VULNERABILITY AND IMPACT INDICES FOR SINGLE INDUSTRY COMMUNITIES:

MINING COMMUNITIES MODEL

By

Maralee E.I. Asselstine

A Practicum Submitted in
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ABSTRACT

The primary purpose of this study was to establish indices of vulnerability and impact for single-industry mining communities. It was determined that the level of risk associated with being a single-industry community is a function of three factors - the stability of the local single industry, the presence of economic activities that are able to function independent of the single industry, and a community's physical and human amenity to economic diversification. It was also shown that, depending on the development of regional service linkages between communities, the impact of decline in a single-industry community would have implications beyond the community level. To illustrate the time relationship between vulnerability and impact and to show that the two community dimensions are not mutually exclusive, an updated model of stages in community development was developed.

Seven vulnerability and five impact indicators were selected to represent the two community dimensions and quantified using nominal measurements. A methodology was suggested to fully develop the indices to the point where levels of community vulnerability and impact can be determined on a scale from 1 to 6. By conducting a community case study, it was determined that it is feasible to implement the indices in terms of their data requirements. It was suggested that problems of time differentials between data collected for the different indicators would be avoided if communities were to develop specialized community data bases for the indices' data requirements. The greatest limitation to implementing the indices is the need for further research to fully develop the indicator subscales that constitute the underlying structure of the indices. In addition, validation of the indicators selected to represent vulnerability and impact would contribute to the indices' accuracy.

The indices, once fully developed and in full use, will provide community leaders and government planners a tool that can systematically analyze single-industry mining communities in terms of their vulnerability to decline and the extent to which this decline would impact a community and surrounding area. Once appropriate vulnerability indicators for other resource-based industries are established, the indices would be fully applicable to other types of resource-based single-industry communities. In particular, the utility of the indices will be recognized from community and government planning perspectives by assisting in the development of a community awareness and planning program and a government monitoring program, as well as in the programs' ongoing management.

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Chapter I

INTRODUCTION

1.1 BACKGROUND

During the early decades of this century, natural resource development was centered primarily on the extension of known and accessible resources. Robinson (1962) notes that settlements established to service the new resource industries were often regarded as "sleeping camps", attracting mainly unskilled and unattached male workers. After the resource was depleted, the temporary accomodations that housed and serviced the workers could be abandoned.

After 1950, the emphasis shifted to developing previously unexploited resources on the more northerly frontiers of Canada (e.g. uranium in Saskatchewan, nickel in Manitoba, zinc in New Brunswick, and asbestos in B.C. and Quebec). Known resources also became economically exploitable as new technology was developed and world demand and prices increased (e.g. copper at Chibougamau, Quebec and iron-ore at Steep Rock, Ontario) (Robinson,1962).

The role of government in the development and growth of the mineral and other primary industries was instrumental during the 1950's when financial support was provided in the development of railroad systems in Canada that provided the necessary linkages between frontier regions and urban centres (Wallace,1977). Canada's resource industries

also benefited from other government incentives, such as tax concessions and special depreciation policies (Wojciechowski, 1979). In turn, Canada benefited from growth in Gross National Product (GNP) and from stimulated regional growth.

As development reached to the more isolated regions of Canada and new technological developments in the resource industries demanded more highly skilled labour with high standards of living, it was necessary to construct more attractive and permanent settlements to accomodate the workers and their families. Between 1945 and 1957 alone, Robinson (1962) identified 46 new towns that were built around a single resource-based industrial enterprise. While these new communities were usually operated as "company-towns", with the parent industry acting as landlord, town council, fireman and recreation director as well as sole employer (Queen's University,1953), over time, community responsibility was gradually passed to the citizens.

During the 1970's, government policy of keeping the private sector's cost of development down by minimizing private responsibilities for social costs (Yudelman,1984) was coming to an end. A greater burden of infrastructure investment was placed on the private sector - what had been traditionally the mining companies responsibility, cost of townsite development, was again being placed in their hands. The Carter Report on taxation in 1967 also led to legislation between 1971 and 1975 that ended the mineral industry's favourable tax position (Wojciechowski, 1979). During a temporary period of high commodity prices and large company profits in the early 1970's, the provinces began to challenge what had previously been a nationalistic approach to taxation of primary industries (Wojciechowski, 1979).

More recently in the early 1980's, the recessionary effects of high interest rates and low product prices in the midst of increased international competition, new technology, and global oversupply of many base metals raised questions regarding the future viability of Canada's primary industries. The seriousness of this situation was addressed by the Royal Commission on the Economic Union and Development Prospects for Canada (Canada, 1985a). Based on comparative historical trends in economic performance indicators for Canada's major industrial sectors, the Commission forecast reliance on the resource industries would decline in relative terms.

