serve the town may vary greatly for, say, a doubling of population even though the total population involved may be small.

These factors must be reasonably accurately estimated if any attempt is to be made to produce a capital budget or 'flow of funds' program for the development of the new town. Such techniques should be applicable to new town projects which may involve substantial capital investment, e.g. the provincial and Federal governments invested an estimated $60 million in the period 1955/58 in Elliot Lake in Ontario.¹

However, in single-enterprise communities which are not company towns, that is, people and enterprises are at liberty to move into or out of the town at will, recent Canadian experience with the prediction of growth is a record of dismal failures. The following sample serves to illustrate the erratic behavior of these towns.

1. Kitimat, British Columbia. Alcan, as the industrial entrepreneurs, appear to have established that Kitimat should be planned for a population of 50,000 although the planner's account of the project refers to a basic service employment

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ratio of one to one (and also includes the admission that the probability of this being achieved in a single-enterprise community was remote).²

Kitimat was commenced in the early 1950's. The population in 1956 was 9,676; in 1958, 12,250 but by 1961, this had declined to 8,217 persons.³ No more recent estimates of growth are available. However, this decline in population does not auger well for further rapid growth. The chances of Kitimat reaching its planned population within a reasonable period appear sufficiently remote to imply that the town may well have been a more satisfactory environment and a more economical project had it been conceived on a smaller scale.

2. **Eliot Lake, Ontario.** Based on uranium mining, Eliot Lake was planned by the Ontario Provincial Government in 1955 to house 12,000 persons. By 1958, an estimated 25,000 lived in the town - an error of over 100% in less than three years.⁴ The Census of Canada reveals that in 1956, Eliot Lake had 3,791 residents but, by 1961, the 1958 'boom' total had declined to 13,179.⁵ Because the uranium supply contracts which the mines were fulfilling were not extended, in 1962 one author could dub the town 'the nuclear ages' first ghost-town almost'.⁶ An estimated 6-8,000 people who had moved to the town in response to the 'boom' conditions stood to lose some $12 million in

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4. Ira M. Robinson, op cit, p.27.


6. Ira M. Robinson, op cit, p.95.
investments. The public sector stood to lose a good deal more in home mortgages, etc.

It would seem that over permissive public policies prevailed in the development of Eliot Lake and that these policies encouraged growth in excess of the basic resource's growth prospects.

3. **Arvida, Quebec.** Built in 1926 to provide housing for workers in another Alcan aluminium refinery, its planned population was also 50,000. In 1931, it had 1790 residents; in 1941, 4,581; in 1951, 11,078; in 1956, 12,919; and in 1961, 14,460. Had any attempt been made to program its development, it would seem that the town, like Kitimat, would have been planned on a lesser scale.

4. **Schafferville, Quebec.** Data is not available on population growth but growth has been sufficient in a matter of a few years to cause the town to outgrow its planned site.

In Australia, some examples of the volatility of growth in these towns can be gauged from the performance of Canberra, which as the national capital grew to only 16,000 in the first thirty-five years of its existence. From 1947 to 1954, population almost doubled to 28,000. By 1961, it had reached 56,000 and by 1966, 92,000. Projected population for 1980 and 2000 are 250,000 and 500,000 respectively. This rapid expansion was triggered by a change in public policies towards the Federal Capital vis à vis, the decision to make it the centre for administration as well as of legislation.

7. Single Enterprise Communities in Canada, op cit. p. 79.


9. Ira M. Robinson, op cit, p.39

Another example is offered by Mount Isa in Queensland. Founded in 1923 as a mining camp, by 1947 it had 3,500 residents. The population grew to 7,400 in 1954 and 13,350 in 1961. As the mining company involved undertook a massive expansion program, population increased rapidly after 1961 to an estimated 17,000 in 1963/4. In 1964, an industrial dispute is estimated to have reduced the population by 3-5,000 in a matter of weeks.11

While it is impossible for anyone to foresee industrial disputes and similar happenings, it would appear that some of the grosser errors in estimating anticipated growth of new single-enterprise communities could be avoided. Unless they can be, any attempt to rationalize programs for capital investment in a new town will be rendered meaningless. The chances for eliminating some of this margin of error are probably best in towns based on the exploitation of basic minerals for these generally lack the 'glamour' that creates 'boom' conditions.

11. Data from Queensland Year Book, 1964, from personal visit to Mount Isa as planning consultant in 1964 and from newspaper reports, August 1964 to February 1965.
APPENDIX IV

Persons and Organizations Contacted in Course of the Study.

The following persons and organizations were contacted in the course of the study in endeavours to ensure that the thesis incorporated the most pertinent and recent developments:—

Mr Jack Robert Miller, Steel Consultant, Battelle Memorial Institute - as a world authority on the iron ore and steel industry.

Sir James Vernon, Managing Director, Colonial Sugar Refining Company Ltd, Sydney - as Chairman, Committee of Economic Enquiry.

Mr John Lloyd, Town Planning Commissioner, Western Australia - for data on Pilbara development.

Mr G.H. Cooper, Director of Industrial Development, Western Australia - for data on Pilbara development.

Mr William Young, Director of Technical Services, Department of Industrial Development, Queensland - for data on the Central Queensland coal industry and the potential of Gladstone.

Mr J.H. Lord, Director, Geological Survey of Western Australia - for data on Pilbara mineral deposits.

Mr Gerald Manners, Department of Geography, University College of Swansea - as an authority on bulk shipping costs.

Mr B.J. Toerien, Chief, Reference and Documentation Unit, U.N. Industrial Development Organization.

Mr Harold Pilvin, Chief, Special Studies Section, Centre for Development Planning, Projection and Policy, U.N.

Mr Rajanikant Desai, U.N. Industrial Development Organization - for the most recent data on studies of the world steel market and of the development of the iron ore and iron and steel industries.
Mr W.K. Ellwood, Operations Manager, Mount Isa Mines Ltd - for data on workforce employed.

