

PROSPECTS FOR REGIONAL ECONOMIC  
DEVELOPMENT: AN INDUSTRIAL COMPLEX  
ANALYSIS FOR NORTHERN MANITOBA

A Thesis

Presented to

The Faculty of Graduate Studies

The University of Manitoba

In Partial Fulfillment  
of the Requirements for the Degree  
Master of Arts  
Department of Geography

by

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June 1981

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A thesis submitted to the Faculty of Graduate Studies of  
the University of Manitoba in partial fulfillment of the requirements  
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MASTER OF ARTS

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## ACKNOWLEDGEMENTS

This study could not have been completed without the aid of several people. I would like to express my gratitude to Dr. D. Todd for his guidance as well as his patience in the preparation of this study. Thanks go as well to Mr. J. Romanowski and Dr. V. Mason for their suggestions on certain aspects of the thesis.

Further acknowledgement is given to my employers at the Secretary of State and especially to my General Manager at Loewen Leasing Ltd., Ron Bailey, for allowing me generous time off work so that I may attend to the work involved with my thesis.

Final thanks to my mother for her "encouragement" in completing my thesis.

## ABSTRACT

The purpose of this study is to review past attempts at developing northern Manitoba and then to offer an alternative. It was seen that past attempts were short-term in nature and that a more long-term and integrated approach was in order. To this end an industrial complex analysis was introduced. Literature pertaining to this type of analysis was reviewed, and prospects related to the case in point were abstracted. In consequence a hypothetical industrial complex based on mineral production was operationalized. As part of this, consideration was given to transportation costs. The result of this was a tentative site for the hypothetical complex was chosen, that being Snow Lake.

Finally, several shortcomings of the study were identified, followed by a discussion on the various policy implications that stemmed from the study.

## PREAMBLE

This study is concerned with the issue of regional economic development in northern Manitoba. In particular its purpose is to identify a set of industries, that is, an industrial complex which would be the most economically feasible for this region of interest. To this end, industrial complex analysis is applied, which is to say, a body of location theory and organizational methods are combined in a regional development role. An industrial complex can be defined as a set of economically linked industries which are also geographically associated.

One may question this approach for development when other seemingly feasible alternatives exist, such as tourism, primary mineral extraction, and hydro-energy development. Indeed these alternatives may be simpler in terms of planning and may also be less expensive. Expanding mineral production, for example, is merely an instance of planning "incrementalism". However, it is the opinion of this author that the potential benefits of these alternatives are much less than the proposed industrial complex. This follows from the assertion that a semi-autonomous complex will have fewer leakages from the region since most of the income effects will be re-spent within the complex system. This would be much less likely to occur, however, with single activity development projects which depend on imports of most of their necessary inputs and thereby suffer extensive leakage penalties. However, if most of the requirements of an industrial complex domestic to the

region are produced within that complex, then obviously leakages will be of much smaller magnitude. Thus an industrial complex has this major advantage over other planning instruments.

The study will begin with an introduction to the northern Manitoba area. In this section the region will be defined and past development attempts will be reviewed and their inadequacies highlighted, if albeit briefly.

Chapter 2 will review literature pertaining to industrial complex analysis. Two types of literature will be discussed, those works that are largely analytical and those that focus on determination of industrial complexes in underdeveloped areas. Both are of equal importance to this study although the latter has more direct relevance to the study region.

Chapter 3 will discuss mineral production. Various aspects of mineral production are to be covered such as its stages (i.e. mining, milling, smelting and refining), inputs and outputs, by-products and market conditions. Finally, this chapter will attempt to relate the above debate to the northern Manitoba situation.

Chapter 4 involves the construction and location of the industrial complex. Three basic steps are involved in its construction. The first is to find those activities that have a high degree of economic association by means of an analysis of linkage coefficients. Of those activities with a high degree of economic linkage, a subset is selected which have great income benefits to the region (using an income multiplier analysis) and which have great employment benefits (by utilizing an employment multiplier analysis). Thus, those

activities with high economic linkages and high income or employment multipliers are included in the complex.