In response to the world-wide recession of the early 1980's, the corporate world of national and international companies underwent significant changes to maintain company competitiveness. "Leaner", "increased productivity", and "restructuring assets" are descriptive terms that still inundate business news today. While at the corporate level, company restructuring could take the form of mergers and acquisitions, at the community level, this could mean the demise of a local company or the closure of a branch plant. The risks associated with a community having a single industry structure become greater in this type of corporate environment and nowhere else in Canada has this risk been greater than in resource-based, single-industry communities.

The downturn of the mining industry in Canada, in particular, has resulted in serious social and economic implications for both government and affected mining communities. A federal-provincial study (Canada, 1985b) estimated that, on a national basis, over 10,000 workers were laid off indefinitely between January 1982 and April 1985,

thereby affecting about 80 communities having a population in excess of 750,000. Between 1982 and 1984, unemployment insurance payments and reduced income tax revenue as a result of layoffs in the mining industry resulted in a net loss of approximately $545 million to government (Canada, 1985b).

Reactionary measures have most often been implemented to address crisis situations in mining communities. Towns such as Pine Point, Northwest Territories, Schefferville, Quebec, Labrador City, Newfoundland, and Uranium City, Saskatchewan have all experienced, to varying degrees, mining related crisis situations resulting from large scale layoffs, closures, and extended shutdowns. The seriousness of these mining-related problems in communities was formally recognized when a Task Force was established in 1982 to examine the special problems of communities dependent solely on the mining industry (Canada, 1982). As a response to this Task Force, the Queen's University's Centre for Resource Studies organized a policy discussion seminar focussing on the problems of mining communities and possible solutions. Fly-in, fly-out camps, a form of temporary settlement that utilizes various systems of commuter rotations, and relocatable communities were among possible alternatives to new town development that were discussed at this seminar (DePape,1984). Two years later, the Institute for Research on Public Policy sponsored a policy discussion seminar that dealt specifically with issues related to the choice between developing new resource towns or utilizing different commuting systems to resource sites.

Financial strategies, such as a Swedish - type investment fund, a personal adjustment plan, a labour- sponsored diversification fund, and reserve-fund options have also been suggested as possible methods for dealing with adjustment problems associated with Canada's mining towns (Canada, 1985b). To varying degrees, these options involve the concept of "shared risk" between government, private industry, unions, individuals, and the mining communities. More recently in 1986, papers were prepared for the Mines Ministers discussing a Community Development Fund and a Personal Adjustment Plan.

In 1985, the Canadian Association of Threatened Single Industry Towns (CATSIT) was established with the mandate to "help provide a more secure future for people living in single-industry towns and resource-based communities in Canada". Since its inception, CATSIT has been represented at numerous conferences and meetings across Canada and held its first annual conference in Sudbury, Ontario in the fall of 1986.

A new federal program, "Community Futures Program", has now been developed to address the diverse needs and aspirations of people living in single-industry communities. In general, this program calls for a community generated response to anticipated social and economic problems associated with an uncertain future based on one industrial activity. Self-help is advocated as the key to the future viability of these communities with a clear emphasis on the development of local entrepreneurial spirit and businesses based on "natural" strengths inherent in a community or region.

While reaction to problems of decline in single-industry communities has been enormous, there has been no corresponding effort undertaken to update our knowledge and awareness of existing single-industry communities for more than ten years. Early research initiatives associated with single-industry communities (Queen's University,1953; Robinson,1962; Lucas,1971; Seimans,1973; Gray,1975) focused primarily on town planning, quality of community life, determinants of labour turnover, stages in community development, and urban sociology. These research initiatives were conducted at a time in Canada's history when resource developments were still on the upswing - detailed study of stages in community development usually ended at the stage of maturity; mining companies sought to reduce high labour turnover; and town planning initiatives focused on the establishment of new communities. Within the last ten years, however, the latter stages of community development, "winding down" and "closure", have figured more prominently in literature. Social and economic impact assessments now determine, more frequently, the impact of the loss of a development in a region or community, not the impact of a new development.

The most recent comprehensive study on single industry communities, initiated in 1974 and published in 1977, attempted to provide a framework whose informational features would become integral to coordination of attempts that deal with problems of economic and social adjustment (Canada,1977). This study also served to generalize the meaning of "single-industry community" and within the definitional parameters it established, considered both the capital of Canada, Ottawa and Pine Point, Northwest Territories as single-industry communities.