Mr T. Barlow, Manager of Operations, Hamersley Iron Pty Ltd - for data on that Company's expected workforce in the Pilbara.

The School of Agricultural Economics, University of Western Australia - for data on available regional input-output tables.

The American Iron and Steel Institute - for data sources.

The Japanese Iron and Steel Exporters Association - for recent data on the Japanese Steel Industry.

In addition to these sources, members of the faculty of the Department of City and Regional Planning at M.I.T. made many contributions. Other members of the M.I.T. community with whom aspects of the study were discussed included Professors Eckaus, Kindleberger and Adelman of the Department of Economics. Throughout the study, the author's associates and staff in Sydney, Australia supplied data and criticism. The chief contributors in this dialogue were Mr George Clarke, of Clarke, Gazzard and Partners; and Messrs A.D. Winter and R.T.M. Whipple and Miss E. Thomson of URBSEARCH.

Other Australian planners with whom aspects of the study were discussed included Associate Professor John Shaw of the University of New South Wales; Dr Raymond Bunker of the University of Sydney; and Mr W. Sutton, Chief Staff Consultant, Toronto City Planning Board. Mr J.W.C. Tomlinson, Ford Fellow, Sloan School of Management and Dr Daniel Paige of the University of Pretoria helped to clarify the author's thoughts on some aspects.
APPENDIX V

Relevant Experience of the Author.

In 1958, the author undertook a population projection for the City of Brisbane using a cohort-survival technique. This technique is reported in 'A Method, suitable for adaption to Planning Purposes, of forecasting future population in any area', Journal of the Australian Planning Institute (June, 1959).

In 1961/2, the author was engaged in a research project to estimate future industrial land requirements for the City of Brisbane. The method adopted involved a crude model of urban growth. See 'A Study of Industrial Employment for Town Planning Purposes', (Sydney: Urbsearch, 1963) (mimeographed).

In 1964, as a consultant planner, the author carried out preliminary studies on the growth of the isolated mining town of Mount Isa. At the same time, he was engaged in an extensive study to estimate the growth prospects of a new rural service centre for a major irrigation area. It was this study which originated the author's interests in developing alternate techniques for projecting the growth prospects of new towns. The results of this study which was largely based on central place and location analysis are summarized in Part III - 'Economic Background', The Murrumbidgee Shire Planning Scheme and Development Plan for Coleambally New Town, (Sydney: Clarke, Gazzard and Partners; December, 1964).

In the latter part of 1964 and 1965, the author was confronted with the same issue in a different setting. The problem was to attempt to project rates of residential sales in a new satellite community, 30 miles south of Perth in Western Australia. The stimulants to growth were an adjacent expanding industrial complex including a new iron and steel plant. It was in the
course of that work that the author and his associates began to consider the naive model suggested in Chapter 3 as a more effective method of assessing growth than the economic base theory. A brief reference to this work may be found in "Rockingham New Town, Report No. 1". (Sydney: Clarke, Gazzard and Partners, 1965) (restricted circulation).
APPENDIX VI

TABLE 1: EXPORTS OF MERCHANDISE, ACTUAL 1962-63 AND
PROJECTED 1974-75.
(Exports f.o.b.)

<table>
<thead>
<tr>
<th>Industry Group</th>
<th>1962-63</th>
<th>1974-75 (a)</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>£m</td>
<td>%</td>
</tr>
<tr>
<td>Rural</td>
<td>822</td>
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</tr>
<tr>
<td>Mineral</td>
<td>74</td>
<td>6.9</td>
</tr>
<tr>
<td>Manufacturing  (b)</td>
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<td>12.5</td>
</tr>
<tr>
<td>Other (c)</td>
<td>39</td>
<td>3.6</td>
</tr>
<tr>
<td>Total</td>
<td>1069</td>
<td>100.0</td>
</tr>
</tbody>
</table>

(a) "Lower" and "higher" refer to the ranges given in the text. 
(b) Excludes processed primary products. 
(c) A residual item including non-rural primary products other than minerals, special transactions, arms, ammunition, etc. and miscellaneous articles.


<table>
<thead>
<tr>
<th>Item</th>
<th>1953-4</th>
<th>1959-60</th>
<th>1961-2</th>
<th>1963-4(a)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Agricultural</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Un-processed</td>
<td>7.9</td>
<td>10.4</td>
<td>17.8</td>
<td>16.2</td>
</tr>
<tr>
<td>Processed</td>
<td>11.3</td>
<td>7.8</td>
<td>8.0</td>
<td>10.5</td>
</tr>
<tr>
<td><strong>Pastoral</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Un-processed</td>
<td>51.7</td>
<td>48.7</td>
<td>42.2</td>
<td>43.4</td>
</tr>
<tr>
<td>Processed</td>
<td>9.1</td>
<td>8.3</td>
<td>6.3</td>
<td>5.3</td>
</tr>
<tr>
<td><strong>Dairy and farmyard</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Un-processed</td>
<td>0.6</td>
<td>0.2</td>
<td>0.2</td>
<td>0.2</td>
</tr>
<tr>
<td>Processed</td>
<td>5.2</td>
<td>5.2</td>
<td>4.0</td>
<td>3.5</td>
</tr>
<tr>
<td><strong>Mines and quarries</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(except gold)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Un-processed</td>
<td>0.3</td>
<td>0.5</td>
<td>0.6</td>
<td>0.6</td>
</tr>
<tr>
<td>Processed</td>
<td>0.2</td>
<td>0.1</td>
<td>0.1</td>
<td>-</td>
</tr>
<tr>
<td><strong>Forestry</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Un-processed</td>
<td>0.1</td>
<td>0.1</td>
<td>0.1</td>
<td>-</td>
</tr>
<tr>
<td>Processed</td>
<td>0.3</td>
<td>0.3</td>
<td>0.3</td>
<td>0.2</td>
</tr>
<tr>
<td><strong>Manufactures</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>6.0</td>
<td>9.2</td>
<td>9.8</td>
<td>10.3</td>
</tr>
<tr>
<td><strong>Refined petroleum oils</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>-</td>
<td>1.7</td>
<td>2.0</td>
<td>1.4</td>
</tr>
<tr>
<td><strong>Unclassified (b)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.9</td>
<td>1.3</td>
<td>1.2</td>
<td>1.3</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
</tr>
</tbody>
</table>

(a) Preliminary.