Also in Chapter 4, a simple location aspect is introduced for the industrial complex. Many factors would have been used in determining the site, including capital availability, labour availability, as well as infrastructure development. However, the only criteria used in this study is that of least transportation costs. The reason for this is simply that data is difficult to obtain for such things as capital or labour availability. Given this circumstance, transportation cost is the only factor taken into consideration in locating the industrial complex. The ramification of this, of course, is that the site can only be seen as a suggestion since other elements must be dealt with in any real planning sense.

In summary, this study will apply a three-pronged thrust, namely, it will review past attempts at development in northern Manitoba, literature pertaining to Industrial Complex Analysis, and the existing nature of mineral production in northern Manitoba. Having done this, an industrial complex is to be constructed on the basis of strong economic linkages and strong income and employment multipliers. Finally, a site will be located for the complex on the basis of cheap transportation costs. The outcome of this study is a detailed appraisal of activities suitable for a northern Manitoba industrial base along with a tentative suggestion of a preliminary site for such an activity.

## CHAPTER 1

### INTRODUCTION

Depending on the criteria used; that is, population density, extent of transportation linkages and communications for instance, there are several definitions of what is the Northern Manitoban area. This study, in attempting to be as comprehensible as possible, will adopt the following definition:

...that part of the province which lies north of a line drawn along the course of the Saskatchewan River from the Western boundary to Lake Winnipeg, thence south-east around the north and east shores of that lake to the mouth of the Winnipeg River, and up the course of that stream to the eastern boundary.<sup>1</sup> (See Figure 1)

This region is, to all intents and purposes, an underdeveloped one. Factors leading to the underdeveloped nature of the Northern Manitoba economy are complex and interrelated and they combine to make the region underdeveloped in both an absolute and relative sense. Relatively, the whole of Northern Manitoba is underdeveloped in comparison to Southern Manitoba whereas, absolutely, there exists a state of dualism within the region meaning that there are industrial centres more advantaged than the isolated, traditional communities usually associated with the northern environment. This situation, therefore, complicates development issues in many ways. For example, strategies designed for the North may be essential to "mainstream"

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<sup>1</sup>Morton, W.L., "Northern Manitoba", p. 1.

