FORMULATING A REGIONAL ECONOMIC DEVELOPMENT STRATEGY: THE KEY INDUSTRY APPROACH FOR MANITOBA

by

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ABSTRACT

This thesis focuses on the role of industrialization in the development process for a region within a nation state. Specifically, it uses the Province of Manitoba as an example. An attempt is made to formulate a logical and consistent approach to identify the industries which a regional authority might promote to achieve regional economic development.

The criteria for the selection of industries to be included in a development plan are: a) linkage effects; b) labour intensity; c) growth potential; and d) whether the industry is "footloose" or not.

The intention is to provide the regional authority with a basis upon which to make decisions. These decisions relate to the type of industry which will best assist in achieving regional development, thus contributing to the alleviation of regional economic disparity in Canada.

The discussion addresses itself to the nature and the reason for the existence of the problem of regional disparity; the relevant considerations of a development strategy at the regional level; the formulation of a procedure incorporating past efforts in the field; and an example using the Province of Manitoba.

The role of government and industrialization are examined in formulating the method for industry selection. The resultant procedure is policy oriented. The direct empirical results were developed using an input-output framework.

While noting the limitations of the approach, the decision maker is afforded the opportunity to study both the effects of industrialization and the role of value judgments on the attainment of the objective.

The demonstration of the model exhibited the glaring data constraint to effective regional analysis in Canada today. However, an application of priorities, designed to minimize the incentive paid to industry per unit of gain received, was demonstrated.

The thesis does accomplish its objective of identifying the nature of regional problems and forwards one possible solution.

PREFACE

Regional governments in Canada continually are proposing and introducing policies to promote regional economic development. These policies are based usually on efforts to encourage industrialization. Unfortunately, the success rate of such policies has not been terribly outstanding.

The following discussion forwards a methodology or a procedure for the conceptualization of a regional economic development strategy. Specifically, it focuses on the role of industrialization in the development process and attempts to formulate a logical and consistent approach to identify the industries which a regional authority would promote to achieve the objectives. It presupposes governmental involvement and addresses itself to proposing industries which regional governments might legitimately seek as they attempt to stimulate the development of a given region.

The methodology is unusual in that it is not unidimensional. There are four specific criteria for industry selection which are established, and, furthermore, the subjective role of the decision maker in the process is given full exposition. As such, the following cannot be considered a theory in the strict usage of the term.

The intention is to provide a regional authority with a basis upon which to make decisions. Specifically, these decisions relate to the type of industry which will best assist in achieving regional development, thus contributing to the alleviation of regional economic disparity in Canada. A methodology of the form postulated will prevent many of the errors in past policy from recurring, as industries often have been sought without rational reasoning as to their ability to generate the desired results.

The following broad subject areas are discussed. The nature and the reason for the existence of the problem is treated in Chapter One. Chapter Two addresses itself to the question of the relevant considerations of a development strategy at the regional level. A brief discussion of past approaches to the problem and their impact on the development of the specific procedure forwarded in Chapter Four is contained in Chapter Three. Chapter Four, then, is the formal presentation of the methodology. An illustrative example is outlined in Chapter Five, while Chapter Six treats the conclusions which follow from the discussions in the analysis.

Acknowledgements while numerous must not exclude specific mention of Professor Henry Rempel, who acted as the primary advisor, and Professor John Gray, whose comments were invaluable. Both provided much insight and considerable encouragement to the author in developing the topic. Professor James A. MacMillan gave generously of his time to be a member of the examining committee. Of course, none of this would have been possible without the efforts of the Faculty in the Department of Economics at the University of Manitoba.

No words can express my indebtedness to the patience of my wife Marsha.

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CHAPTER ONE

The Problem

The question of how to solve the problem of regional economic disparity in Canada has remained unanswered for a considerable length of time. The necessity of solving this problem is more pressing than ever for Canadians have expressed an unwillingness to accept this phenomenon as a permanent characteristic of their society. Indeed, they are alarmed at the persistent number of families, whole communities and regions that must contend with chronic poverty despite a continually increasing national prosperity. For many, the question remains. How can the regional differences in economic well-being be alleviated so as to provide a better quality of life for all Canadians? In seeking the solution, federal, provincial and even municipal governments have introduced a plethora of programs intended to utilize labour and other resources of economically depressed regions, for the purpose of expanding national output and enhancing the economic condition of individuals residing in all areas of Canada.

These programs have been varied both in format and effectiveness. They have included efforts in the areas of manpower; natural resource development; agriculture; infrastructure improvement; recreation; and industrialization. Historically, industrialization programs have received the major emphasis. Also, it has been in this area where the most sensitive political and economic decisions have had to be made.

The problem, in a broad sense, is to alleviate regional economic disparity; while the immediate goal of this study is to develop a

consistent methodology for formulating more effective industrialization programs to assist in solving this problem. The overall objective remains, however, the promotion of regional economic development.

This is not to suggest that the other facets of public policy go unstudied, or that the complementarity of programs be ignored. It is worthwhile to remember that activities of government not related specifically to developmental programs also have developmental impacts. As such, there are many related areas for research in this field. Rather the subject of this research is recognition that, a) industrialization programs will remain within the domain of the decision maker in future efforts on the part of government to achieve regional development in Canada, and b) there is always a need to improve methods for obtaining the necessary information upon which to formulate such public policy.

Given the scope of the following discussion, two important concepts should be outlined. First, industrialization is to be interpreted in the broadest manner. It is intended to encompass the addition to any form of productive capacity in order to generate economic activity within a region. Second, there is merit in giving explicit recognition to the constraints to public policy solutions. These constraints are of the following nature.

The first constraint is especially relevant. It is a manifestation of the deep commitment in our governmental process to the tenet of grass-roots democracy. In practical terms, this often has tended to exclude solutions which might otherwise appear optimal because of the existence of a parochial approach to problem solving, and the relatively short time horizon for most programs necessitated by the due process of elections. The decision maker in this type of system is encouraged to seek immediate solutions, and hence places greater priority on short term objectives.

It is important, therefore, to maintain a broad perspective coupled with patience in solving the problem of regional economic disparity.

The second constraint has been self-imposed essentially. While we have been content, in the past, with benefit-cost analyses directed towards a single objective, a single industry or a single commodity, we have gradually come to realize that this approach can only yield limited answers and, therefore, limited tangible results. The nature of the problem is not uni-dimensional and so neither should be the analytical framework. Policy objectives of a more complex nature should be incorporated within any method of policy formulation.

Having recognized this though, it is conceded that the following analysis pays particular attention to industrialization. This constraint is not intended to imply a single, constrained policy approach. Rather for preciseness the focus has been limited, but the implication remains that a regional economic development policy is formulated only after having considered studies of the heretofore mentioned alternative aspects of a solution. It is assumed that industrialization capable of providing employment and additional income for the indigeneous population is an integral part of the whole. The redistributive impacts of a given policy within a region are left, by necessity, to the function of other policy instruments.

A third constraint concerns the economic powers of a particular region within a nation state. Instability resultant from a policy of national economic expansion can be controlled somewhat by a particular set of monetary and fiscal measures. This option is not open to an individual region attempting to do similarly within its own jurisdiction. It follows that a regional policy should take full account of the limited resources, both economic and legislative, required for the success of a given strategy.

Yet another constraint is the effect of scale economies associated with industrialization in close proximity to large urban centres. This phenomenon is operating in direct opposition to the attainment of the objective, for typically the concern for regional development concentrates on the hinterlands.

These constraints not only serve as a warning of the impediments to regional development, but also they indicate a need for a departure from past practices. Formerly the policies and programs for less affluent regions have been defined in terms of either encouraging out-migration or attracting heavy industry. This implies that a less developed region's economic problems arise out of local disequilibria in the factor market, and hence, all that is required is to shift either people or productive capacity so as to equate supply and demand for a particular factor in each region.

This particular approach fails to recognize the interregional differences inherent in the nature of the causes of the problem. For example, one region may be lagging because of a heavy reliance on old stagnating industries. The constraint to employment expansion in this case may be a lack of research and development activity, resulting in a failure to absorb a growing labour force. Another region may rely heavily on primary product production. The capital intensive technology customarily employed by these industries may be the obstacle to the required employment expansion. Possibly, the importation of capital and/or out-migration might be suggested as a policy solution in both cases. But, the former indicates a human-capital constraint, whereas in the latter case the lack of industrial diversification is indicated as the prohibitive factor to employment expansion. For these reasons, a properly conceived economic development policy should be cognizant of, on the one hand, the industrial

structure of the region, and, on the other, the resource endowments required for economic expansion. If these two aspects are not incorporated into the development plan, then there may exist a divergence between the policy objectives and the feasibility of the policy.

In proceeding, full knowledge is taken of the role and the effect of central government policies on regional economic development. However, for the most part attention is focused on the possibilities for the regional authorities in the development process. The reasons for this position are obvious. Although central government policies are important in determining the final distribution of industry and employment between regions, it is the regional government which is faced with the practical implications and realities of these policies. Furthermore, the regional governments might well institute measures within their own jurisdictions which can contribute more effectively to the national objective as it applies to their own locale. For not only do the regional governments provide basic services for the areas affected by the national policy, but also provisions should be made for the social amenities for the population employed in the new activities. This more immediate and direct responsibility of the regional governments is a justification in itself for the point of view adhered to in this study. Consideration of the central government's activities will only be introduced when it is conceded that they will augment significantly the possible alternatives of the regional government.

Finally, regional governments do have a mandate to attempt to produce employment generating programs within their jurisdictions and to elevate the per-capita income of the residents in their regions. The less developed regions' successful achievements in these regards will reduce, in an indirect manner, the disparities existent in the distribution of

such economic phenomena. In establishing the framework for the subsequent analysis, the naive notion of regional equality is not posited. Although such a position can be viewed as the ultimate, it is not a reasonable consideration within Canada within the foreseeable future. Rather the notion is that much can be done to improve the economic well-being of individuals currently residing in less affluent regions in Canada. One can attempt to achieve a more equitable balance between regions and, at the very least, endeavour to reduce the apparent trend to increases in inequality. This is a very important task both as it reflects upon a region's inhabitants and the future of the nation as a whole.

The foregoing provided much of the impetus for undertaking this research. While the following is neither revolutionary nor foolproof, it is a definite attempt to develop a rationale for overcoming what has been described above, and to provide an input to policy formulation designed expressly to alleviate regional economic disparity in Canada.

CHAPTER TWO

The Considerations in Formulating A Development Strategy

The need for a development strategy, not to mention a regional development strategy, is not often acknowledged in a relatively prosperous nation. But a nation state is not a homogeneous entity. Regional differences do exist with respect to employment opportunities and per-capita income. Although it may be based on an egalitarian position, there is an attempt being made to eliminate these regional differences in Canada, without great success.

Given that regional governments, in attempting to alleviate regional economic disparity in Canada, participate in programs to promote employment expansion in their respective regions, a methodology should be devised to assist in this decision making process. In developing the methodology, careful attention will be paid to the objective and the major facets of a regional development strategy.