(b) Includes small consignments of less than $100 value and military supplies, etc.

### TABLE 3


<table>
<thead>
<tr>
<th>Year</th>
<th>Number of persons of all ages residing permanently on rural holdings in Australia</th>
</tr>
</thead>
<tbody>
<tr>
<td>1959</td>
<td>1,024,656</td>
</tr>
<tr>
<td>1960</td>
<td>1,021,401</td>
</tr>
<tr>
<td>1961</td>
<td>1,015,133</td>
</tr>
<tr>
<td>1962</td>
<td>1,009,947</td>
</tr>
<tr>
<td>1963</td>
<td>1,004,941</td>
</tr>
</tbody>
</table>


(b) Distribution of Employment by Industry, 1962-3 and projected 1974-5.

<table>
<thead>
<tr>
<th>Industry Group</th>
<th>1962-3</th>
<th>1974-5</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>'000</td>
<td>%</td>
</tr>
<tr>
<td>Rural industries</td>
<td>428</td>
<td>10.2</td>
</tr>
<tr>
<td>Mining and quarrying</td>
<td>51</td>
<td>1.2</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>1180</td>
<td>28.2</td>
</tr>
<tr>
<td>Tertiary</td>
<td>2529</td>
<td>60.4</td>
</tr>
<tr>
<td>All industries</td>
<td>4188</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Source: Report of the Committee of Economic Enquiry, p.1098
### TABLE 4: GROWTH OF PROVINCIAL CENTRES

<table>
<thead>
<tr>
<th>Provincial Centre and State</th>
<th>Distance to nearest metropolis</th>
<th>Population in thousands 1947</th>
<th>1954</th>
<th>1961</th>
<th>1966</th>
</tr>
</thead>
<tbody>
<tr>
<td>Newcastle, N.S.W.</td>
<td>100</td>
<td>127</td>
<td>178</td>
<td>219</td>
<td>234</td>
</tr>
<tr>
<td>Woolongong, N.S.W.</td>
<td>60</td>
<td>63</td>
<td>88</td>
<td>128</td>
<td>162</td>
</tr>
<tr>
<td>Geelong, Victoria</td>
<td>90</td>
<td>45</td>
<td>72</td>
<td>88</td>
<td>104</td>
</tr>
<tr>
<td>Canberra, A.C.T.</td>
<td>180</td>
<td>16</td>
<td>28</td>
<td>48</td>
<td>92</td>
</tr>
<tr>
<td>Launceston, Tasmania</td>
<td>40</td>
<td>49</td>
<td>56</td>
<td>60</td>
<td></td>
</tr>
<tr>
<td>Townsville, Queensland</td>
<td>700</td>
<td>34</td>
<td>40</td>
<td>49</td>
<td>57</td>
</tr>
<tr>
<td>Ballarat, Victoria</td>
<td>80</td>
<td>40</td>
<td>48</td>
<td>53</td>
<td>56</td>
</tr>
<tr>
<td>Gold Coast, Queensland</td>
<td>50</td>
<td>12</td>
<td>20</td>
<td>34</td>
<td>53</td>
</tr>
<tr>
<td>Toowoomba, Queensland</td>
<td>80</td>
<td>33</td>
<td>42</td>
<td>46</td>
<td>52</td>
</tr>
<tr>
<td>Rockhampton, Queensland</td>
<td>350</td>
<td>35</td>
<td>42</td>
<td>42</td>
<td>45</td>
</tr>
</tbody>
</table>

APPENDIX VII

The Federal Structure and Financial Arrangements

The Commonwealth, having the sole right to levy direct taxes in Australia, is the major collector of public revenues, receiving some 72% of the total. The States collect about 22% while local government incomes constitute some 6%. The State's incomes are increased by the distribution of a portion of the revenues collected by the Commonwealth. This amounts to about 20-25% of the total Commonwealth revenues and accounts for about 40% of the States total receipts. The method of allocating the major part of these revenues to the States is based upon a formula which takes into account movements in population in each State and increases (if any) in the level of average wages per person employed. The remainder of the payments take the form of interest upon loans and a wide range of smaller special purpose grants.

It should be noted that the Commonwealth's refunds to the States constitute a much larger share of their real incomes than do their total receipts. Some one third of the States' income is made up of revenues from their business undertakings, e.g. railways, and these revenues are immediately absorbed by operating expenses.

The total amount to be allocated by the Commonwealth to the States is determined at the Annual Premiers Conference. The Commonwealth, representing the national interest, speaks with unchallenged authority on the national economic position at this Conference and uses these arguments to justify the amount it is prepared to allocate to the States. The States on their parts are anxious to increase the amount available to them but

they do so only by presenting strong cases in their favour. At best, they gain only marginal increases.

Since the Commonwealth increased its special grant activities, it has a further political device with which to divide the States and to further its own arguments. No State Premier can afford to refuse any proffered special grant because his State will thereby gain investment and population. If at the next Census his State records an increase in its share of the national population, it will gain a larger share of the funds allocated by the formula. Thus the State may be able to improve its services to the people, e.g. in education, and the Premier will gain voter support.

The Loan Council Meeting held at the same time as the Premiers' Conference determines the extent of loan raisings which the public sector will undertake in the incoming year. Here again, the Commonwealth's opinion of the nation's economic circumstances is unchallenged. As loans are a major source of finance for all public works expenditures in Australia, the Commonwealth effectively controls the States' development programs. No State can, of its own volition, undertake to raise loans for specific developmental works because all the States have transferred their loan raising powers and the necessity to meet interests and amortization payments to the Commonwealth.
APPENDIX VIII

The effects of variable costs in the costs of production per annual ton in hypothetical steel works.