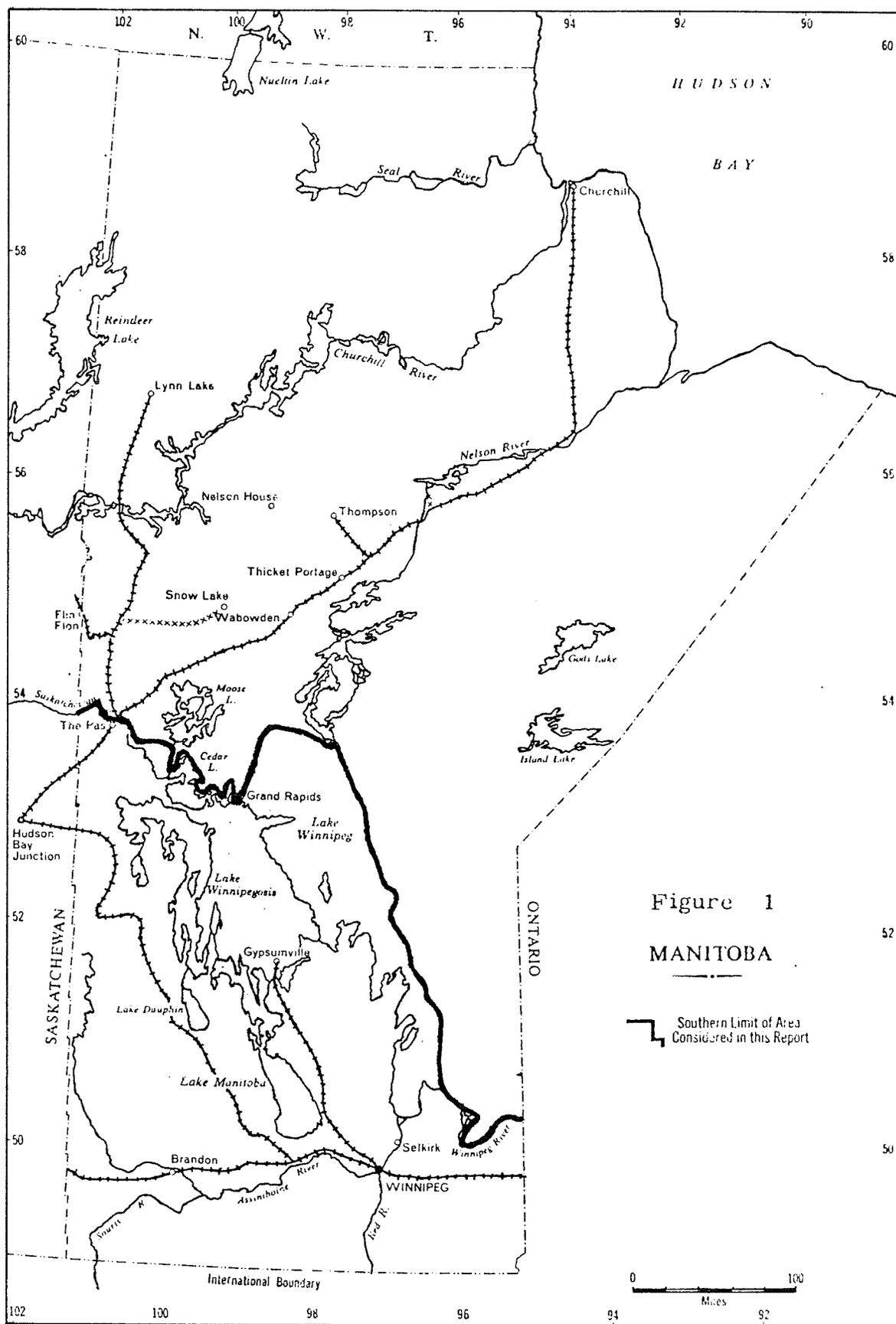


Figure 1  
MANITOBA

— Southern Limit of Area Considered in this Report

industrial centres such as Churchill, Thompson and Flin Flon but may not at all deal with problems of the isolated communities; on the contrary, they may have adverse effects.

However, it can be argued that the major obstacle against Northern development has been geographic isolation which not only affects communication and transportation, but

...has been a barrier to the learning skills and attitudes required to take full advantage of the options offered in the new communities.<sup>2</sup>

Other obstacles mentioned in a report presented to the commission of Northern Affairs are listed as follows:

1. resistance to change by both public as well as civil servants
2. physical conditions of the North which complicate and retard communication among the people
3. the language and cultural barrier
4. lack of development opportunities
5. lack of a team support system<sup>3</sup>

In addition to these are the kind of institutional problems noted by Brewis, problems stemming from government intervention itself. Bureaucratic procedures have often resulted in lack of clarity and incongruent policy frameworks which have emerged in disjointed programs of limited success. An example of this is the Community Development Program which began in 1960. Since its inception it has gone through several policy changes. For example, in 1963 the focus

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<sup>2</sup>"Manitoba's Changing Northland", Department of Regional Economic Expansion, p. 49.

<sup>3</sup>Campfens, H., "Community Development in Northern Manitoba, A Research Report Presented to: Commission of Northern Affairs", p. 51.

was on "...handicraft promotion and development of cooperatives..."<sup>4</sup>  
while in 1964 "...the concern was with employment and job training  
through vocational and opportunity services..."<sup>5</sup>

Changes were instituted before existing policy measures could be fully effective. Cases such as this are not isolated instances. Reorganizational changes and changes in administrative location also had ramifications on the overall nature of planning, switching from a community development level to an individual level such that attention focused on social assistance and child welfare etc., before reverting to a community development approach. This lack of consistency may have minimized the chances of success.