THE OBJECTIVE

Regional economic development[1] is the process of establishing and/or

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[1]The author apologizes to the multi-dimensional economic development theoreticians for the pragmatic definition. Economic development is the historical evolution of a society's economy, whereby all individuals retain a betterment of their socio-economic condition. Since, by definition, it is an abstract concept, the author wishes to "explain" its components at a somewhat lower level of abstraction; such as the process of industrialization. By the very nature of things our theories must be partial. They cannot encompass all of the dynamic human and social variables. But economic development is the consequence of the totality of interrelationships both social and economic. By necessity only the economic phenomena are stressed in this study but the expansion into other dimensions should not detract from the validity of the analysis.

promoting economic activities capable of expanding employment thereby providing the population in a given region with the means of support, as the size of the population dictates. The development strategy has as its major tenet, therefore, the expansion of productive capacity with the intention of increasing employment assuming per-capita income will increase as a result. This is not intended to suggest that this be achieved to the detriment of other considerations in the social or cultural spheres, rather it is postulated that this approach will assist the given region in obtaining the necessary capabilities for the provision of services, etc., customarily associated with more affluent regions.[2] Since industries have differing abilities to generate economic activity within a region, the 'key' to an economic development policy for a region is the degree of industrialization and the type of industrial structure.

The realization of regional economic development will eliminate the necessity for individuals and families to move in order to better their economic condition and will avoid the sacrifice of social and other amenities for the prerogative of living in a given region. Indirectly, regional economic development will reduce, also, national agglomeration into a few large, concentrated metropolitan areas complete with the external diseconomies this action creates.

THE CONCEPT OF A REGION

It is often suggested, although not always required, that a clear indication be given of the scope of a study. It is neither the intention nor the purpose here to provide an exhaustive, definitive discussion on the concept of a region. A region may be defined on economic, social,

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[2]This position is discussed at length and supported by Chenery [13].

political or geographical criteria.[3] It is sufficient to note that there is no universally accepted definition. The decision here is to use, initially, the political adaptation, and hence, a province is considered to be a region. The reason for the choice is to provide a starting point in order to initiate the analysis. By using a province, the capability of introducing policy alternatives through the political system is enhanced.[4]

THE ROLE OF GOVERNMENT AND A REGIONAL DEVELOPMENT STRATEGY

The fact of government involvement is taken as given. It is then necessary to briefly examine the role government might play. This necessity is enhanced further by choosing regions which coincide with political jurisdictions.

Less affluent regions are characterized by obsolete infrastructures, unfavourable age and income distributions, and little opportunity for advancement. Altering these conditions are a direct concern.

The central government traditionally has sought only to increase the income and/or population of depressed areas. In the past, this has been undertaken through sporadic public investment, incentive programs and more recently through attempts to decentralize its activities. No doubt decentralization is essential but at best it will only curtail the divergence between the affluent and depressed areas. It will not result in economic

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[3] For a complete discussion see Losch [47]; Meyer [51]; or Richardson [66].

[4] This definition also avoids the debate about jurisdiction which would serve only to complicate the issue unnecessarily at this point. Since public policy formulation is paramount to the purpose for the research, political adaptation becomes a concern. Hence the use of a political delineation of a region.

parity between the two. This can best be achieved by the redistributive powers of the central government from the more affluent to the less advantaged regions.

The regional government should implement the regional economic development plan; for it is the regional government which is charged with the responsibility for the provision of many programs necessary to support a successful, rational economic development strategy. But an economic plan, in order to be successful, should operate in conjunction with a social, physical and financial plan ensuring the following: a) the existence of technical and scientific facilities and faculties; b) government funded research;[5] c) training and retraining programs to provide an adequate pool of skilled and semi-skilled manpower; d) sufficient supporting industries and infrastructure; e) easily available capital; f) transportation links; and g) proper urban planning and environmental control.

It is also necessary to distinguish between government policies which seek to assist areas regardless of their potential, and ones that are intended to stimulate the actual and potential development of a region in the economy. The former focus on the redistributive aspects for they lend assistance to regions simply because they are less affluent. The latter will be termed economic redevelopment policies for they centre on the latent potential of a region to utilize its resource endowments. It is in

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[5]These funds should be forthcoming from both central and regional governments, thus initiating directed research into the economic problems of a given region. The research should include careful study of the required increases in income and employment associated with a forecasted change in the size of the population, including specific methods of achieving the targets established in this manner. Furthermore, the undertaking of this research is predicated on the willingness to make the necessary resources available for the successful implementation of the regional development policy derived.

the latter sense that this research is designed to make a contribution to government activity in regional economic development. For it is only when government activities assist in assimilating and co-ordinating these many considerations that the involvement of government not only becomes justifiable but also it facilitates greatly the formulation of a regional development strategy and enhances its chance for success.

CHARACTERISTIC INDUSTRIES

It has been assumed, within the context of this study, that industrialization of one form or another is the key aspect of a regional development strategy. This is based primarily on the following premise. If a regional government intends to expand employment and ensure a relative degree of employment stability simultaneously, the most promising sector is one in which the income elasticity of demand for the output is relatively high. It is, therefore, of paramount importance to be able to identify which industries are to be included in the development strategy. Specifically, a selected industry should conform to the following criteria: a) an ability to generate further economic activity within the region as a result of locating in a given region; b) a high labour content in production for employment expansion; c) a potential for future growth; and d) an ability to locate within a region without the requirement for costly, publicly subsidized incentives.

The criteria are self-explanatory but there is some reason to justify the inclusion of the second, namely the specification of labour-intensity. This criterion is in accordance with the desire to employ or re-employ as many people as possible.

Increasing employment requires that two facets of the process be recognized. First, without resorting to employment multipliers requiring

sophisticated and often questionable estimation procedures,[6] "the more labour-intensive the selected industry, the greater the rise of total employment in the area."[7] Second, as a result of the first industry locating in an area, additional industrialization is stimulated thereby generating further employment.

It is the existence of the second facet which leads many to argue that an initial capital-intensive industry may have greater total employment effects once all indirect employment generation is taken into account. This does not discount, however, similar results being achieved by a growing, labour-intensive industry with strong linkages. Furthermore, while considerable debate can take place over the longer run ramifications, little doubt remains with respect to the immediate impact. For this reason, labour-intensity is preferred in the following approach to industrialization for regional development.

By assuming relative factor prices, factor proportions and technology are constant over the period of analysis, the labour intensity of an industry can be represented by the proportion of value added paid to employees in wages and salaries. Then the total payment to a factor as a proportion of valued added would remain fairly equal between industries over time.

Adhering to the assumption of fixed factor proportions, i.e., an elasticity of factor substitution equal to zero, the ratio of value added to the wage bill is an adequate measure of the labour intensity of an

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[6] See Westcott [82]; and Weiss and Gooding [81].

[7] Klaassen [36], p. 31.

industry. It will not promote unwittingly the creation of low wage employment. This can be demonstrated further by the process of bidding up wages as the demand for labour increases resultant from the operation of labour-intensive industry.

In addition it could be argued that since the value added is the payment to factors, why insist on discriminating in favour of labour. It is just as logical to try to increase the payments to capital. But, since there are no "a priori" reasons for assuming that the capital is owned by the indigenous population of a depressed area, but certainly it is more reasonable to assume the labour is, a decision of a policy nature is made to favour the labour input in the production process. This is, in part, strengthened by the objective of the development strategy; namely employment expansion. Such reasoning is consistent under the previous assumption of fixed factor proportions.

Of lesser importance in the short-run, but nonetheless crucial to the development process, is an industry's ability to generate future employment in the same industry, i.e., through expansion of the industry established. Therefore, a growth industry is defined as one in which there was a high percentage increase in employment in the half-decade, 1962-67. The change in employment is used as the measure of growth for essentially two reasons. First, since there is no substitution of factors, the output and value added per worker is effectively proportional to the number of people employed in the industry. Second, the demand for labour and not the value of total demand for the industry is the key aspect for the analysis. Therefore, describing a growing industry in terms of employment focuses on the major objective of selecting industries for the development of a region.

A CHARACTERISTIC INDUSTRY AND THE NOTION OF A FOOTLOOSE INDUSTRY

The theory of location[8], discussed briefly in the next chapter, is perhaps less important in the approach adopted in this paper, but it does assist in clarifying one final consideration which should not be overlooked in a regional development strategy. Previously, proximity to markets or raw materials represented in differing transportation costs was thought to be of major consequence in locating an industry in a given area. This theory has been extended to include the proximity of technically complementary industries.

As a result of the lesser role played by transportation costs and the advent of rapid communications systems, more and more industries have come to be known as "footloose" industries, or industries which can locate virtually anywhere. Such industries may be defined as ones whose long-run economics are not affected by geographical location, i.e., industries for which transportation and communications costs are insignificant in locational decisions. The ever increasing presence of such industries makes it mandatory for regional governments to evaluate more carefully the basis for seeking particular industries to locate in their locale.

There are no "a priori" reasons for a "footloose" industry to locate in a less affluent region. Quite the contrary. Such industries typically locate in developed areas to take advantage of scale and external economies. This often precipitates the need for regional governments to bid by way of a system of incentives for these industries to locate in less affluent areas. This is costly. It may facilitate, in addition, detrimental income transfers from the region. In terms of static microeconomic analysis, policy

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[8] See Hoover, [28].

decisions to attract such industry will introduce further distortions into the regional economy with the accompanying "dead-weight loss" of welfare.

Realizing these possibilities, regional governments should avoid seeking "footloose" industry for the purpose of promoting regional economic development. Therefore, it becomes necessary to be able to identify "footloose" industries. This is accomplished by using the concept of a "relevant region."[9] This concept closely parallels the ranking of commodities and regions by Leontief, and was utilized subsequently by Isard.[10] The relevant region for a particular industry determines the area within which it is "footloose"; or whether within a given area, an industry depends very heavily on the demand for its output and the supply of all its inputs falling within the same region. If the industry requires that this be the case for the area under consideration, this area is considered the relevant region for the industry and the industry is not "footloose" with respect to the region.

Regional governments should seek industries which have a potential for generating increasing employment and further industrialization, where these considerations are not nullified by introducing further distortions into the economy. Much can be done in the areas of non-economic, socio-cultural programs which contribute to the climatic considerations on the part of such industry. These programs, ancillary to an industrialization program, may benefit the indigenous population more directly, while ultimately improving the possibilities of such industries locating in the region at some future time.

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[9] Klaassen, Op. Cit., p. 78.

[10] See Isard [31].

A STRATEGY

It remains only to combine the considerations mentioned above[11] for a regional government to formulate a regional economic development strategy or plan. The basic tenets of such a strategy will highlight employment creation through a rational industrialization policy.

At the present time, lack of research effort and co-ordination in the area of regional development represents a major hindrance to accomplishing this objective. If a strategy is to be comprehensive and reliable, the most probable place to begin is for the regional and, indeed, the central government to foster the necessary programs for data collection and processing. As will be discussed later, this is being initiated to some extent but unfortunately the current scarcity of reliable data is quite obvious to the researcher.

The most crucial aspect of any development strategy is its implementation. Although this is categorically outside the scope of this study, it is clear that given the political structure in Canada where governments are apt to change irregularly and the time horizons of politicians being as short as they are, any reasonable strategy should lend itself to continuing acceptance to succeeding administrations if it is to meet with any degree of success in the longer term.

The discussion to this point does not suggest regional governments assume a passive role in the development process. Nor are the actions which they can take limited. Rather, the considerations introduced in the preceding sections illustrate two fundamental points. One, regional governments

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[11] Those complementary aspects in the socio-cultural spheres, which are the natural appendages to an economic development strategy, need to be considered as well in the overall approach.

should take great care to express the criteria for industry selection in formulating a regional development strategy. Two, the regional governments should act in a positive manner in areas where results are most likely to be forthcoming. Where programs are required for the success of a project or the implementation of a plan, it should be clear the programs are achieving the desired results. The resources of a regional government should not be expended where the developmental effects can be considered tenuous at best.