In this Appendix, an examination is made of the effects of some variable costs upon the production in two hypothetical steel works. The data has been drawn from the work of the E.C.L.A. 1

The hypothetical steel works proposed consist of the following components:

**Plant A:**  
Annual capacity of pig iron production: 400,000 tons.  
Process - coke blast furnace.  
Annual capacity of steel: 500,000 tons.  
Process - L.D.  
Rolling mill capacity:  
Flat products - 200,000 tons.  
Bars and sections - 100,000 tons.

**Plant B:**  
Annual capacity of pig iron production: 800,000 tons.  
Process - coke blast furnace.  
Annual capacity of steel production: 1,000,000 tons.  
Process - L.D.  
Rolling mill capacity:  
Flat products - 400,000 tons.  
Bars and sections - 300,000 tons.

Note: the charge of the L.D. converters is based on the assumption of the ECLA study, vis. 0.788 tons of hot metal and 0.34 tons of scrap. Rolling mill capacity does not equal steel productions because of losses during processing.

1. E.C.L.A., 'The Iron and Steel Industry in Latin America: Plans and Perspectives', op cit, was the basic source for this Appendix.

2. Both plants are assumed to operate with L.D. process and continuous casting for non-flats.
The following table sets out an itemization of costs as derived by the ECLA for each plant:-

<table>
<thead>
<tr>
<th>Item</th>
<th>Plant A</th>
<th>Plant B</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Coke Blast Furnace</strong></td>
<td>(U.S. dollars per ton at 1962 prices).</td>
<td></td>
</tr>
<tr>
<td>Assembly costs</td>
<td>28.30</td>
<td>28.30</td>
</tr>
<tr>
<td>Salaries and wages</td>
<td>1.53</td>
<td>0.99</td>
</tr>
<tr>
<td>Fuel and power</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>Oxygen</td>
<td>0.58</td>
<td>0.53</td>
</tr>
<tr>
<td>Other supplies</td>
<td>2.72</td>
<td>2.38</td>
</tr>
<tr>
<td>Capital charges (a)</td>
<td>6.78</td>
<td>5.20</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>40.91</td>
<td>38.40</td>
</tr>
<tr>
<td><strong>L.D. Process</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Molten pig iron</td>
<td>32.23</td>
<td>30.25</td>
</tr>
<tr>
<td>Scrap</td>
<td>12.49</td>
<td>11.53</td>
</tr>
<tr>
<td>Iron and ferroalloys</td>
<td>46.93</td>
<td>44.38</td>
</tr>
<tr>
<td>Salaries and wages</td>
<td>2.54</td>
<td>2.07</td>
</tr>
<tr>
<td>Other conversion costs</td>
<td>7.14</td>
<td>6.61</td>
</tr>
<tr>
<td>Capital charges (a)</td>
<td>3.12</td>
<td>2.26</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>60.69</td>
<td>55.81</td>
</tr>
<tr>
<td><strong>Flat Products</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ingot steel</td>
<td>101.15</td>
<td>84.27</td>
</tr>
<tr>
<td>Fuel</td>
<td>2.01</td>
<td>1.48</td>
</tr>
<tr>
<td>Credit for scrap</td>
<td>- 19.97</td>
<td>- 14.10</td>
</tr>
<tr>
<td>Salaries and wages</td>
<td>18.60</td>
<td>6.22</td>
</tr>
<tr>
<td>Other conversion costs</td>
<td>11.25</td>
<td>10.67</td>
</tr>
<tr>
<td>Capital charges (a)</td>
<td>38.60</td>
<td>29.70</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>145.74</td>
<td>118.24</td>
</tr>
<tr>
<td><strong>Non Flat Products</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Steel ingots</td>
<td>69.50</td>
<td>63.89</td>
</tr>
<tr>
<td>Credit for scrap</td>
<td>- 4.89</td>
<td>- 3.83</td>
</tr>
<tr>
<td>Salaries and wages</td>
<td>7.80</td>
<td>4.37</td>
</tr>
<tr>
<td>Other conversion costs</td>
<td>7.30</td>
<td>5.95</td>
</tr>
<tr>
<td>Capital charges (a)</td>
<td>8.05</td>
<td>6.83</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>87.76</td>
<td>77.21</td>
</tr>
</tbody>
</table>

(a) reckoned at 9% of capital invested without considering taxes, profits, etc.

Note: the inputs throughout have been adjusted in price to reflect those recorded for the previous process.
This table may be written to show the total annual costs of each item as follows assuming that all output is processed to flat products or sections.

<table>
<thead>
<tr>
<th>Item</th>
<th>Plant A (in thousands of dollars)</th>
<th>Plant B (in thousands of dollars)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assembly costs</td>
<td>11,320</td>
<td>22,640</td>
</tr>
<tr>
<td>Scrap (a)</td>
<td>1,752</td>
<td>4,741</td>
</tr>
<tr>
<td>Fuel and power</td>
<td>802</td>
<td>1,393</td>
</tr>
<tr>
<td>Oxygen</td>
<td>232</td>
<td>424</td>
</tr>
<tr>
<td>Other supplies (b)</td>
<td>2,633</td>
<td>5,054</td>
</tr>
<tr>
<td>Other conversion costs</td>
<td>6,550</td>
<td>13,663</td>
</tr>
<tr>
<td>Wages and salaries</td>
<td>5,182</td>
<td>6,651</td>
</tr>
<tr>
<td>Capital charges</td>
<td>12,797</td>
<td>20,349</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>41,268</strong></td>
<td><strong>73,925</strong></td>
</tr>
</tbody>
</table>

(a) allowing for use of scrap arising in rolling mills.
(b) includes costs of ferroalloys, etc. in steel.