Underlying the program's inadequacy were its association with the Welfare Department and lack of government commitment to the North. Research carried out by Hubert Campfens and presented to the commission of Northern Affairs (which included a survey carried out in several Northern communities), showed that the government programs were short term "make-work" in nature offering no economic or social improvement and regarded by some community leaders "...essentially as a form of 'welfare-in-disguise'..."<sup>6</sup>

Loans from various sources such as the Province's "Community Economic Development Fund" have been very active but are criticized, however,

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<sup>4</sup>Campfens, H., "Community Development in Northern Manitoba, A Research Report Presented to: Commission of Northern Affairs," p. 51.

<sup>5</sup>Ibid., p. 25.

<sup>6</sup>Ibid., p. 27.

...for pursuing primarily a policy that is geared to individual entrepreneurs rather than collective economic ventures that appear more practical for Northern Community Development.<sup>7</sup>

Finally, the program was also criticized for an

...absence of any linkage system between the Planning and Priority Committee of Cabinet (P.P.C.C.), or any other departmental policy-making bodies and Northern communities...<sup>8</sup>

i.e., between both government and community leaders.

One must also account for Federal-Provincial attempts at Northern development, namely the Canadian-Manitoban Northlands Agreement, 1976-1981, whose broad objective is,

- a) to increase incomes and employment opportunities throughout Manitoba; to increase opportunities for people to live in the area of their choice with improved standards of living;
- b) to encourage socio-economic development in the northern portion of Manitoba; to provide the people of the area with real options and opportunities to contribute and participate in economic development, to continue with their own way of life with enhanced pride and purpose and to participate in the orderly utilization of natural resources.<sup>9</sup>

To achieve these ends, several programs were initiated including resource and community development, information and extension (news-letters, seminars, etc. to encourage public and community involvement in the development process), human development services and manpower development services (education and training), community services programs (roads, water supplies and other types of infrastructure), and transportation programs. In actuality, distribution of funds were prioritized as follows:

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<sup>7</sup>Op. cit., p. 29.

<sup>8</sup>Ibid., p. 51.

<sup>9</sup>"General Development Agreement, Canada/Manitoba", Dept. of Regional Economic Expansion, p. 17.

1. Human Development and Community Services--67.19%
2. Transportation and Communication--25.7%
3. Co-ordination and Pilot Action--3.6%
4. Resources and Community Economic Development--3.6%<sup>10</sup>

The objective of the fourth-ranking priority was,

...to provide the resources necessary for the assessment, planning, development and support of resource-based and other opportunities for a community economic development approach, emphasizing local participation, which is designed to provide long-term employment and increased well being in communities on the basis of converging basic human needs with productive activity arising from the resources of the region.<sup>11</sup>

Two programs were involved in the carrying out of the above objective which were cost shared by DREE (60%) and Manitoba (40%).

These programs were:

1. Community Economic Planning and Support;
2. Regional Resource Development Planning.

The former provide funds for:

...technical and planning services, management advisory services, market and feasibility studies, applied experimentation, data collection and resources analysis.<sup>12</sup>

Five activities were involved here. The first was the Co-operative Development Strategy which:

...investigated the possibility of establishing a co-operative financial service in remote northern communities that would satisfy both community needs and the requirements of the Credit Union Act.<sup>13</sup>

Norway House was selected as the experimental site.

The second activity was a community resource planning and

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<sup>10</sup>"Canada-Manitoba Northlands Agreement, 1976-1981", Progress Report, p. 6.

<sup>11</sup>Ibid., p. 8.

<sup>12</sup>Ibid., p. 9.