CHAPTER THREE

Approaches to Regional Development

There have been various approaches to solving the problem of regional economic development through industrialization. Taken together they contribute greatly to formulating a regional development strategy, but rarely has there been any specific attempt to synthesize the aspects of these different theories. The theories will be discussed separately but it is necessary to bear in mind the contribution of each to the advent of an industrialization based theory of regional economic development. The purpose of reviewing these theories is to relate how the methodology to be presented will incorporate and co-ordinate the more fundamental elements of past developments in this field.

Specifically, these theories represent "positive" approaches seeking "normative" conclusions. It is the recognition of this aspect of the literature which resulted in the present effort to construct a methodology to allow the gap to be bridged more directly.

THE CONCEPT OF LOCATION THEORY

The location theorists, such as Alonso [4]; Bos [7]; and Hoover [28], attempted to overcome the dilemma of either relocating industry where unemployment existed or where the availability of natural resources dictated, by studying the distribution of existing industry. Typically, these studies revolved around the cost structure of an individual firm.

The methodology employed is usually a linear programming technique in which the supplies and demands for the inputs and outputs and the relevant

prices are constrained within the boundary conditions; and subject to these constraints a unique cost minimizing solution is determined. Of crucial concern are transportation costs.

It is not necessary at this time to debate the relevance of transportation costs as a prime concern for industry location. Walter Isard [31] opened the subject to considerable inspection by stressing communication costs incurred by distance, rather than purely physical transportation costs, as an underlying feature of locational decisions. He noted that the concept of distance in a physical sense does not always coincide with the concept of distance as it applies to the entrepreneur. Economic distance as it pertains to communication with producers, consumers and governments is possibly of more concern to the individual firm than the purely physical distance separating the producers from inputs and markets.

While these considerations could be incorporated into existing location theory, at present the location model contributes to the understanding of the regional distribution of industry and can indicate the opportunity cost of trying to locate a firm in a less than optimal location. But more specifically to the problem at hand, namely generating employment in an economically depressed area, it stresses the need to take direct account of the availability of inputs and the ready uses and/or markets for the output of an industry locating in an area. This realization not only allows for determining the feasibility of locating an industry in a region, but also lends itself to determining the total impact of the industry on the area by not only purchasing inputs but also by providing output locally. This last aspect of the location model is central to the methodology forwarded by this research.

INTERNATIONAL TRADE AND REGIONAL ECONOMICS

A number of economists have searched for the solution to regional economic expansion within the theory of international trade. Focusing on a comparative cost approach, minimizing total costs has been the basic criterion for industry selection. This is the approach of Tiebout [79] and it has been applied to the Canadian context by Shearer [73].

Based upon the precept that cost minimization is valid not only for industry location but also for regional growth and for overall national welfare maximization, these theories stress the need to exploit or develop comparative advantage. This also is a "positive" approach seeking "normative" conclusions.

With the exception of resource based and/or market oriented industries with minimal transport costs, often depressed areas do not lend themselves to the establishment of sufficient capacity to realize the economies of scale required to compete as designated in this model.[12]

The contribution of international trade theory to the development of the following methodology related to the phenomenon of transferring economic activities in the production process outside of a region. The result was the realization that a development strategy should include some provision for stressing the introduction of industries where it becomes feasible to draw inputs locally. That is to say, an industry can become competitive by lowering the cost curve, rather than by necessarily moving along it to realize the economies of scale. In a sense, the regional development strategist could attempt to repatriate industries where the differential in transport and marketing costs are more than augmented by the saving in

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[12]This situation sometimes supports the strategy of paying an initial subsidy of one form or another, as in the infant industry literature of international trade.

the input costs. So, industries which draw inputs from a depressed area should be investigated in this light.

THE BALANCED GROWTH FORMULA

The debate in economic development literature on the merits of balanced versus unbalanced growth has proceeded for a number of years. Furthermore, there is no indication that it is not likely to continue for some time to come.

The case for the balanced growth formula is forwarded by Fleming [18][13] and is put into clearer perspective by Scitovsky's [72] discussion of the subject in connection with external economies. In a word, this approach advocates advancement on many fronts simultaneously in the industrialization process. Interdependence is held to be the major criterion for the continuance of the process of establishing industries in depressed areas.

For a depressed area facing a scarcity of resources this approach appears to be rather euphoric. It is perhaps somewhat unrealistic in practical terms to attempt to establish a complete industrial superstructure in phase one of a development program. Although, it is, in general, a conclusion to most theories of economic development, it remains, however, a rather tenuous objective to realize in the initial phases.

The theory of balanced growth does draw the attention of the decision maker to one key aspect in proceeding with an industrialization policy. When seeking an industry to locate in an area, this industry should be, in some way, complementary to industries (if any) already operating in the depressed area. In a sense, the industrialization program should be designed to help complete the balance as outlined by the balanced growth

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[13]For an equally lucid discussion of the unbalanced growth approach see Streeten [77].

theorists, for most regions in Canada are not completely void of industry.

Furthermore, by emphasizing the interdependencies between industries, the balanced growth theories lend credence to the existence and importance of linkages. These theories do not contend, however, that the linkages represent the dynamic force intimated by the following approach to industrialization. But after having considered the balanced growth approach, further investigation into the nature and effects of linkages is stimulated. To this extent, it represented an impetus to the subsequent analysis.

AGGLOMERATION EFFECTS AND GROWTH POLES

To date the theories of regional economic development reviewed have stressed the need for explicit recognition of the existing situation in seeking industries for the development process of a depressed area. But there is also a need for concern about the future pattern of industrialization which will occur as a result of the development strategy. The theory of agglomeration and growth poles direct themselves to this question.

Perroux [62] outlines the nature of growth poles and the essence of agglomeration effects. These two concepts offer much in explaining why subsequent industries will locate in close proximity to the key industries established in the development strategy. It is true, however, that they do not present a very clear explanation as to how the process is initiated.

But, the previous theories have shed some light on the rationale for industry selection which will assist the regional development strategist to designate the "FIRST" industry to be located in the depressed area. The theories of agglomeration and growth poles then completes the process by postulating how the development process will continue as a result of the development strategy.

These theories are very close to the theory of linkages which forms the

foundation of the methodology to be developed. The former note that the location of an industry in an area increases the desirability and the viability of the subsequent industries to locate in the same area. This is very similar to the theory of forward linkages. But the theory of linkages also examines the effects on the original industries as a result of an industry locating in a depressed area. In this way, the methodology presented improves on the theory of agglomeration and growth poles.

THE NEED FOR COMPREHENSIVE ANALYSIS

In attempting to combine and build on the useful aspects of the approaches mentioned above, explicit recognition is given to the fact that these approaches singularly lack certain capabilities for completing a normative development strategy. The strictly microeconomic analyses which study the problem from the point of view of the individual firm fail to stress directly the interrelationships existing between industries within a given region. This is a particularly serious handicap if the objective is to augment the industrial base of the region through the establishment of new industry. The success of an industry locating in a region could be altered significantly if the broader spectrum was considered. But the point of view of the individual entrepreneur and the individual firm is important and should not be neglected, for indeed the acceptance of the development strategy will hinge on this point.

In addition to establishing the potential of an industry locating in a region and its effect on the regional economy through its inter-industry relationships, the development strategy should also satisfy both the employment objective and the need for continued development in the future. The incorporation of these two considerations into a theory of regional economic development is the crucial aspect of the synthesis that forms the methodology

of Chapter Four.

The omission or the implicit treatment of these questions, by the theories that have gone before and the failure to put them in a proper juxtaposition creates the need for work along the lines formulated in the subsequent discussion.

CHAPTER FOUR

The Analytical Framework

THE FOUNDATION

The basic underlying supposition is that certain industries possess an ability to act as catalysts to the economic development of a region once they are operating within a depressed area. This catalytic reaction is fostered by the process of inter-industry relations. The concern then is to establish a rationale for identifying these industries.

The model will incorporate the input-output analysis so very crucial to locational decisions; giving explicit recognition to the need for the new or the expansion of the old industry to draw its resource inputs from the region and to market its intermediate products within the region in order to promote regional economic development. But it will go even further than this by making these actions criteria for industry selection. Furthermore, the theory will subsume the theories of international trade and agglomeration by investigating directly the exact stimuli radiating from an industry in order to determine its effect on further industrialization. In these regards, a fuller explanation of how the industrialization process will assist in a given depressed area to achieve economic development is contained within the model.

This particular approach is encompassed within the literature of the unbalanced growth school of development economics. The position of this school relies heavily on the interdependencies between industries and their ability to generate development. These interdependencies will be defined later as 'linkages'.

But this does not complete the model. This is because the objective function is to maximize employment and not necessarily total area output. Also, specific attention will be paid to the chosen industry's potential to foster further expansion both within itself and also within the region by means of the interdependencies.

Albert O. Hirschman [27] is credited with conceiving this variation on the unbalanced growth theme. The line of reasoning, stressing the need to examine the industrial structure of a depressed area, was supported later by Chenery [14].[14] Both authors realized that in order to study adequately the role of industrialization in economic development, attention must be paid to the industrial structure of an economy with the key aspect being the interdependence and interrelationships between industrial sectors. Studying the effects of any one particular sector[15] does not prove to be a very powerful explanatory tool, for the optimum level of output of any one sector is related fundamentally to the development of the other industrial sectors in the economy.

The measure of industrial interdependence in Hirschman's theory is contained in the concept of linkage effects. There are four kinds of linkages to be considered, falling into two major categories.

"The input-provision, derived demand, or <u>backward linkage effects</u>.... will induce attempts to supply through domestic (i.e., regional) production the inputs need in that activity. The output-utilization, or <u>forward linkage effects</u>....will induce attempts to utilize (a particular industry's) outputs as inputs in some new activities".[16]

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[14]Although Chenery's discussion primarily addresses itself to external economies, this reference is referring specifically to his concluding remarks on pp. 470-471.

[15]This facet is central to most benefit-cost analyses on the role of industrialization in economic development.

[16]Hirschman [27], p. 100.

These two major types of linkages, measured in terms of gross value of purchases and sales, may be subdivided into gross and net linkages.[17] A gross backward linkage is understood to be the direct and indirect increase in supply of all producing industrial sectors needed to sustain a unit increment in final demand of a particular purchasing industrial sector. A gross forward linkage is the direct and indirect increase in supply of a particular producing sector needed to sustain a unit increment in final demand of all purchasing sectors. The concept of net linkages merely refers to the DOMESTIC (i.e., regional) supply, in both cases. Hirschman, therefore, was referring to net linkage effects.

Thus, Hirschman's theory of linkages presents a reasonable basis for overcoming the scarcity of resources (including capital), managerial and entrepreneurial talent, and domestic markets capable of establishing and sustaining an extensive industrial complex. This is important since these factors are formidable obstacles to most depressed areas embarking on a development program. By focusing on the linkages between industries, concentration of the development effort in a few areas will result in the reaction proceeding to generate further increases in the production of the region. This is the first step in the realization of the objective, namely the provision of employment.

Hirschman attaches more importance to backward linkages for they are more compulsive in as much as they represent direct pressure by the purchasing sector on the producing sectors to produce the inputs required by the former. In his view the forward linkages are relatively weaker since an industry can only induce further processing of its output by other industrial sectors but remains relatively passive in the process. However, when considering

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[17] Acharya and Hazari [1], p. 110.

the total effect of an industry within a region, equal attention should be paid to the operation of the linkages in both directions.