Plant A produces 300,000 tons of finished products at a cost per average ton of $137.56. Plant B produces at a cost per average ton of $105.60 despite the larger component of higher-cost flat products in its output.

**Capital Costs.**

The capital costs of Plants A and B are approximately $142,000,000 and $226,000,000 respectively, i.e. about $470 and $320 per annual ton of final product respectively. Scale is thus of great importance in capital outlay. Moreover, on the basis of the ECLA estimates, where capital charges are 9% per annum, capital costs constitute 31% of production costs in Plant A and 27% in Plant B. A variation of one per cent in the cost of capital will result in about a 3% change in the cost of production. Thus the comparative advantage of the plant must be strongly influenced by the cost of capital, i.e. the rate of interest at which capital can be attracted to the project.

The capital costs noted in this example do not cover costs incurred in providing facilities such as water supply or
housing or urban infrastructure. A recent paper\textsuperscript{3} suggested that the costs of new town building in Australia vary from $10,000 for each of the first 10,000 residents to $7,500 per capita for 100,000 residents. Plant A would probably employ at least 7,500 workers (see Fig VIII - 1). Their direct dependents alone would number approximately 30,000. Thus cost of infrastructure would amount to $300,000,000. For Plant B, workforce would be 10-12,000 workers or a directly dependent population of about 50,000 persons. The cost of a new town would approach $500,000,000. These figures do not take account of the population dependent on 'service' industries attracted by the steel workers.

It is evident that the cost of housing workers and providing them with some reasonable level of amenity would far exceed the direct costs of investment in the iron and steel works. Any plant burdened with such costs would be hopelessly disadvantaged, e.g. for Plant A or B, the capital charges would exceed all other production costs and result in a 60% increase in total annual costs.

\textbf{Labour costs.}

Labour costs in Plant A amount to 12% of the total annual costs and in Plant B to 9%. The ECLA study used a labour cost of $1.50 per man hour, which seems to indicate that the labour inputs accounted for are limited to those workers actually engaged in the processes described.\textsuperscript{4} If all workers, clerical, yard and others, are taken into account, labour costs may

\begin{itemize}
\item \textsuperscript{3} Lansdown, \textit{op cit.}
\item \textsuperscript{4} The ECLA study, while based on 'modern technology', appears to understate the labour force required in the plant. For example, at $1.50 per man hour, assuming a 50 week year and 40 hour working week, the million ton plant has a workforce of around 2,200 which is extremely low when compared to the trend line on Figure VIII - 1.
\end{itemize}
FIGURE VIII - 1.
Employment in steel plants.

Plants listed:
1. Mannesmann, Brazil.
3. Huachipato, Chile.
4. Belgo-Mineira, Brazil.
5. Volta Redonda, Brazil.

double and they would then account for 21% and 18% of the total costs.

Any substantial variations in the rate of return to labour may sharply alter the distribution of comparative advantage between plants.

Median taxable income in Australia is about $2,000 per taxpayer. Median actual income is probably closer to $3,000 per annum or about $1.50 per hour. Thus Australian conditions would resemble those recorded above. Norris reports that Japanese steel workers earn about $146 per month or $1,750 per annum. Assuming that they also work 50 weeks of 40 hours, their rate of pay is about $0.875 per hour. In Plant A this would amount to a reduction in total costs per annum (all others remaining constant) of about $2 million or 5%. For Plant B, the reduction would be about $2.8 million or around 4%. Because wages in a Pilbara plant would probably be higher than the Australian average, a Japanese plant would enjoy substantial advantages in terms of labour.

Technology
In another ECLA document, the following table appears indicating the advantages of modern technology in the steel industry over existing practices.

5. No statistics are available to indicate the median or average wages or incomes of Australian workers in various industries. The only income figures available are those in the Report of the Taxation Commissioner which show State-wide distributions of taxable incomes only.


7. ECLA, Los Principales Sectores de la Industria Latino-Americano: Problemas y Perspectivas, Undecimo periodo de sesiones: ciudad de Mexico, Mayo be 1965, (E/CN. 12/718), p.31
The influence of the type of technology used in a plant producing 1.5 million tons per annum of flat products on the hypothetical costs of production and investment:

<table>
<thead>
<tr>
<th>Department</th>
<th>Theoretical costs of Production</th>
<th>Investment per ton of productive capacity installed</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Intermediate</td>
<td>Modern</td>
</tr>
<tr>
<td>1. Reduction of ore</td>
<td>39.57</td>
<td>39.41</td>
</tr>
<tr>
<td>2. Steel (ingots or plate with continuous casting)</td>
<td>64.15</td>
<td>61.39</td>
</tr>
<tr>
<td>3. Milling and rolling plates</td>
<td>120.52</td>
<td>100.62</td>
</tr>
</tbody>
</table>
APPENDIX IX

The influence of proximity on international trade.

If freight charges on finished products affect the ability of producers to sell in distant markets, it might be expected that the export markets of producing countries would tend to cluster around them. The following listing shows the major markets of five leading steel exporting countries in 1963 and classifies them in terms of their proximity to the supplier. It appears to bear out the above assumption.

The proximity classifications employed are:

- Close - within the same world region;
- Medium - within an adjoining world region;
- Remote - within any other world region.

The entries in the proximity classification columns are the tonnages shipped in thousands of metric tons. Only markets receiving more than 75,000 tons are included. The world regions used are those adopted in the U.N. Statistics of World Trade in Steel, from which the data were drawn.