<sup>13</sup>Ibid., p. 9.

feasibility analysis which:

...was designed to undertake data and information gathering, land use planning, feasibility studies, pilot projects and general assistance related to known and/or potential resource development possibilities in northern communities.<sup>14</sup>

This involved three sub-activities: (1) Comprehensive Land-Use Planning; (2) Community Resource Development Feasibility Studies (studied and experimented with wild rice development, thermal treatment of wood products, a survey of small-scale technology, a portable sawmill, and fish rearing ponds); and (3) Community Resource Development ("...consisted of management assistance to forestry and fisheries undertakings, planning assistance to wildlife development, and ongoing support by Department field staff.")<sup>15</sup>

The third activity was Community Wildlife Management, the fourth, a Business Management Advisory Service, and finally the fifth, Remote Economic and Employment Projects ("...designed to increase the level of small-scale economic development in remote northern communities.")<sup>16</sup>

The second program, Regional Resource Development Planning, identified, specified and assessed major resource development projects. The only project initiated was a survey and the promotion of mapping activity of the northern area.

Another activity implemented (but in the Human Development Sector) was the Program Support Services/Economic Development Services whose intent it was to "provide the opportunity to northern residents

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<sup>14</sup>Op. cit., p. 10.

<sup>15</sup>Ibid., p. 15.

<sup>16</sup>Ibid., p. 18.

to increase the degree of local ownership, control, employment and income in the northern economy."<sup>17</sup> Projects focused on various business ventures (e.g. trading company, hotel, box factory, construction companies, marketing birchwood for fireplaces, fishing projects, motel-restaurant and poolroom, taxi business, dry-cleaning, laundromat). A final activity worth mentioning in the same sector was Northern Corporate and Community Based Enterprises, which "...provided work experience for northern residents in building construction (pre-fab houses), heavy construction and forestry..."<sup>18</sup>

The above brief review of government intervention into northern economic development has brought out several points. From the provincial aspect, it indicates:

1. lack of consistency in policy objectives
2. lack of government commitment to the north insofar as budgetary allocations are concerned
3. resulting projects were of short-term "make-work" type
4. lack of linkage between government and community bodies.

While at the joint Federal-Provincial level, it suggests:

1. Very small funding to Resource and Community Development
2. Policy in this area appears to be far-reaching, all encompassing and long term, however, with the exception of perhaps the human development and transportation and communication sectors, the activities appeared to be small in scale and non-integrated.

It is the opinion of this author that a more long-term, integrated approach should be taken, which would involve interrelated activities that could provide social benefits as a derivative of their economic and geographic linkages.

The purpose of this research is to further the study of

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<sup>17</sup>Op. cit., p. 48.

<sup>18</sup>Ibid., p. 50.

economic and geographic linkages. To this end it attempts to identify a set of industries or an industrial complex which would be the most economically feasible for the northern Manitoba area. This requires the application of industrial complex analysis which is a body of location theory and organizational methods that are combined to earmark a regional development role.

An industrial complex can be defined as a set of economically linked industries which are also geographically associated. That is to say:

A set of activities at a specific location that are linked by certain technical and production interrelationships. These interrelationships are such that the industries concerned may operate optimally when clustered together spatially rather than when they trade over a wide area, although complexes may exist with split location or an even more limited degree of spatial interdependence.<sup>19</sup>

Methods of identifying such complexes are discussed in the review of literature that follows in Chapter 2.

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<sup>19</sup>Richardson, H.W., "Regional Economics", p. 418.

## CHAPTER 2

### LITERATURE REVIEW

#### 2.1 Introduction

The purpose of the literature review is twofold. First it provides the author with an historical background to his topic and second, it may also aid him in choice of technique. To the reader, of course, it is for his edification. In this review, particular attention is not given to various results of the studies but to the methodology they use. These studies will not only enhance this author's understanding of the topic, but also offer a wide variety of methods from which he can choose the most suitable for the type of analysis to be performed.

#### 2.2 Growth Poles

Perhaps in reviewing literature pertaining to Industrial Complex Analyses, one should first look at Perroux's notion of "growth poles" for it is here that the importance of industrial interaction within a centre is recognized.

Technical and economic interdependencies are considered as *conditio sine qua non* for the realization of regional growth.<sup>20</sup>

Hence the growth within a centre or pole could be transmitted to the whole region, i.e. by means of the "spin-off" effect. Thus

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<sup>20</sup>Nijkamp, P., "Planning of Industrial Complexes by Means of Geometric Programming," p. 3.

the importance of industrial complex analysis becomes apparent. Given a combination of industries located in close proximity (growth pole), and growth or development occurring not only within one component of the complex but spreading, because of linkages, to the various other components and also to the centre itself, then according to growth pole theory, this would also spread within the rest of the region, and perhaps interregionally.