It is also of some importance to note that linkage effects many emanate from different reference points. There are four such sets of points: a) within firms; b) among firms; c) among industrial sectors; and, d) among economies or regions. This study refers specifically to those linkages among industrial sectors.[18]

Furthermore, to avoid confusion the "inducement mechanism" of linkages is not a variation on the customary usage of the term which relates to final consumption demand. Hirschman's idea stresses the inducement resultant from other investment. He then expands the idea to encompass not only the type and quality but also the sequential order of the investments. Favoured in the initial stages of the development program are the intermediate manufacturing industries which exhibit both high forward and backward linkages.

From the preceding discussion, an attempt will be made to develop a method of identifying 'key' industries characterized by their high interdependence with other industries, as measured by linkage effects, and to study the incidence of these linkage effects. After establishing this, the analysis will proceed to ensure that those industries possess the potential for generating employment. The connection is made by use of the labour-intensity and growth potential criteria. Once an industry has been shown

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[18] It should be pointed out that not all the industries are always located within the region. In this case, linkages among industrial sectors may result in linkages among regions. However, since the major concern of this study is the industrial economic development of a particular region, and not the industrial organization of the region or the interregional effects of industrialization, the linkage effects among industrial sectors within the same region are of major interest.

to possess the characteristic of stimulating additions to the productive capacity of the region, its ability to provide employment directly and in the future are studied by the use of the two additional criteria. Finally, industries selected in this manner should illustrate the possibility of locating within the region concerned without the need for additional incentives. This last characteristic is investigated by using the "relevant region" criterion. Failing any of these criteria, such industries cannot be recommended as key industries for the development strategy of a depressed area.

THE DETERMINATION OF LINKAGES

Linkages, in a sense, are nothing more than a precise method of stating the interdependence existent between industries as a result of transportation, communication and other relevant considerations discussed in previous theories of regional development. Beyond this they permit the analyst to identify the directional impetus of these various factors as they influence industrialization. This aspect is of rather crucial importance if the policy impacts on the industrial structure of a regional economy are important.

But perhaps more important, linkages demonstrate the ability of an industry (by means of increasing output of an established firm or by introducing a new one) to foster the expansion of output in other industries. So linkages not only typify but they also illustrate the mechanism of development through industrialization. As such, the analysis is very much akin to a general equilibrium linear programming technique. The expansion of output is investigated as it pertains to the industry in question and the effects subsequently are traced to the other industries in the regional economy.

Current emphasis on area development has heightened the need for empirical knowledge of the interrelationships both within and among the area economies. Although this study focuses on the former, policymakers should be cognizant of program impacts both before and after its implementation. To this end, the interindustry analysis, or input-output framework, provides a powerful approach to area development and industry structure analysis.

It is not the intention to thoroughly disect the theory of Input-Output analysis.[19] What follows is a condensed presentation of the framework which was originally devised by Leontief [43].[20] This particular analytical technique has been adopted because it is very compatible with the quantitative derivation of linkages. Hirschman states that a refined measure of linkages can be obtained by considering the inverse of the input-output matrix. This fact is established by the very nature of the coefficients. The "matrix makes it possible to estimate the direct and indirect repercussions of an increase in final demand requirements for any one industry on the other sectors of the economy"[21]; for the coefficients represent the derived demand in all the purchasing and supplying sectors resultant from a unit increase

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[19]The limitations and conditions attached to the analytics and conclusions of this study are discussed in the subsequent chapters.

[20]For a complete discussion of the assumptions and the construction of the input-output table see Leontief [43], Miernyk [52] or Klein [38]. The conceptual and practical problems associated with this technique are discussed adequately by Evans and Hoffenberg [16]. Furthermore, Sawyer [70] has applied this theory to the Canadian economy as a whole, while Frank, Batrik and Haronitis [20] have used this technique for the Province of Ontario. Sawyer's effort led to a book by Caves and Halton [11] which deals with how one might develop more complete interindustry relationships for the Canadian economy and their practical use.

[21]Hirschman, op. cit., p. 108.

in final demand of any one sector. Demonstrated below is the working of the model, including the theoretical and practical derivation of linkages using the input-output analysis.

THE MODEL[22]

In essence, the input-output system is a special adaptation and a simplified version of the general equilibrium theory of production.[23]

Consider the following expression for regional income.

$$Y = C+I+G+E-M \qquad (1)$$

where; Y = regional income;

C = regional consumption;

I = regional investment;

G = net regional government expenditures;

E = regional exports;

M = regional imports;

This equation is derived by considering only the area's economic transactions. In representing this relationship in an input-output system, it must be realized that:

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[22]This presentation of the model closely parallels that of Chenery and Clark [12]; some of the notation is that of Macmillan and Lu [48], pp. 9-17.

[23]The reason it is used here, even though the study considers an essentially disequilibrium situation, is that it is designed to study the reactions in an economy to exogeneous stimuli. Granted the unemployed resources lie outside the reference frame of the input-output approach. Nevertheless it does illustrate where these resources will be employed following their introduction into the system as active participants. The closed nature and consistency of the system required that there always be a solution and hence a disequilibrium internal to the system cannot exist. But the approach only studies the active facets of the economy whereas unemployed resources are inactive and can only be accounted for once they are actively employed. Therefore, the disequilibria are hypothetically peripheral to the actual input-output framework, but this could be overcome by expanding the activities in the table to take into account the disequilibria by the use of slack variables.

a) each commodity is supplied by a single industry or industrial sector in production;

b) the inputs purchased by a given sector are a function of the level of output of that sector; and,

c) the total effect of production is equal to the sum of the effects of the individual sectors.

In the income stream, total income must equal total expenditures. Similarly, in the input-output system, total (regional) sales must equal total (regional) purchases.

Total regional sales of sector i can be expressed as follows:

$$X_{i.} = \sum_{j=1}^{n} X_{ij} + C_i + I_i + G_i + E_i \qquad (2)$$

where;

$X_{i.}$ = total sales of sector i to all other j sectors;

X_{ij} = sales of the ith sector to the jth sector;

C_i = regional consumption from the ith sector;

I_i = investment goods sold by the ith sector;

G_i = regional government expenditures in sector i;

E_i = exports to other regions by sector i.

Total regional purchases are equal to:

$$X_{.j} = \sum_{i=1}^{n} X_{ij} + \sum_{i=1}^{m} P_{ij} + \sum_{i=1}^{n} M_{ij} + M_{pj} \qquad (3)$$

where;

$X_{.j}$ = total purchases of the jth sector from all other i sectors;

P_{ij} = inputs purchased from factor i by sector j;

M_{ij} = imports of sector i outside the region purchased by sector j in the region;

M_{pj} = total inputs purchased from all payment sectors by sector j.

Let A, the "technological" matrix, or the matrix of input coefficients, be defined as $A_{ij} = x_{ij}/X_{ij}$, or;

$$A = \begin{bmatrix} a_{11} & \cdots & a_{1n} \\ \vdots & a_{ij} & \vdots \\ a_{n1} & \cdots & a_{nn} \end{bmatrix}$$

for i = 1,.....n, and,

j = 1,.....n,

where, a_{ij} denotes any elements in the matrix and the element is the quantity of output of industry i required in the production of one unit of output in industry j. Or a_{ij} is the input-output coefficient including both regional purchases and imports of intermediate goods by sector.

Equation (2) then can be rewritten in the matrix form:

$$X = AX+C+I+G+E \tag{4}$$

where; X is a column vector representing the regional output of sector i. From equation (4), an inverse can be calculated:

$$X-AX = C+I+G+E; \tag{5}$$

$$(I-A)X = C+I+G+E; \tag{6}$$

where I is the identity matrix and,

$$(I-A) = \begin{bmatrix} (1-a_{11}) & \cdots & -a_{1j} & \cdots & -a_{1n} \\ \vdots & & & & \vdots \\ -a_{i1} & & (1-a_{ij}) & & -a_{in} \\ \vdots & & & & \vdots \\ -a_{n1} & \cdots & -a_{nj} & \cdots & (1-a_{nn}) \end{bmatrix}$$

The solution to the system is:

$$X = (I-A)^{-1} \quad (C+I+G+E) \tag{7}$$

and $(I-A)^{-1}$ is known as the Leontief inverse.

Furthermore, it is possible to introduce imports into equation (4) when the region is able to identify the import content of the intermediate goods. Equation (7) then could be written as:

$$X = (I+M-A)^{-1} \quad (C+I+G+E) \tag{8}$$

where $(I+M-A)^{-1}$ is known as the "domestic" inverse. The input-output model now can be used to calculate the linkages.[24]

Let

$$L_{ij} = (I-A)^{-1} \tag{9}$$

and,

$$\overline{L}_{ij} = (I+M-A)^{-1} \tag{10}$$

where; L_{ij} is any element in the Leontief inverse and $\overline{L}_{ij}$ is any element in the "domestic" inverse matrix.

With the use of these two matrices, the gross and net forward and backward linkages can be calculated. The linkages calculated using the Leontief inverse are the 'gross' linkages, while the linkages determined by using the domestic inverse are 'net' linkages. Therefore,

$$L_{.j} = \sum_{i=1}^{n} L_{ij} \tag{11}$$

$$\overline{L}_{.j} = \sum_{i=1}^{n} \overline{L}_{ij} \tag{12}$$

$$L_{i.} = \sum_{j=1}^{n} L_{ij} \tag{13}$$

$$\overline{L}_{i.} = \sum_{j=1}^{n} \overline{L}_{ij} \tag{14}$$

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[24] Acharya and Hazari, op.cit., p. 109.

where; $\bar{L}._j$ and $L._j$ are the net and gross backward linkages respectively; $\bar{L}_{i.}$ and $L_{i.}$ are the net and gross forward linkages.

Or, the gross forward linkage is the sum of all the elements of a row in the Leontief inverse represented in equation (7), while the gross backward linkage is the sum of any column of this inverse. The net linkages are calculated in a similar manner using the domestic inverse matrix in equation (8).

THE INCIDENCE OF THE LINKAGE EFFECTS

Using this method for calculating the net versus the gross linkage effects enables the determination of the incidence of these linkages. The difference between the gross and net linkages is a measure of the import content of production.

Thus, the following general postulate evolves. When the import content of production is high with respect to the backward linkages,[25] the secondary employment and income generating effects of the region's industry are accruing to suppliers outside the area. Similarly, when the difference between the gross and net forward linkages is high, the effects of further processing and marketing the output of the region's industry are accruing to individuals and industries outside the area. It is important to identify the incidence of these linkages in order to ensure that a region's development potential is not dissipated and does serve the economic advancement of depressed areas.

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[25]That is to say, the difference between the gross and net linkages is large.

ASSIGNING PRIORITIES TO INDUSTRIES FOR REGIONAL DEVELOPMENT

When an industry (or a number of industries has been designated as one exhibiting high linkage effects, it remains to determine whether or not it meets with three additional criteria before becoming the nucleus of a development strategy. The industry should be relatively labour-intensive; have a high growth potential; and should be able to locate with the region without requiring fiscal and/or grant incentives, i.e., the relevant region for the industry is the one under consideration. This last criterion is very crucial. There are no "a priori" reasons for a footloose industry to locate in a depressed areas. Therefore, while the regional government may choose to stimulate industries linked to "footloose" industries, or seek "footloose" industries themselves, these criteria can be used to serve as a guide to minimize the incentive required per unit of gain received for the region.

The combining of all four criteria facilitates the final listing of priority industries for the development strategy. There are, of course, other avenues to formulating policy. The particular approach adhered to in the following analysis attempts to avoid (or at least minimize) the cost of attracting industry or the creation of income transfers by following an import substitution industrialization strategy. If costs have to be incurred as a result of designating industries in the manner suggested, further investigation should be initiated to determine their relative importance and the potential impacts. However, successful operation of the methodology presented, provided at least some industries conform to the criteria, should minimize, if not eliminate, direct costs in the form of payments and/or subsidies to individuals or industries. On the other hand,

costs resulting from social improvements should be evaluated separately using other criteria for they affect not only the industries in question.