<table>
<thead>
<tr>
<th>Exporting country</th>
<th>France</th>
<th>Italy</th>
<th>Netherlands</th>
<th>Switzerland</th>
<th>U.S.A.</th>
<th>Belgium-Luxembourg</th>
<th>Denmark</th>
<th>Sweden</th>
<th>U.S.S.R.</th>
<th>Greece</th>
<th>Iran</th>
<th>Spain</th>
<th>Canada</th>
<th>Norway</th>
<th>Austria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Importing country</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>close</td>
<td>1881</td>
<td>1060</td>
<td>836</td>
<td>640</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>medium</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>474</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>remote</td>
<td></td>
<td></td>
<td></td>
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APPENDIX X

A Proposed Test of the Sensitivity of a Plant in the Pilbara to changes in external factors.

There are several external factors which may influence the viability of a Pilbara plant and which may be completely outside of the control of either the company operating the plant or any Australian Government. Among these are changes in transportation costs to competitors and changes in the distributions of markets. Both of these factors tend to be associated with changing advantages arising from economies of scale being reallocated among competing plants.

Kendrick has investigated the effects of economies of scale in the distribution of steel making capacity in Latin America as well as the allocation of capacity to minimize total costs. His approach accepted a series of possible plant locations, and a series of markets of known size. Transport costs from each plant to each market were assumed to be constant per ton of steel shipped. Capacity was then allocated to meet the market requirements and to minimize total costs allowing for economies of scale in production.

The formulation proposed here is in the same vein but seeks to test the effects on the allocation of productive capacity, of changes in the magnitude and geographical distribution of markets and of variations in freight charges on various links in the transportation system connecting plants to markets and to raw materials. It assumes that the scales of production at all plants in the system are approximately equal, that the processes in use are the same, and that the costs of production are equal.

The formulation begins from the following premises:

1. That production costs are equal.
2. That markets will tend to buy steel from the plant which can land its product there at the lowest cost, i.e. from the plant which incurs the least transportation costs.
3. That when the markets are so operating, transportation costs in the whole system must be minimized for all plants and markets.
4. That there are three plant locations in the system, one of which is located at the source of the ore (in that it incurs no assembly costs in obtaining ore), a second is located at the source of coal and the third is at another known location distant from either coal or ore.
5. That all three plants draw their raw materials from these two sources.
6. That all markets are known in geographic location and either in actual size or in relative magnitudes.
7. That transportation costs consist of two components - terminal costs which cover the costs of loading and unloading at either end of any particular trip and which are related to cargo type and which vary on each link in the transportation network; and travel costs which are directly proportional to the length of the trip, which vary with type of cargo, and which are constant per ton mile for similar links in the network. That is to say, that all distribution costs from any one plant will be based upon a common per ton mile rate regardless of destination but this rate might vary from plant to plant.
8. That all transportation charges relate to seaborne cargo.
9. That allowance must be made for vessels engaged on a round trip basis but which have to make one leg of their journey in ballast
10. That all plants require the same inputs per ton of output.
Let A be the plant at the source of ore.
Let B be the plant at the source of coal.
Let C be the third plant.

The following parameters are known for any one application of the formulation:

- $o$ - the tonnage of ore required to yield one ton of finished steel;
- $c$ - the tonnage of coal required to yield one ton of finished steel;
- $d_{AB}$ - the distance from plant A to plant B;
- $d_{AC}$ - the distance from plant A to plant C;
- $d_{BC}$ - the distance from plant B to plant C;
- $M$ - the total market available in any one year;
- $m_k$ - the market available at point k in tons of finished steel, where $k$ varies from 1 to $n$;
- $d_{AK}$, $d_{BK}$, and $d_{CK}$ - the distance from the three plants to market $k$.

The endogenous variables are:

- $CA$, $CB$ and $CC$ - the capacities of plants A, B and C respectively, in tons per annum; and
- $m_{Ak}$, $m_{Bk}$ and $m_{CK}$ - the tonnages shipped from each plant to each market in the year. No constraints are imposed upon the upper limits of the plant's capacity. The lower limit is zero value.

The exogenous variables would be the terminal and travel costs which may be written as follows:
Travel costs on a per ton mile basis -

for raw material assembly:

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<th>C</th>
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<tr>
<td>B</td>
<td>$f_{BA}$</td>
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<td>(coal)</td>
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<td>C</td>
<td>$f_{CA}$</td>
<td>$f_{CB}$</td>
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<td>(ballast)</td>
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for distribution of products:

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<td>$f_{An}$</td>
</tr>
<tr>
<td>B</td>
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<td>$f_{B2}$</td>
<td>$f_{B3}$</td>
<td>...</td>
<td>$f_{Bn}$</td>
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<tr>
<td>C</td>
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<td>$f_{C1}$</td>
<td>$f_{C2}$</td>
<td>$f_{C3}$</td>
<td>...</td>
<td>$f_{Cn}$</td>
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Terminal costs in 't' may be written in a similar fashion.

The formulation is to be applied iteratively. There are scale economies in terminal costs and these should be allowed for.

It is felt that the initial costs used will make allowance for this but that subsequent possible variations should be inserted to adjust terminal costs as the iterations proceed.

The total assembly costs, $TA$, can be written as follows:

$$c \cdot CA(d_{AB} \cdot f_{BA} + t_{BA}) + o \cdot CB(d_{AB} \cdot f_{AB} + t_{AB}) + o \cdot CC(d_{AC} \cdot f_{AC} + f_{CA}) + t_{CA} + t_{AC} + c \cdot CC(d_{BC} \cdot f_{BC} + f_{CB}) + t_{BC} + t_{CB}.$$ 

But, $c(d_{AB} \cdot f_{BA} + t_{BA})$ is a constant for any given set of values of $t$ and $f$. It may be written $\Phi_{A}$. Similarly for the other coefficients.

Then $TA = CA \cdot \Phi_{A} + CB \cdot \Phi_{B} + CC \cdot \Phi_{C}$.

But, $CA = \sum_{k=1}^{n} m_{Ak}$, and so on.
Thus, $TA = \sum_{k=1}^{n} m_{Ak} + \sum_{k=1}^{n} m_{Bk} + \sum_{k=1}^{n} m_{Ck}$;

$= \sum_{k=1}^{n} (\phi_{A} \cdot m_{Ak} + \phi_{B} \cdot m_{Bk} + \phi_{C} \cdot m_{Ck})$;

i.e., $TA = \sum_{A=A}^{C} \sum_{k=1}^{n} (\phi_{A} \cdot m_{Ak})$.