Therefore the problem at hand can be stated as, what is that combination of industries and how can it be found?

### 2.3 Walter Isard: Case Study of Puerto Rico

In 1959, Walter Isard, E.W. Schooler and T. Vietorisz presented a landmark study called "Industrial Complex Analysis and Regional Development: A Case Study of Refinery-Synthetic Fibre Complexes in Puerto Rico," which was preceded by two reports, "Industrial Complex Analysis and Regional Development," by W. Isard and T. Vietorisz, 1955; and "Industrial Complex Analysis: Agglomeration Economies and Regional Development," by W. Isard and E.W. Schooler, 1959. The latter also discussed conceptual problems involving industrial complex analysis.

The study began with a review of alternative approaches to industrial complex analysis, which included the Location Quotient, Coefficient of Localization, Labour Coefficient, and Interregional Input-Output approach. For each, the analysts presented their limitations and then concluded with reasons for an Industrial-Complex approach. This method can be best summarized as combining:

...an evaluation of inter-industry relationships along input-output lines, with an analysis of the factors that lead to regional differences in costs and revenues, along industry comparative-cost lines.<sup>21</sup>

It attempts to fulfil two objectives:

1. to identify favourable industrial activities
2. to estimate the value of locational advantage

The analysis proceeded with a study of the resource setting in Puerto Rico. The authors concluded that the primary resources were cheap labour, proximity to Venezuelan oil, and easy access to U.S. mainland markets. Given this, Isard et al. presented a flow chart illustrating linkages between natural gas and oil, with various intermediate and end products. The possibilities of setting-up activities were great, therefore certain considerations were made to delimit a number of them. Some of the considerations were, labour (its cheapness); transport costs (if a product had always been imported, such as fertilizers, its production would mean a savings in transport costs); and demand (the production of antifreeze would be senseless since there is no demand for it and also its production utilizes little labour).

From these and other considerations, the authors narrowed down the complexes to those involving oil refining, petrochemical fertilizers, and synthetic fibres.

Further delimitations were made by using minimum feasible plant size as a criterion (i.e. based on technological economies of scale).

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<sup>21</sup>Isard, W., E.W. Schooler and T. Vietorisz, "Industrial Complex Analysis and Regional Development: A Case Study of Refinery, Synthetic Fibre Complexes in Puerto Rico," p. 1.

From engineering sources, minimum sizes were given. Thus a product was eliminated if its required output was below the minimum feasible plant size.

Next an explanation was made of Isard's basic activity matrix or input output table (see Table 1). At the top of the matrix are various activities and to the left are various inputs or outputs. Under each activity (for example, Hydrated Lime) is a column indicating the amount of each commodity used as an input or output (at left) when the activity is operated at unit level, which is defined as "...that level which yields on an annual basis the amount of primary product listed in the corresponding column."<sup>22</sup> In this case it is 10 MM lb. Certain commodities were omitted for various reasons. Two important inputs omitted were capital and labour for the reason that both do not change proportionally to a change in the scale of operations as do the others. Thus, for example, if the production of an activity is doubled, one would simply double the inputs in the Column. This is not possible, for instance, with labour and instead engineering sources would have to be used to estimate how labour would vary.

The next step involved the setting up of programs or complexes, which is to say, "...feasible combinations of various activities."<sup>23</sup> First, various intuitive constraints were again made on aspects such as demand, labour, and minimum and maximum scales of operation. Then various programs were chosen on the basis of feasibility. Each of the

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<sup>22</sup>Isard, W. and T. Vietorisz, "Industrial Complex Analysis and Regional Development", p. 42.

<sup>23</sup>Ibid., p. 28.

Table 1  
Activity Matrix

Inputs or  
Outputs.