The question is raised immediately. What relative weights, or signs of importance, should be given to the different criteria? Answering this question presupposes that there will be a trade-off involved. Some industries will possess high linkages but will lack the other characteristics, and so on as various other combinations of criteria are possible.

The choice here is to use an elimination process. It does not solve the problem of weighting, nor is it less arbitrary. The industries above the cut-off point are assigned a weight of one; those below a weight of zero. The weighting process itself is a multiplicative one. In using the method advocated, it will become evident that all that is required is for the policy maker to be able to interpret correctly economic and political stimuli in the performance of his/her tasks.

Turning to the actual process, first the linkage effects of the various industries are calculated. A grouping of high forward and backward linkage industries is determined in this manner. Secondly, these industries then are subjected to the labour-intensity criterion. Only those high linkage, labour-intensive industries are investigated as to their growth potential. This will produce a refined list of a small number of industries on which the regional government can concentrate its efforts. Finally, the ability of the industry to locate in the region without incentives can be determined, and those which have been designated as high linkage, labour-intensive, growth industries which can do so are the ones to be given priority.

This process may not satisfy all the quantitative requirements for some. The particular sequence of criteria chosen is only one application. With no claim that it is superior to another sequence, it reflects the

priorities to maximize linkages, then employment etc. For a different ordering of priorities a different sequence would have to be used.

The completion of the methodology is as follows. The determination of the labour-intensity and the growth potential of an industry has been discussed already. It remains to develop the method for determining the relevant region for an industry.[26]

DETERMINING THE RELEVANT REGION

Let X_{ij} be the sales of industry i to industry j (1 = 1,....n) and X_{ji} be the purchases of industry j from industry i, (j = 1,....n). Therefore

$$X_{ij} = X_{ji} \tag{15}$$

represents the equality between the sales of industry i to industry j and the purchases of industry j from industry i.

The sales of industry i to industry j also can be expressed in terms of the gross output of industry i, or

$$X_{ij} = a_{ij}X_{i}. \tag{16}$$

and the purchases of industry j expressed in gross output of industry j is

$$X_{ji} = X_{ij} = a_{ji}X._{j} \tag{17}$$

Thus, the sales of industry i to industry j can be represented as

$$X_{ij} = X_{ji} = a_{ji}X._{j} \tag{18}$$

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[26]The theory, while modified slightly, is that of Klaassen [36], Chapter 7 and Appendix 2. This theory will be applied to the region under consideration in this study, as part of the methodology in formulating a regional development strategy.

The total sales of industry i used as intermediate inputs are

$$\bar{X}_{i\cdot} = \sum_j a_{ij} X_{i\cdot} = \sum_j a_{ji} X_{\cdot j} \tag{19}$$

and the total purchases of industry j used as intermediate inputs are

$$\bar{X}_{\cdot j} = \sum_j a_{ji} X_{\cdot j} \tag{20}$$

Define:

$$X_{i\cdot} = \bar{X}_{i\cdot} + d_i \tag{21}$$

where; $X_{i\cdot}$ = gross output of industry i,

d_i = final demand for industry i that is not used as intermediate input.

Furthermore,

$$X_{i\cdot} = \sum_{i=1}^{n} X_{ij} + v_{i\cdot} \tag{22}$$

where; v_i = the value added in industry i.

Let

$$D_i = d_{i1} + X_{i\cdot 1} \tag{23}$$

where; D_{i1} = total demand of industry i in region 1, for i = 1,....m.

and

$$E_{i1} = X_{i\cdot 1} - D_{i1} \tag{24}$$

or the exports of industry i from region 1 are the difference between the gross output of industry i in region 1 and the demand for the products of industry i in region 1, assuming there is no inventory buildup.

Therefore,

$$X_{i\cdot 1} = D_{i1} + E_{i1} \tag{25}$$

or

$$X_{i\cdot 1} = a_{if} d_1 + \sum_j a_{ji} X_{i\cdot 1} + E_{i1} \tag{26}$$

where; d_1 = total final demand in region 1

$a_{if}d_1$ = final demand for industry i's products in region 1

a_{if} = proportion of the total final demand (d_1) in region 1 for the products of industry i.

Now, $X_{jil} = a_{ji}X_{j\cdot 1}$ (27)

is the sales of industry j to industry i,

and,

$$r_{ijl} = a_{ij}X_{i\cdot 1} \quad (28)$$

is the total purchases of industry i from industry j. The net imports of intermediate goods by industry j in region 1 for industry i's products are

$$M_{ijl} = a_{ij}X_{i\cdot 1} - a_{ji}X_{j\cdot 1} \quad (29)$$

and the total imports for industry i are

$$M_{il} = b_i X_{i\cdot 1} - \sum_j a_{ji} X_{j\cdot 1} \quad (30)$$

where; b_i is the total purchases as a proportion of the gross output of industry i.

Therefore;

$$b_i = 1 - a_{vi} \quad (31)$$

where; a_{vi} is the proportion of value added in the gross output of industry 1.

Then from (30)

$$X_{i\cdot 1} = \frac{1}{b_i} \sum_j a_{ji} X_{j\cdot 1} \frac{1}{b_i} M_{il} \quad (32)$$

Suppose industry i can either be an exporting industry, an importer of intermediate products or both. Furthermore, assume that the transportation and communication costs for selling the products of industry i in the home region are insignificant, then $t_d E_{il}$ are the total transportation and

communication costs for industry i, where; t_d is the transportation and communication costs per unit of export, E_{i1}. If t_j is the transportation and communication costs for importing one unit of intermediate product of industry j, the total transportation and communication costs for industry i in region 1 are

$$t_{i1} = t_d (X_{i\cdot 1} - D_{i1}) + \sum_j t_j (b_{ij} X_{i\cdot 1} - a_{ji} X_{j\cdot 1}) \qquad (33)$$

$$\text{for } j \neq t.$$

or

$$X_{i\cdot 1} = \frac{t_d}{t_d + \sum_j t_j b_{ij}} \cdot D_{i1} + \frac{t_j b_{ij}}{t_d + \sum_j t_j b_{ij}} \cdot \frac{a_{ji}}{b_{ij}} \cdot X_{j\cdot 1} + \frac{b_{it}}{t_d + \sum_j t_j b_{ij}} \cdot \frac{a_{tj}}{b_{it}} \cdot X_{t1} \qquad (34)$$

where; $X_{j\cdot 1}$ excludes transportation and communication output and,, X_{t1} = gross output of transportation and communication industries in region 1,

b_{it} = purchases of industry i from the transportation and communication industries,

a_{ti} = proportion of the output of industry i purchased by the transportation and communication industry.

Now, let

$$H_1 = \frac{t_1}{t_d + \sum_j t_j b_{ij}} \qquad (35)$$

and

$$H_j = \frac{t_j b_{ij}}{t_d + \sum_j t_j b_{ij}} \qquad (36)$$

then by substituting (35) and (36) into (34), we get

$$X_{i\cdot 1} = H_d D_{i1} + \sum_j H_j \frac{a_{ji}}{b_{ij}} X_{j\cdot 1} \qquad (37)$$

where; j = 1,....t,...n, and

$$H_d + \Sigma_j H_j = 1$$

$X_{1\cdot 1}$ now INCLUDES the transportation and communication sectors.

Now the following situations can arise:

a) If all $H_j = 0$, then $H_d = 1$, and then (37) becomes

$$X_{i\cdot 1} = D_{i1} \tag{38}$$

The following interpretation can be ascribed to equation (38). The gross output of industry i in region 1 equals the demand for industry i's products in region 1 and it can be said that the size of the region determines the size of the industry. There are no imports or exports of industry i's products in region 1. In this case, industry i is a <u>completely market-oriented</u> industry.

b) If one $H_j = 1$, then all the other H_j's plus $H_d = 0$, then (37) becomes

$$X_{i\cdot 1} = \frac{a_{ji}}{b_{ij}} X_{j\cdot 1} \tag{39}$$

In this case, the size of industry i is determined by the size of industry j and industry i is known as <u>supply oriented</u> with respect to industry j. The ratio of the size of industry i to industry j is a_{ji}/b_{ij}. If industry j is operating at its maximum capacity it can be termed a <u>bottleneck industry</u>.

c) A "balanced" industry is one in which $t_d = t_j$. Then from (35),

$$H_d = \frac{1}{1+b_i} \tag{40}$$

and (36) becomes

$$H_j = \frac{b_{ij}}{1+b_i} \qquad \text{for all } j \tag{41}$$

It is now possible to determine what is meant by a "footloose" industry.

d) When all the t's = 0 and, therefore, the H's are indeterminate, the industry is said to be "footloose". The size of industry i is independent of D_{i1} and $X_{j\cdot 1}$.

Equation (33) now can be utilized to: a) determine if the region under consideration is the relevant region for industry 1, or whether industry i is footloose with respect to the region; and, b) determine the ability to attract and/or locate industry i in the region without the need for incentives using the results of (a) above. If the industry is not footloose with respect to the region, i.e., the region under consideration is the relevant region for industry i, it will be assumed that industry i can be located successfully within the region, or vice-versa. Equation (33) also can be tested statistically using the data for the number of employees in industry i in the region if the gross output figures are unavailable. Using equation (37),

$$X_{i\cdot 1} = H_d D_{i1} + \sum_j H_j \frac{a_{ji}}{b_{ij}} X_{j\cdot 1}$$

each variable then is divided by the value for the nation as a whole. The equation becomes a proportion, and may be written as:

$$\frac{X_{i\cdot 1}}{X_{i\cdot}} \cdot X_{i\cdot} = H_d \frac{D_{i1}}{D_i} \cdot D_i + \sum_j \frac{a_{ji}}{b_{ij}} \frac{\cdot X_{j\cdot 1}}{X_{j\cdot}} \cdot X_{j\cdot} \qquad (42)$$

Since we are interested in the relevant region for industry i and assuming exports and subsequently imports of intermediate goods are exogenously determined,

$X_{i\cdot} = D_i = (a_{ji}/b_{ij})\, X_{j\cdot}$ and equation (42) becomes

$$\frac{X_{i\cdot 1}}{X_{i\cdot}} = \frac{H_d D_{i1}}{D_i} + \sum_j H_j \frac{X_{j\cdot 1}}{X_{j\cdot}} \qquad (43)$$

For simplicity in recognition, equation (43) can be expressed as:

$$P_{i1} = H_d D'_{i1} + \sum_j H_j P_{j1} \qquad (44)$$

where; $P_{i1} = \frac{X_{i\cdot 1}}{X_{i\cdot}}$

$$D'_{i1} = \frac{D_{i1}}{D_i}$$

and $P_{j1} = \frac{X_{j\cdot 1}}{X_{j\cdot}}$ for $j = 1,.....n.$

If equation (44) is tested statistically be regression analysis, the correlation coefficient will be an increasing function of the size of the region. Therefore, when the correlation coefficient is high, the region under consideration is the relevant region, and it will be assumed that the industry is footloose only within that particular region.

Since the H's represent the relative importance of transportation and communication costs in either marketing the output of an industry or in procurring its requirements, a completely market-oriented industry is one for which

$$P_{i1} = D'_{i1} \qquad (44A)$$

This is the case when the proportion of gross output of industry i in region 1 equals the proportion of total final demand for industry i in region 1.

When the gross output of industry i in region 1 is completely determined by the supply of requirements in region 1, i.e.,

$$P_{i1} = P_{j1} \qquad (44B)$$

then industry i is completely supply oriented. These two conditions are determined by the values for the H's which can be derived statistically.