Similarly, the total distribution costs may be written:

$TD = \sum_{k=1}^{n} m_{Ak}(t_{Ak} + d_{Ak} \cdot f_{Ak}) + \sum_{k=1}^{n} m_{Bk}(t_{Bk} + d_{Bk} \cdot f_{Bk}) + \sum_{k=1}^{n} m_{Ck}(t_{Ck} + d_{Ck} \cdot f_{Ck})$.

But again, $(t_{Ak} + d_{Ak} \cdot f_{Ak})$ is a constant for any one set of $t$ and $f$. It may be written as $\phi_{Ak}$, and so on.

Thus $TD = \sum_{k=1}^{n} (m_{Ak} \cdot \phi_{Ak} + m_{Bk} \cdot \phi_{Bk} + m_{Ck} \cdot \phi_{Ck})$, or

$= \sum_{A=A}^{C} \sum_{k=1}^{n} m_{Ak} \cdot \phi_{Ak}$.

Then $TA + TD = \sum_{A=A}^{C} \sum_{k=1}^{n} (\phi_{Ak} + \phi_{A}) \cdot m_{Ak}$, which is the total transportation cost in the system and is to be minimized. The constraints upon this minimisation are:

$\sum_{A=A}^{C} \sum_{k=1}^{n} m_{Ak} = M$,  \hspace{1cm} $\sum_{A=A}^{C} m_{Ak} = m_{k}$,

$\sum_{k=1}^{n} m_{k} = M$ and $m_{Ak}$, $m_{Bk}$ and $m_{Ck} \geq 0$.

Then $CA = \sum_{k=1}^{n} m_{Ak}$, $CB = \sum_{k=1}^{n} m_{Bk}$ and $CC = \sum_{k=1}^{n} m_{Ck}$.

Thus by varying $f$ and $t$, the effects of changes in transportation costs can be assessed. By varying the distributions of markets, i.e., $m_{k}$, effects of changes in the geographical distribution of
markets and in the relative magnitudes of markets upon the optimal distribution of plant capacity can also be gauged.
APPENDIX XI

Announced Plans for Steel Production by Countries in Pilbara's Logical Export Market and Nearby Areas.  

South Africa
Production in 1965 - 3,450,000 tons.
Resources - plentiful.
Target - 5,000,000 tons in 1970.

Rhodesia
Production in 1965 - 113,000 tons.
Resources - plentiful.
No Target known.

Other East Africa
Production in 1965 - less than 70,000 tons.
Resources - many small occurrences of iron ore and coal known but few deposits warranting large scale mining or production. One exception - Zambia.
Target - Uganda is planning an integrated iron and steel industry; Uganda, Ethiopia and Sudan have small plants producing from locally available scrap.

Middle East States
Production - none known.
Resources - unknown.
No Target known.

Iran
No Production except from crude furnaces.
Resources - sufficient for small plants.
Plans - discussion of erection of a plant to produce 240,000 to 300,000 tons annually.
India
Production in 1965 - 6,899,000 tons.
Resources - among the world's largest.
Targets - 1968 8.9 million tons.
1970 14.8 million tons.5

Pakistan
Production in 1965 - 13,000 tons.
Resources poor.
Plans were under consideration in 1963 for the establishment
of two plants using imported pig iron and scrap to
produce 350,000 tons annually.3

Ceylon
No known production.
Resources - very limited.
Plans - an agreement was signed in 1958 with USSR to erect a
small steel plant. Initial output of 35,000 tons.3

Burma
Capacity installed to produce 20,000 tons in 1959.
Resources - limited.
Plans for a larger steel works appear to have been dropped.3

Malaya
No known Production.
Reserves of iron ore extensive. No known coal deposits.
Plans - for a small plant being considered.3

Singapore
No recorded production
No local resources
Plans in hand for a small 30-60,000 tpy plant with later
expansion to 500,000 tpy.3
Indonesia

No recorded production

Resources of ore are large but highly adulterated with titanium, nickel and chrome. Coal is ample.

Plans - a steel plant being built by the USSR was planned to be in operation by 1965. Planned output is 100,000 tons of crude ingots. Pig iron will be imported initially. Later stages call for 300,000 tpy pig iron capacity.\(^3\)

Thailand

Small local production - under 10,000 tpy.

Resources - limited.

No firm plans for production.\(^3\)

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2. 'The World Battle for Steel', \textit{op cit.}


5. 'Indian Steel - Vision in Shreds', \textit{op cit.}
APPENDIX XII

Forecasts of Future Imports

There are no precedents known for forecasting long-range steel demands of individual countries that do not require massive detailed information about the structure and prospects of the whole economy. The forecast set out below is based on limited data and attempts to use general rules of thumb to assess future requirements. The forecast must therefore be treated as highly suspect. It is presented here only to show orders of magnitude of possible markets.

Figure XII - 1, shows that over the period 1957-63, a number of countries experienced increases in per capita consumption of steel and also of GNP. Expressed as a demand elasticity, the relationships tend to approximate unity. The forecast is based on the assumption that this is a reasonable elasticity for gross projection in low income countries.

Figure XII - 2 reaffirms the ECE's findings on the characteristics of the curve relating GNP per capita and per capita steel consumption. This cross-sectional analysis shows an overall elasticity of approximately one except at high income and consumption levels.

The method used for the forecast sets out from estimates of imports in 1963 by country. To these were added the recorded local production in 1963 to yield total apparent consumption.