	<u>Activities</u>		
	1. A	2. B	3. Hydrated Lime
1. A	--	--	--
2. B	--	--	--
3. C	--	--	--
4. D	--	--	--
5. E	--	--	--
6. Power	--	--	- 3.500
7. Fuel	--	--	- 3.500
8. Lime	--	--	+10.500

Note: A negative number indicates an input while a positive number indicates an output.

Source: Isard, W., E.W. Schooler and T. Vietorisz, "Industrial Complex Analysis and Regional Development: A Case Study of Refinery, Synthetic Fibre Complexes in Puerto Rico", p. 42.

programs chosen involved four major steps. These were: (1) petroleum refinery; (2) primary petrochemical operations; (3) secondary petrochemical operations; and (4) the production of the finished fibre and fertilizer. All were based on a single refinery prototype (see Figure 2). Also, all the programs were constructed around four flow-sheets which illustrated directional links between six basic chemicals and the finished products. For example, Figure 2 is part of one of the flow charts used. One should note that each activity in the flow-sheet belongs to the column headed by Dacron Staple in the basic activity matrix (see Table 2).

Since it was decided that the production of Dacron Staple should be at 36.5 million lb. and as has been stated earlier, the activity listed is produced at a unit level of 10 mm lb., then all amounts in the columns of Table 2 were multiplied by 3.650. The results are shown at the top of the boxes in Figure 2. The values represent amounts of inputs and outputs associated with each program. The numbers at the bottom of each box represent the number of the activity in the basic activity matrix. From these flowsheets, which represent full programs, sub-programs were also constructed.<sup>24</sup>

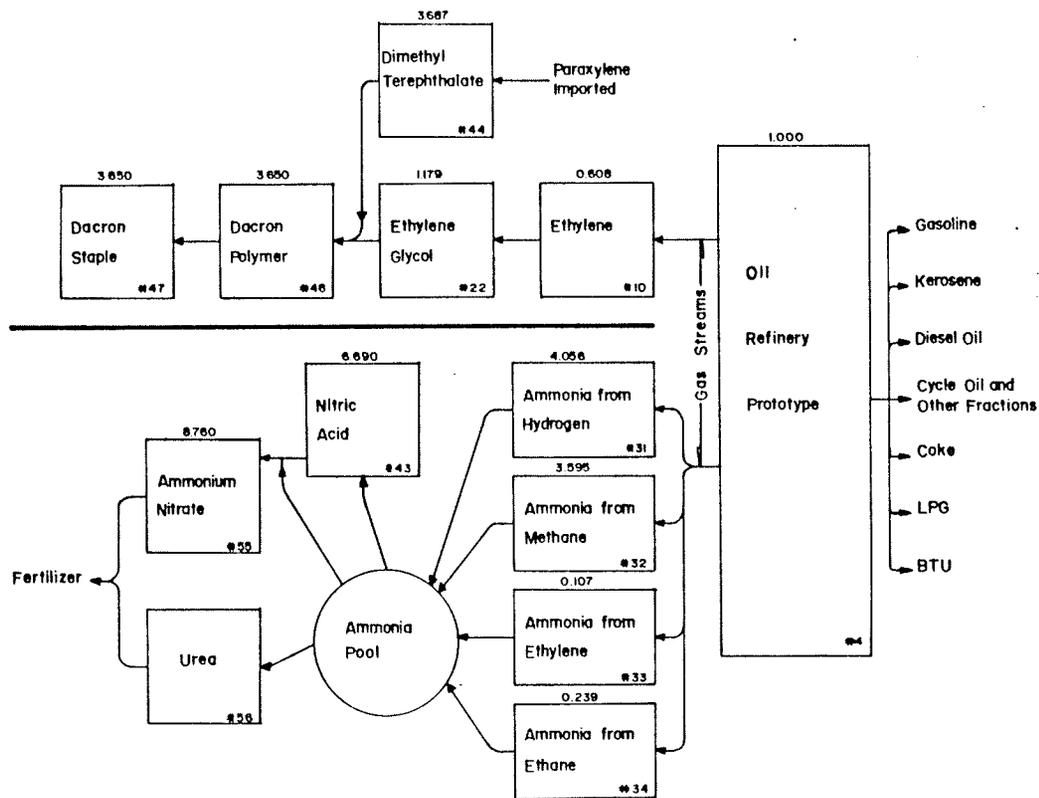
The next stage was to make cost comparisons and revenue differentials between industries on the mainland and in Puerto Rico on the assumption that complexes of both were identical. The first step was to find the difference between the cost of the purchase of the Puerto Rican commodity and revenues associated with the sale of the