Equation (44) determines whether or not the region '1' under consideration is the relevant region. If one of the H's is not equal to zero, we will infer that the industry is either supply or market-oriented. The more supply-oriented an industry is, the larger is the relevant region. If the source of supply is completely uncorrelated to the demand of industry i for these requirements, the relevant region for such an industry is the economy as a whole.

If H_d is not equal to zero but the correlation coefficient is relatively low, then industry i is demand-oriented and the relevant region is one which is larger than the region under consideration. If the correlation coefficient is significantly large, the relevant region is the one under consideration.

This essentially concludes the methodology for identifying industries for regional economic development. It is evident that the method is general and could be applied to any region. For the purposes of exposition and demonstration, Chapter Five will provide, data permitting, an illustration of how the method could be applied to the Province of Manitoba.

CHAPTER FIVE

The Methodology In Practice

The discussion in this chapter addresses itself to two major questions which evolve from the preceding presentation of the methodology. The first question is how might this methodology work in practice. That is to say, how are decisions arrived at based on the operations of the model. The second question is what are the limitations of such an analysis.

THE IDENTIFICATION OF KEY INDUSTRIES

The procedure is initiated by calculating the linkage effects for the industrial sectors in the given region under consideration. For the purpose of example, the Manitoba case is presented. Table 1 lists the linkage effects, or degree of interdependence, by industry group in four major categories; Group I - the industrial sectors for which the forward and backward linkages are relatively higher then for other industrial sectors; Group II - the industrial sectors which exhibit relatively high backward linkages, both with respect to other industrial sectors and the forward linkages; Group III - industrial sectors which have higher forward than backward linkages; and Group IV - industrial sectors for which the forward and backward linkages are low. This table was developed using the Leontief inverse from the 1961 Input - Output Table for the Province of Manitoba.[27]

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[27] "The Input - Output System of the Manitoba Economy, 1961", Government of Manitoba; Winnipeg, Manitoba, Canada. The realized results are subject to the unknown quality of the 1961 table.

TABLE 1

Degree of Interdependence Between Industrial Sectors,

Manitoba 1961

GROSS LINKAGES

Industrial Sectors	Backward Linkages	Forward Linkages
I Interdependence: Both Forward and Backward Linkages Relatively High		
Rubber & Leather	2.46	4.30
Livestock	2.22	2.40
Furniture and Fixtures	2.23	2.25
Crops	1.96	3.13
Petroleum Products	1.96	2.52
Non-Metallic Minerals	1.92	2.09
Misc. Manufacturing	1.82	1.63
II Interdependence: Backward Linkages Relatively Higher Than Forward Linkages		
Beverages	4.70	1.09
Meat and Other Foods	2.61	1.24
Dairy Products	2.61	1.02
Grain Mills	2.59	1.17
Machinery	2.03	1.24
Textiles	1.94	1.12
Chemicals	1.90	1.34
Wood Products	1.85	0.16
Transportation Equipment	1.87	1.36

TABLE 1 (Cont'd)

Industrial Sectors	Backward Linkages	Forward Linkages
III Interdependence: Forward Linkage Relatively Higher Than Backward Linkages		
Wholesale Trade	1.33	7.27
Transportation	1.57	3.96
Services	1.26	2.49
Paper and Allied Products	1.61	2.18
Metal Fabricating	1.70	1.89
IV Interdependence: Both Backward and Forward Linkages are Low		
Clothing	1.77	1.36
Electrical Products	1.83	1.47
Mining	1.39	1.08
Printing and Publishing	1.40	1.09
Primary Metals	1.49	1.35
Forestry	1.43	1.08
Construction	1.20	1.48
Electric Power	1.16	1.46
Petroleum	1.14	1.08

The linkage effects represented in Table 1 are Gross Linkages. They are expressed in real terms as defined in Chapter Four. No recognition is given as to the regional incidence of the linkages when they are stated as Gross Linkages.

It is of interest to note the industries which exhibit the highest Gross Linkages for later comparison with those which have the highest incidence of linkage effects in Manitoba, i.e., net linkages.

To calculate the linkage effects of industrial sectors as they affect the regional economy, the domestic inverse of the 1961 Manitoba Input - Output Table is used. The results are contained in Table 2, which depicts the net linkages, once again broken down into the same category headings as the Gross Linkages.

It is noteworthy that the following industrial sectors do not appear in Group I of Table 2, as they did in Table 1.

1. Rubber and Leather Products
2. Furniture and Fixtures
3. Non-Metallic Minerals
3. Miscellaneous Manufacturing.

Furthermore Group I of Table 2 contains the addition of three industrial sectors.

1. Printing and Publishing
2. Construction
3. Metal Fabricating.

Therefore, merely by changing the emphasis and stressing the geographical incidence of the linkage effects, rather than just considering total linkages irrespective of their incidence, alters significantly the composition of Group I. This would seem to suggest that, indeed, the introduction of regional considerations significantly changes the

TABLE 2

Degree of Interdependence Between Industrial Sectors,

Manitoba 1961

NET LINKAGES

Industrial Sectors	Backward Linkages	Gross-Net Backward Linkages[1]	Forward Linkages	Gross-Net Forward Linkages[2]
I Interdependence: Both Backward and Forward Linkages Relatively High				
Livestock	1.84	0.38	1.93	0.47
Petroleum Products	1.53	0.43	2.29	0.23
Printing & Publishing	1.31	0.09	1.01	0.08
Crops	1.22	0.74	1.79	1.34
Construction	1.32	-0.12	1.11	0.37
Metal Fabrication	1.03	0.67	1.07	0.82
II Interdependence: Backward Linkages Relatively Higher Than Forward Linkages				
Meat & Other Food Products	1.76	0.85	1.02	0.22
Grain Mills	1.72	0.87	0.99	0.18
Dairy Products	1.85	0.76	0.80	0.22
Clothing	1.32	0.45	0.95	0.41
Non-Metallic Minerals	1.29	0.63	0.97	1.12
Transportation Equipment	1.28	0.59	0.93	0.43
Furniture & Fixtures	1.21	1.02	0.79	1.46
Mining	1.20	0.13	0.98	0.10
Beverages	1.02	3.68	0.63	0.46

TABLE 2 (Cont'd)

Industrial Sectors	Backward Linkage	Gross-Net Backward Linkages[1]	Forward Linkages	Gross-Net Forward Linkages[2]
III Interdependence: Forward Linkages Relatively Higher Than Backward Linkages				
Trade	1.28	0.05	5.65	1.62
Transportation	1.29	0.28	2.65	1.31
Services	1.21	0.05	2.12	0.37
Electric Power	1.10	0.06	1.40	0.06
IV Interdependence: Both Backward and Forward Linkages Low				
Primary Metals	0.87	0.62	0.99	0.36
Misc. Manufacturing	0.86	0.96	0.98	0.65
Paper & Allied Products	0.78	0.83	0.88	1.30
Chemicals	0.67	1.23	0.68	0.66
Wood Products	0.96	0.89	0.63	-0.47
Electrical Products	0.79	1.04	0.60	0.87
Rubber & Leather	0.86	1.60	0.51	3.79
Machinery	0.58	1.45	0.36	0.88
Petroleum	0.30	0.84	0.51	0.57
Textiles	0.40	1.54	0.38	0.74
Forestry	0.37	1.06	0.36	0.72

1. The figures represent the difference between the Gross and Net Backward Linkages.
2. These figures are the difference between the Gross and Net Forward Linkages.

industries which the decision maker might consider for the regional development plan.

Table 2 also contains figures for the difference between the Gross and Net Linkages, on both the forward and backward side. An attempt could be made to discern which have the highest impact in Manitoba from these figures. But this is rather awkward for it neglects the linkages themselves.

To facilitate matters Table 3 was constructed.

Owing to the analysts preference for Group I industrial sectors because of their overall high linkages, and based on Hirschman's position that backward linkages are more important, Table 3 lists the TOTAL linkage effects for Group I and Group II from Table 2.

To determine which industries' linkage effects have the highest incidence in Manitoba, the Region Impact Coefficient (RIC) was devised. It is the ratio of total net to total Gross Linkage effects. In this way, it demonstrates the fraction of the total linkage effects which affect the other industrial sectors in Manitoba.

To select the industries for further analysis, an arbitrary figure of 70%, as the portion of the linkage effects of an industrial sector which have to accrue to the region's industries, was chosen.

There is nothing magical about the number 0.7, but it does require that an industrial sector have more than "two-thirds of the impact of its linkage effects going to other industrial sectors in the region. It would be preferable to have this figure as high as possible from the policy oriented point of view. This would ensure that an industry finally selected would have a major impetus to further increases in industrial output in the region. However, this aspect has to be counter-balanced

TABLE 3

Regional Impact Coefficients (RIC)[1] of High Linkage Industries

	Total Gross Linkage	Total Net Linkage	RIC
Livestock	4.62	3.77	0.82
Petroleum	4.48	3.82	0.85
Printing & Publishing	2.49	2.32	0.93
Crops	5.09	3.01	0.59
Construction	2.68	2.43	0.91
Metal Fabricating	3.59	2.10	0.58
Meat & Other Food Products	3.85	2.78	0.72
Grain Mills	3.76	2.71	0.72
Dairy Products	3.63	2.65	0.73
Clothing	3.13	2.27	0.73
Non-Metallic Minerals	4.01	2.26	0.56
Transportation Equipment	3.23	2.21	0.68
Furniture and Fixtures	4.48	2.00	0.45
Mining	2.47	2.18	0.88

[1] RIC = the ratio of total net to total gross linkages.

with the notion of limiting too severely the alternatives in selecting an industry with respect to this first criterion. The figure of 0.7 has already excluded almost 75% of all the industrial sectors in the Manitoba economy from further consideration in the selection process.

Ten industries then qualified to be analyzed with respect to their labour-intensity and growth potential. These are the second and third criteria respectively in the selection of key industries for the regional economic development strategy.

The results are contained in Table 4.

The value added, wages and salaries, and thus the labour-intensity index were calculated for the year 1967. This was the latest year for which comparable statistics are available for the ten industries under consideration. Value added is the figure for the portion of the value of the output attributable to the production process of the industry. The wages and salaries measure the total payments to labour in both the managerial and the production worker classifications.

Once again, the need to establish a critical value for the labour-intensity index arose. Again quite arbitrarily, the critical value was set at 2.00. The choice of this figure stipulates that at least half the value added be paid in the form of wages and salaries in the industry, for that industry to be considered for further analysis. This can lead to another debate revolving about the validity of such a decision. But as was the case in the past, and as will be assumed in the future, these figures are merely for illustrative purposes. Individual decision makers or decision making bodies can set the critical values as they see fit, given the political and other constraints which they deem relevant, and hence affect their decisions.

TABLE 4

Growth Potentional and Labour-Intensity of High RIC Industries

Industries	No. Employed 1962	1967	Change	Growth Indication (Percent Change)	L.I.[1]
Livestock[2] (719,819)	(770,519)		(+50,700)	+ 7.09	-
Petroleum Products	737	470	-267	-36.23	3.04
Printing & Publishing	3,793	4,212	+419	+11.05	1.80
Construction	28,400	34,959	+6,559	+23.10	2.88
Meat & Other Foods	5,594	5,865	+271	+ 4.84	1.83
Grain Mills	2,382	3,096	+714	+29.97	1.66
Dairy Products	1,504	1,386	-118	- 7.85	1.83
Clothing	5,960	6,414	+454	+ 7.62	1.60
Mining	4,021	4,988	+967	+24.05	2.68
Transportation Equipment	2,023	3,559	+1,536	+75.93	1.56

[1] L.I. = Labour-Intensity index which is the ratio of value added to total wages and salaries.