1. Long Term Trends and Problems of the European Steel Industry, op cit, p.121.
2. Derived from the U.N. Statistics of World Trade in Steel, 1963. These cover only major exporting countries (they accounted for 94% of world production in 1963) but there may be minor flows which were not included. The data relate only to finished and semi-finished steel products.
3. From U.N. statistics and data from papers at the Interregional Symposium, op cit.
FIGURE XII - 1.

Changes in the Apparent Consumption of Steel per capita; 1957-63.

Sources: Long term Trends and Problems of the European Steel Industry, op cit; and U.N. Statistics of World Trade in Steel.
FIGURE XII - 2.

Scatter diagram of per capita G.N.P. against per capita apparent consumption of steel, by nations, 1963.

The dashed line is that found by the E.C.E. in their 1959 study based on a similar plot of 1957 data. The deviation between the 1957 line and the 1963 data may result from a less complete enumeration of data in the latter year.
Dividing this by the estimated population in 1963, the per capita consumption in 1963 in kilograms is obtained. The latest estimates of GNP per capita are included so that any gross deviations can be identified for these may offset future consumption. Estimates of population in 1976 and of the increase in GNP per capita were obtained. Assuming elasticities reflecting past behaviour and probable future prospects, the per capita consumption of steel in 1976 was estimated. Multiplying this by expected population yields total apparent consumption in 1976. By subtracting estimated local production from this last figure, a rough order of magnitude of the level of imports is obtained.

It must be stressed that this is a very crude method and the results depend largely on personal opinions about elasticities, rates of economic growth, and extent of future local production. The significance of the Indian market is pertinent. Any misjudgement of this market, drastically alters the whole trade perspective.

6. Based on the projections of P.N. Rosenstien-Rodan, "International Aid to the Developing Countries", Review of Economics and Statistics, May, 1961, p.132. His estimates of population in 1961 often differ from those published by the U.N. Where these were significant to the rounding of estimates, the difference between the two was added or subtracted to the estimated future population. In view of the imprecision of basic population data, this crude adjustment to a projected population estimate is not considered out of order.
7. Estimates of future production were largely intuitive, guided by the best available published targets for production most of which apply to earlier years.
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<td>8.4 s'000 mts.</td>
<td>-</td>
<td>8.4 s'000 mts.</td>
<td>14.9 by 10^6 kilos</td>
<td>30 $ by 10^6 %</td>
<td>1 kilo s'000 mts.</td>
<td>- s'000 mts.</td>
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<td>74.0</td>
<td>10.6 7</td>
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<td>130 50 80</td>
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<td>25.8 5</td>
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<td>760</td>
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<td>- - 1 - 1000 400 600</td>
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<td>TOTAL</td>
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<td>4580000 metric tons</td>
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APPENDIX XIII

Components of Lags

The lag is believed to consist of five separate time intervals some of which may elapse concurrently. These five intervals are as follows:

1. The information interval: This is the time required for information about any potential market opportunity in the local economy to be transmitted from the locality to some entrepreneur capable of responding to the opportunity. It is doubtful if this interval can ever be quantified. It obviously varies inversely with the size, rate of growth and 'glamour' of the new town since these will govern the amount of the new town’s publicity (information) in public and private communication systems. It will also vary directly with the capital needs of the investment opportunity. A project requiring a large amount of capital will find fewer entrepreneurs capable of responding and thus the probability of the interval increasing is itself increased. (Industrial promotion campaigns conducted by States attempting to attract industries are aimed at reducing this interval.)

2. The decision interval: Once a qualified entrepreneur is aware that an investment opportunity exists, he must investigate it and decide whether or not to act upon it. The extent of these investigations will usually be related directly to the size of the investment. One reason for this is that if the investment is small, there will be a number of entrepreneurs who could respond and the opportunity must be seized before another acts upon it. Moreover, the size and rate of growth of demand, both in the short term and the long term, are important influences and the decision interval is likely to vary
inversely with size and rate of growth. A large town with a high rate of growth offers a much better 'cushion' for a misjudged investment than does a small slow growing one — provided, however, the investments are limited to those to meet locally-stimulated demand.

3. The mobilization increment: Once an investor has decided to act on an opportunity, he may have delays during which time he has to arrange capital for the new project, prepare plans for new plant or buildings or arrange disinvestment at his present location. The influences operating here are probably similar to those in the decision interval. Personal factors will also appear — e.g. credit ratings, etc. of the entrepreneur.

4. The construction interval: This will obviously vary with the size of the investment and will also depend upon the capacity of the local building industry to accommodate the work. In a fast growing town, there should be a well developed building industry but excessive demands might exceed its capacity and result in additional delays. The extent of these delays will be governed by mobility in the national building industry. Moreover, since the bulk of the building activity will be in housing, the minimum construction standards established for it will govern the ability of marginally skilled labour to enter the building industry, e.g. through self-built housing. Delays in commercial projects represent a loss of income to the entrepreneur and consequently, the bid price for building services may increase and additional builders may enter the local economy. This is less probable in housing where the limiting factor will probably be with shortage of mortgage funds.

It may be assumed that the construction intervals for projects in the new town will not exceed those applicable to similar projects elsewhere. It is feasible that a separate sub-model
of the building industry could be developed but this is a refinement beyond the scope of the present discussion.

5. The operational interval: After construction is complete there will be a period when inventories are established, staff trained, and so forth. Modern business management minimizes this delay. There is, however, another aspect to this interval. That is the problem of staffing. If suitable local staff is available, it must be assumed that they will be employed. However, if staff have to be imported, there arises the question of housing for them. Experience in isolated new towns has shown the importance of the family life in creating stable workforces. If married men are to be employed in the new town, they must be offered housing. If there is a steady demand for housing at the national level, it is improbable that the amount of funds available from either public or private sources for housing finance in the new town will vary greatly from year to year. It must be assumed that the amount of funds available in any one year will be a function of the past rate of growth of the new town. This acts as a dampening constraint on any fluctuations in the provision of housing. If private enterprise wishes to house its own workers at its own cost, these should be included in the locational analysis of the market opportunity.
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