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<sup>24</sup> Sub-programs are output or scale variations of the program and are determined directly from the original program.

Figure 2

Dacron A Program



Source: Isard, W., E.W. Schooler and T. Vietorisz, "Industrial Complex Analysis and Regional Development: A Case Study of Refinery, Synthetic Fibre Complexes in Puerto Rico", p. 87.

Table 2  
Basic Activity Matrix

	Dacron Staple
2. Steam MM lb.	- 0.500
5. Power	-12.000
46. Dacron Polymer	-10.000
47. Dacron Staple	-10.000

Source: Isard, W., E.W. Schooler, and T. Vietorisz, "Industrial Complex Analysis and Regional Development: A Case Study of Refinery, and Synthetic Complexes in Puerto Rico", p. 46.

same product. The authors expected a priori differences in these variables. However the gap between costs and revenues on the mainland were marginal except for transactions that were very great, since, "...the New York market...is so large that a transaction by a single refinery, will leave the price unaffected."<sup>25</sup>

Therefore the price difference associated with the sale between Puerto Rico and the mainland would be different from the price difference associated with the purchase. Both differences were recorded although only one was used in the study at any time (use of either appears to be intuitive).

With the information based on the amounts of inputs and outputs associated with the various programs presented and information based on the price differentials, the two were combined to give a net locational advantage or disadvantage for Puerto Rico. Combination was accomplished by multiplying the various input and output amounts by their associated price differential and then through summation of their products. The summation could be either positive or negative indicating an advantage or disadvantage for the combined total of all inputs and outputs.

At this juncture the advantages or disadvantages of labour inputs were computed. This was done for both imported and local labour. The advantage or disadvantage for imported labour (chemical-petroleum type) was found by multiplying total inputs of imported labour by a predetermined price differential of \$1.00. For local textile-type labour, total inputs of this labour was multiplied by a price difference

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<sup>25</sup> Isard, W., E.W. Schooler and T. Vietorisz, "Industrial Complex Analysis and Regional Development: A Case Study of Refinery, Synthetic Fibre Complexes in Puerto Rico", p. 95.

of \$0.75 per man. Both price differentials were based on Joseph Airov's "Location of the Synthetic Fiber Industry", where labour cost differentials were determined for both skilled (imported chemical-petroleum-type labour) and less-skilled (textile-type, local labour). Both labour inputs were listed in separate columns. Advantages and disadvantages were also listed for mainland polymer transport, Tennessee-Texas fuel cost difference and ammonia process difference. Table 3 illustrates how the results were displayed. The final net advantage or disadvantage for each complex was calculated by the summation of columns one to six, for each row.

Initially, extrapolating from columns 1 and 2, the analysis showed that, "...the petrochemical and to a lesser degree the refinery activities involved significant disadvantages for Puerto Rico (on skilled labour and transport account)".<sup>26</sup> However, when all six functions were taken into account all full programs had a net advantage in locating in Puerto Rico.

To offset the initial great disadvantages mentioned above, six alternatives to the full-length complexes (short programs) were evaluated, using the same method of calculation. These alternatives consisted of combinations of refinery, fertilizer and fibre activities (which have high demand and inexpensive textile labour costs). Most of the short programs had a net advantage in Puerto Rico, with short-program D having a greater advantage than full program Dacron A.

The above analysis, as had been previously mentioned, was

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<sup>26</sup>Op. cit., p. 2.