[2] No reliable figures are available on employment and value added. The figures presented are total acres devoted to livestock production in Manitoba for the census years 1961, and 1966. These figures were used to calculate the growth indicator. Furthermore, it is assumed that this industry is relatively labour intensive as understood in the context meant here.

Source: "Manufacturing Industries of Canada, Sections E and G", Statistics Canada, 1961-1969.

From an economic development point of view, stressing as it were the position of labour, it may be desireable to seek industries for which the index is a close to one as possible. But in order that the demonstration of the methodology proceed, the figure 2.00 is set as the cut-off point. Any industries for which the labour-intensity index is above 2.00 are eliminated from further consideration.

Thus, the list of industries is narrowed to include only seven industries, which are contained in Table 5.

These seven industries then are investigated with respect to their growth potential. The critical minimum, in this case, was set at 10% for the years 1962-1967. The period was established on the following grounds. The year 1962 is the one immediately following the year for which the input-output data was available and 1967 is the last year for which comparable statistics were available for the industries. This establishes the growth rate for the subsequent five year period from the year for which the linkage effects were noted for the industries. Once again, the 10% growth rate is quite arbitrary.

The list of industries, comprising the prime targets for future expansion in Manitoba from the regional economic development point of view, is narrowed for four[28]. These industries are: 1) Livestock; 2) Printing and Publishing; 3) Grain Mills; and 4) Transportation Equipment.

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[28]The question of the availability of data is discussed in the following section in conjunction with the limitations of the analysis. The author did not wish to allow the lack of data to seriously hamper the illustration, and so unless otherwise indicated by fact no industry was excluded from the analysis. This is a direct judgement made due to the availability of data at the regional level in Canada.

TABLE 5

Labour-Instensive, Domestic Linkage Industries in Manitoba, 1961

Industry	RIC	Labour-Intensity Index
Livestock[1]	0.82	--
Printing and Publishing	0.93	1.80
Meat and Other Foods	0.72	1.83
Grain Mills	0.72	1.66
Dairy Products	0.73	1.83
Clothing	0.73	1.60
Transportation Equipment	0.68	1.56

[1]Livestock was allowed to remain for further consideration because of its consistent appearance in Group I and no information is available to refute that it is not labour-intensive. The only explanation for this is the adherence, once again, to the position of trying not to limit too severely the alternatives at the early stages in the analysis.

These industrial sectors displayed a high incidence of their forward and backward linkages in the region; were relatively labour-intensive; and displayed "acceptable" growth over the half-decade immediately following the year for which the linkages were calculated, respectively.

The four industrial sectors in question need only be investigated vis-a-vis their ability to locate within the region. The decision maker should now determine whether or not the industries are footloose with respect to the region. This is achieved by the use of equation (44) from Chapter Four which determines whether or not Manitoba is the relevant region for the industries in question. In order to do this, the major demand and supply related industries have to be determined for each of the four remaining industries. The necessary information is obtained from the input-output table.

The results for the Transportation Equipment Industry are contained in Table 6. If an industrial sector purchased from or sold to the industry in question products or services amounting to at least 5% of the total output of the industry in question, it is assumed that the industry has an influence on the location decision of the industry under consideration for the development plan. Once again, this figure can be adjusted to suit the decision maker but it is interesting to note the number of industries which do not, in fact, exert this type of influence.

From Table 6, only new construction was a major purchaser of transportation equipment in 1961. Similarly, the major supplier were the primary metal and trade sectors. The appropriate proportions then were determined for the years 1962-1969. Equation (44) was tested with regression analysis; where D'_{29} is New Construction in Manitoba; P_{20} is Primary Metals; P_{36} is the Trade sector; and of course P_{23} is Transportation Equipment.

TABLE 6

TOTAL SALES AND PURCHASES OF TRANSPORTATION

EQUIPMENT INDUSTRY IN MANITOBA, 1961

SALES			PURCHASES		
No.	Industry	% Gross Output Trans. Eq. Industry	No.	Industry	% Gross Output Trans. Eq. Industry
01	Crops	1.38	16	Wood Products	1.10
02	Livestock	1.38	20	Primary Metals	6.41
29	New Construction	5.75	21	Metal Fabricating	0.55
30	Repair Construction	0.59	24	Electrical Products	0.63
37	Transportation	3.43	26	Petroleum	0.77
			27	Chemicals	0.83
			30	Repair Construction	0.50
	Total Final Demand	78.84	32	Electric Power	0.96
			35	Misc. Supplies	2.98
			36	Trade	26.46
			38	Transportation	2.09

Source: "The Input-Output System of the Manitoba Economy, 1961", Government of Manitoba, Winnipeg, Canada.

TABLE 7

ANOVA: TRANSPORTATION EQUIPMENT INDUSTRY

Source	DF	SS	MS	F
Regression	3	0.0312	0.0104	0.245
Deviation	4	0.1700	0.0425	
Total	7	0.2011		
$R^2 = 0.394$				

The equation then has the form:

$$P_{23} = H_{29} D'_{29} + H_{20} P_{20} + H_{36} P_{36}$$

The results are noted in Table 7.

The F statistic (Critical Value = 9.12) indicates that the null hypothesis of all the H's equal to zero cannot be rejected. Therefore, the Transportation Equipment Industry is neither market nor supply oriented with respect to any of its major purchasers or suppliers in Manitoba. In addition, the low R^2 indicates the industry is footloose with respect to the Province. Hence, it is deleted from the list of priority industries to be included in the development strategy.

A similar analysis is repeated for the three other industries.

From Table 8, equation (44) for the Grain Mills Industry is as follows:

$$P_{10} = H_{02} D'_{02} + H_{01} P_{01} + H_{02} P_{02} + H_{12} P_{12} + H_{36} P_{36}$$

where, P_{10} = Grain Mills; D'_{02} = Livestock; P_{01} = Crops; P_{02} = Livestock P_{12} = Foods; and P_{36} = Trade.

The results of the regression are contained in Table 9.

TABLE 8

TOTAL SALES AND PURCHASES OF GRAIN

MILLS INDUSTRY IN MANITOBA, 1961

SALES			PURCHASES		
No.	Industry	% Gross Output Grain Mills	No.	Industry	% Gross Output Grain Mills
01	Crops	4.39	01	Crops	46.69
02	Livestock	20.88	02	Livestock	6.09
11	Beverages	1.28	03	Forestry	3.73
12	Foods	10.57	07	Non-Metallic Minerals	0.95
			12	Foods	5.99
	Total Final Demand	60.41	18	Paper and Allied	4.64
			27	Chemicals	1.15
			35	Misc. Supplies	1.02
			36	Trade	12.15
			37	Transportation	2.24

Source: "The Input-Output System of the Manitoba Economy, 1961", Government of Manitoba, Winnipeg, Canada.

TABLE 9

ANOVA: GRAIN MILLS INDUSTRY

Source	DF	SS	MS	F
Regression	5	0.4732	0.0946	9.978
Deviation	2	0.0190	0.0095	
Total	7	0.4922	0.0703	
$R^2 = 0.981$				

From Table 9, the F statistic is significant at the 10% level of confidence[29] indicating that not all of the H's are equal to zero. Since, the F statistic was found to be significant Table 10 is presented to illustrate that the Grain Mills Industry is supply oriented with respect to the Livestock Industry.

TABLE 10

COEFFICIENTS FOR THE GRAIN MILLS INDUSTRY

Industry	B	S_b	t
D'_{02}	-1.786	0.982	-1.82
P_{01}	-0.008	0.024	-0.32
P_{02}	2.151	0.694	3.10
P_{12}	-0.088	0.074	-1.19
P_{36}	0.303	0.452	0.67

[29] A 10% level of significance was used to test the null hypothesis because of the limited sources of data.

TABLE 11

TOTAL SALES AND PURCHASES OF PRINTING

AND PUBLISHING INDUSTRY IN MANITOBA, 1961

SALES			PURCHASES		
No.	Industry	% Gross Output P & P	No.	Industry	% Gross Output P & P
31	Communications	1.26	18	Paper and Allied	17.79
34	Services	11.53	27	Chemicals	1.25
36	Trade	4.50	31	Communications	0.58
			34	Services	0.70
	Total Final Demand	82.28	35	Misc. Supplies	0.96
			36	Trade	7.62
			37	Transportation	77.76

Source: "The Input-Output System of the Manitoba Economy, 1961", Government of Manitoba, Winnipeg, Canada.

Furthermore, the high R^2 indicates this industry is not footloose with respect to Manitoba. It, therefore, becomes a designated priority industry as established by the methodology.

The procedure for determining if the Printing and Publishing Industry is footloose with respect to Manitoba, i.e., whether Manitoba is the relevant region for this industry, is repeated in the same manner. Table 11 indiates the variables to be included in the regression equation:

$$P_{19} = H_{34} D'_{34} + H_{18} P_{18} + H_{36} P_{36} + H_{37} P_{37}$$

The regression subsequently yields the following analysis of variance (ANOVA) table.

TABLE 12

ANOVA: PRINTING AND PUBLISHING INDUSTRY

Source	DF	SS	MS	F
Regression	4	0.1263	0.0316	75.203
Deviation	3	0.0013	0.0040	
Total	7	0.1276	0.0182	
$R^2 = 0.995$				

Therefore, in a similar manner, the Printing and Publishing Industry is found not to be footloose; for it is indicated by the R^2 that Manitoba is the relevant region for the industry. The F statistic illustrates that not all of the H's are equal to zero. To further analyze this result Table 13 is presented.

It should be noted that the Crops, Grain Mills and Trade sectors could be included as supply sectors at the discretion of the analyst.

TABLE 13

COEFFICIENTS FOR THE PRINTING AND PUBLISHING INDUSTRY

Industry	B	S_b	t
D'_{34}	0.087	0.156	0.56
P_{18}	0.341	0.199	1.72
P_{36}	0.461	0.144	3.20
P_{37}	0.041	0.058	0.71

The reason they were excluded was merely procedural. The regression procedure requires the k, the number of variables, be less than n, the number of observations on each variable. Otherwise, there is no estimation problem. Due to the lack of data, i.e., $n \leq 8$, the Crops, Grain Mills and Trade sectors had to be eliminated due to the constraints on the degrees of freedom for the mean-squares. When suitable data is available, technically speaking these variables can be inserted.

Table 14 indicated the equation for the Livestock Industry to be:

$$P_{02} = H_{10} D'_{10} + H_{12} D'_{12} + H_{01} P_{01} + H_{10} P_{10}$$

TABLE 14

TOTAL SALES AND PURCHASES OF LIVESTOCK

INDUSTRY IN MANITOBA, 1961

SALES			PURCHASES		
No.	Industry	% Gross Output Livestock	No.	Industry	% Gross Output Livestock
01	Crops	5.07	01	Crops	39.33
10	Grain Mills	11.88	10	Grain Mills	6.06
12	Foods	7.50	21	Metal Fabricating	1.02
28	Misc. Manufacturing	0.50	23	Transportation Equip.	0.66
			24	Electrical Products	1.05
	Total Final Demand	34.93	26	Petroleum Products	2.02
			32	Electrical Power	1.05
			34	Services	2.06
			36	Trade	5.01
			37	Transportation	7.96

Source: "The Input-Output System of the Manitoba Economy, 1961", Government of Manitoba, Winnipeg, Canada.

The ANOVA table resultant from the regression for the Livestock Industry is as follows.

TABLE 15

ANOVA: LIVESTOCK INDUSTRY

Source	DF	SS	MS	F
Regression	4	1.7957	0.4489	0.618
Deviation	3	2.1807	0.7269	
Total	7	3.9764	0.5681	
$R^2 = 0.672$				

From the above results, the F statistic indicates that none of the industries in the equation show the Livestock Industry to be oriented on either the demand or supply side with respect to other industrial sectors in Manitoba. It is also apparent from the R^2 that the Livestock Industry if footloose with respect to the Province of Manitoba. However, given that there is a Livestock Industry in Western Canada, it might be of some relevance to extend the analysis to include a region larger than Manitoba. Alternatively, the relative efficiency of the industry in Manitoba, compared to other Western Provinces, could be investigated. Aspects for expanding the analysis will be dealt with directly in the next section, but the two above are included at the point since data necessary for the approach of this paper are not readily available for this industry.

This concludes the illustration of the methodology in practice. The indication from the analysis based on the available data, suggests the inclusion of the Grain Mills and Printing and Publishing industries in the development plan. The regional authorities then would be advised, based on the data available to seek the expansion of these sectors in the Manitoba economy.

Before drawing any definite conclusions, it is incumbent upon the discussion to this point to examine the limitations of the above methodology and the implications of these limitations upon policy decision making resultant from an analysis as illustrated in the preceeding discussion.

LIMITATIONS AND FURTHER CONSIDERATIONS

The limitations of the approach to formulating a regional economic development strategy based on the key industry arguments could proceed logically on two fronts. One is embodied in the specific assumptions needed to produce the arguments upon which the calculations rest. The second revolves about the general applicability of the methodology.

In the first instance, the limitations of the input - output analysis and the assumptions of constant returns to scale and fixed factor coefficients is documented fairly extensively, as noted. What is of major concern in employing the input - output framework in a development context is the exclusion of the effects of technological advancement and changes in the production techniques of the industries in question. This is because of the constant a_{ij}'s. These two aspects are crucial to a concept of a developing economy and are not embodied in the preceeding analysis.

In line with this, there is the general observation that the results, obtained by a procedure such as the one illustrated, represent a "one point in time" picture of the regional industrial structure. With improved data

collection and processing techniques, input - output tables could be revised regularly in order to identify trends and to observe if the results hold over time. Furthermore, the data should be recent to facilitate an evaluation of the strategy. Such data would allow for comparative analysis over time, enabling decision makers to utilize the methodology to gain a more intertemporal view of the development process.

Besides more frequent tables, data is not available currently for regions of varying sizes. In some cases, such as the Livestock Industry in this example, decisions may have to be taken at different political levels, or with a number of regions co-operating. It is, therefore, a distinct limitation, that at the present time the size of a region is dictated quite often by the availability of data. For a more complete analysis, investigations should be carried out on a broader scale to encompass varying decision - making jurisdictions.

As in the case of using input - output analysis, an argument could be made advising against the appropriateness of employing regression analysis to study regional development. Such an argument would be based on the underlying restrictive assumptions.

To discuss the limitations of an approach on the basis of assumption rather than prediciton is not foregin to economics. Indeed, the case becomes even more confused when both positive and normative elements are being combined. In short, the limitations of the analytical tools used, by necessity, simplify the question - but not beyond recognition - for the answer is left to be explained by experience.

Perhaps of no greater interest but certainly of more importance is the question of general applicability. This question quickly reduces to the

basic problem of nearly all work of an empirical nature in the social sciences. But in this case, it is even more serious. Although regional problems have existed, there remains in Canada very little data collection which is broken down by region. There are attempts being made to rectify this situation[30]. But clearly there is a tremendous dependence on reliable, current data on a regional scale for this methodology to work. The earlier discussion of how this might be achieved is especially relevant.

However, the general lack of data need not discourage the usage of the methodology. Continued analysis is needed as methods for refining the data are developed. Although results obtained in this manner are less preferred, it does not negate the fact that a vast amount of information and knowledge can be gained. As economists, we are operating continually in the realm of "second-best", but nonetheless, we can have a lot to say about many problems in the world around us just by undertaking research to shed some light on, if not to provide, concrete answers.

In addition to the static nature of the present illustration and the weakness of the data, there may be aggregation problems. Just because an industrial sector possesses high linkages in Manitoba, this does not suggest any individual firm within the industry in every part of the Province will conform to this fact. Therefore, there is just cause for more careful microeconomic analysis to supplement this methodology to determine the feasibility of a venture and its optimum location with the region.

Due to the lack of explicit reference to the number of jobs created by the strategy, there would be considerable merit in developing employment

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[30] In Manitoba, for instance, a Bureau of Statistics has been established specifically to collect data on provincial matters. Statistics Canada is attempting to expand its research efforts into the area of regional data collection and The Manitoba Bureau is intended to fill the gaps. (The Financial Post, July 8, 1972, p. 6.)

output functions to carry the analysis further.

Finally, although it is not necessarily a limitation, some concern might be expressed due to the lack of objectivity at certain points in this procedure. What this points out is the inability of a decision making process to be completely objective. The only instance where this can be a serious limitation is when the decision maker interprets incorrectly the manifestations of the objectives as they are translated into criteria determination. But this is really the limitation of human error and understanding. There is no reason to expect that if political, social and economic stimuli are perceived by the decision maker, this necessarily relates to improper critical values as illustrated in the methodology. This relates fundamentally to the decision to exclude a definite weighting process of criteria in favour of a strict elimination process. Subjectively weighted criteria would not erase the need for a clear understanding of the objectives of a policy and subsequent transmission of this understanding into valid criteria for policy formulation.

The methodology presents a ranking of criteria in order of decreasing importance and so the objective is met by the need for an "economic activity" to pass each criteria successively. The restrictive assumptions, while seriously jeopardizing the validity of the constructs, do not necessitate the abandonment of the methodology when there appears to be no superior one to take its place.

Rather the crucial question is whether or not the methodology will be successful in attaining the objective. There are no 'a priori' grounds upon which to establish that it will not, and therefore the question is rhetorical at this point. In the final analysis, the data constraint is the most serious limitation at present for it prevents the achievement of the degree of certainty in the results which would induce a decision making authority to

implement recommendations based on such a method. This prevents the true test of the method, namely its success or failure in practice. Therefore, it is the second limitation which should be attacked. From this the actual validity of the first can be established accurately. Furthermore, final demand linkages are ignored by this method.

For the present, one can only recognize, in the first instance, the limitations of the methodology, but one cannot seriously vouch for their consequences on the outcome of the implementation of a development strategy conceived in the manner present.

CHAPTER SIX

Conclusions

Studies of complex economic problems often pose more questions than answers. The research for this thesis resulted in the occurrence of both components. Not only was the role of industrialization and government decision making put into perspective, but also the need for comparative studies on differing developmental approaches was demonstrated.

Recognizing possible alternative strategies, the analysis concentrated on the "modus operandi" of an industrialization based development strategy. This is not to say the contributions of other factors are unimportant. Rather co-ordinated research on a broader scale is warranted for an adequate treatment of the interrelationships and the relative merits of other feasible alternatives. Prospective research should include the various economic activities in both the private and public sectors.

Turning to the features of this endeavour, the main facet was the construction of a method for governmental selection of industries to be included in a development plan. In addition, the functions of government and industry in the development process were of major concern.

Government, on the one hand, can provide the necessary direction. Co-ordination of public policy, through the provision of necessary complementary requirements to industrialization, are paramount for a successful development strategy. Government possesses the facilities and can provide the resources to ensure these aspects are forthcoming. In addition, the regional authority is charged with the responsibility for developing criteria

and establishing priorities with respect to the industrialization path. This study illustrates the example where employment provision was the main objective. Subsequently, the primary function of the political authority is the evaluation of methods for attaining the objective.

Industrialization, on the other hand, is cast in the role of catalyst. It possesses the capacity to generate employment and income in the region. Together with government, industrialization forms the mechanism to initiate and continue the process of regional economic development.

While examining the role of government and industrialization, this study contributes mainly in postulating a methodology and not a theory for industry selection to be included in the development plan. This exercise should be the responsibility of the regional government. It is, therefore, policy oriented. The methodology was developed with the idea of producing results for the decision maker.

By drawing on past endeavours to solve the problem, criteria were established for industry selection. These included:

1) high linkage effects within the regional economy to give continuous impetus to the industrialization process;

2) labour-intensity to ensure employment provision;

3) growth potential to allow for the future expansion; and

4) seeking "non-footloose" industry to avoid resource wastage in attempting to attract industry. Employment provision and economic developmental inertia are central to the argument.

The method is based on the input-output analysis framework. This analytical tool, although possessing many limitations as noted, facilitates the calculation of the domestic linkages and the identification of footloose industries. It yields direct empirical results. In applying the methodology

to the Province of Manitoba, two industries were found to be acceptable. These were the Grain Mills and Printing and Publishing industries.

The methodology developed should be expanded to consider intertemporal influences. By revision of the input-output tables, a time series analysis could be undertaken in a step-wise manner. In this way, trends and the validity of the results over time could be determined.

The forte of the methodology is its ability to include and give explicit recognition to the role of subjective elements in the decision making process. This is extremely important. This facet not only permits flexibility but also enables the generation of information regarding the impact of politically determined critical values in the analysis. Many writers have noted the importance of this phenomenon; it is incorporated in the methodology formulated.

Specifically, the decision maker is afforded the opportunity to study both the effects of industrialization and the role of value judgements on the attainment of the objective. Following this, the ramifications for the development of the region are determined. Reality is thus preserved. Pre-requisite to the analysis is an understanding and an ability to interpret political, social and economic stimuli on the part of the decision maker. This requirement is necessitated by the arbitrary nature of the critical values set in the operation of the criteria.

Manitoba served as an example for this study. But, data permitting, the region can be defined in conformity with any boundary. The analysis looses no validity to generalization. However, more efforts will have to be made to provide the necessary data. Also, political co-operation among jurisdictions will be required beforehand.

One final note on the appropriateness of the objective. While some may argue that it is not valid, this detracts from the major thrust of the analysis in a theoretical manner. The methodology produces a rational, logical procedure for incorporating objective functions, in this case employment provision, into the construction of analytical frameworks. This objective function is not taken as given, and then applied to a theoretical procedure. Rather, the objective function is tantamount to another step in the methodology.

One harsh lesson has been learned from demonstrating the operation of the model. It is the glaring data constraint to regional analysis in Canada. More information is required on regional economic phenomena. This is the crux of any analysis attempting to solve regional problems. As such, one could expect completely different results as the data are improved.

Therefore, the power of the methodology, at this point, rests on its logic. It is also contingent upon the judgment of the decision maker. Unfortunately, the validity of the methodology can be ascertained only by experience. However, the consistency should cause no one at this stage to seriously doubt the ability of a policy formulated in the manner suggested to obtain the desired result; specifically employment generation through an industrialization based regional economic development strategy.

Further research is required to gain a better perspective of what may have been accomplished by this study. The study of regional economic development in Canada may well continue indefinitely. Such is the nature of seeking solutions to complex, dynamic problems in economic development.

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ABBREVIATIONS:

AER	American Economic Review
CJEPS	Canadian Journal of Economics and Political Science
ECC	Economic Council of Canada
JDS	Journal of Development Studies
MSESS	The Manchester School of Economics and Social Studies
OECD	Organization for Economic Co-operation and Development
QJE	Quarterly Journal of Economics
RES	Review of Economic Studies
REST	Review of Economics and Statistics
SC	Statistics Canada (formerly Dominion Bureau of Statistics)

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