The issue today, however, goes beyond the question of which communities are of a single industry nature - most people would agree that, intuitively, a single-industry community is one with a disproportionate dependency on one industry. The real issue to be addressed today revolves around the level of risk associated with being a community of single industry. For example, what is the degree to which a community is vulnerable to external or internal forces threatening its future viability? How severely would a community be impacted from the loss of its major industry? What are the regional implications of a community losing its major economic activity? These are some of the compelling questions that have been raised in the 80's and which have not been fully addressed.

1.2 PROBLEM STATEMENT

In the past, various methods of identifying single industry communities were developed and standard community identification criteria established. The establishment of criteria, most notably small population, geographical remoteness, and dependence on one economic activity, provided the necessary groundwork for the development of community lists and typologies which, today, provide useful but limited information and insight into contemporary problems involving single-industry communities.

Within the context of a changing economic climate, both on a global and national level, it has become increasingly apparent that many single industry communities, in particular communities based on non-renewable resources, are, to varying degrees, subject to economic and so-

cial decline. The degree to which a single industry community is vulnerable to decline and the extent to which this decline would impact the community and surrounding area are community dimensions that have not been systematically analyzed and documented.

The establishment of two community indices, vulnerability and impact, will provide government, private industry, and organizations a framework for identifying single-industry communities in terms of their vulnerability to decline and impact from loss of their single industry. By using an index format that utilizes ranges of measurements to establish levels of vulnerability and impact, controversy over the appropriateness of finite definitions of single-industry communities is avoided. For example, is 15% or 30% of a community's labour force in a single industry an appropriate cut-off when considering it to be of a single industry nature?

The indices are, first and foremost, considered to be planning tools that provide a method for identifying the degree of vulnerability associated with a single-industry community and the severity of impact from loss of the single industry before its actual demise. Identification of areas of community weaknesses (or strengths) revealed in a scale of vulnerability is a first step towards overcoming a community's weaknesses and enhancing its strengths. In contrast to reactive measures that are implemented after the fact (i.e. mine closure), community leaders and government workers would be able to allocate scarce resources in the pursuit of preventive measures against social and economic impact resulting from industry decline.

Utilizing an index format also provides a mechanism for conducting comparative community analyses that measure a community's situation relative to others. Government would then be better prepared in the difficult task of assigning priority amongst communities that are in need of social and economic adjustment assistance. For example, programs designed to assist single-industry communities could provide funds in accordance to their ranking on the vulnerability or impact index.

1.3 OBJECTIVES

The primary purpose of this study was to establish indices of vulnerability and impact for single-industry mining communities. Specific objectives were:

1. to identify and quantify indicators that reflect the degree to which a single-industry mining community is vulnerable to decline and the extent to which this decline would impact the community and surrounding area;

2. to provide a methodology for establishing levels of vulnerability and impact;

3. to determine the feasibility of implementing the indices using a community case study format; and

4. to assess the applicability of the indicators used in the vulnerability and impact indices for mining communities to other resource-based communities, for example, fishing and forestry.

1.4 METHODOLOGY

The methodology utilized in this study can be broken down into two parts. Part 1 dealt with the concepts of community vulnerability and impact and how to make the concepts into operational indices. This was achieved by:

- defining the major components contributing towards a community's vulnerability to decline and the extent to which this decline would impact the community and surrounding area;
- based on supportive literature and logic (face validity), selecting indicators able to represent the components of vulnerability and impact;
- quantifying the indicators using nominal measurements;
- developing an up-to-date interpretation of stages in community development to help build a theoretical background that explains the relationship between vulnerability and impact over time;
- Suggesting a methodology for combining the different indicators to produce a final index of vulnerability and impact; and
- Commenting on the limitations and utility of the indices as presented.

Part 2 of the study's methodology dealt with a case study of a mining community to determine the actual feasibility of implementing the indices in terms of the effort required to make the indices operational.

1.5 SUMMARY

The minerals industry serves as a timely example of the social and economic consequences of a serious economic restructuring in one of Canada's primary industries. With hindsight, it is clear that programs and policies were unable to address effectively the problems of dealing with a significant reduction in the industry's labour force (Canada, 1985b).

The 1982 Task Force on Mining Communities concluded that there was a need for the earliest possible identification of communities in distress. The Macdonald Commission (Canada, 1985a) identified the need for special community/industry - adjustment programs for single-industry communities with government judging whether communities or sectors are in long-term decline. This study assists in the decision making process by providing a systematic method of defining single-industry communities in terms of their vulnerability to decline and impact from loss of their single industry.

Chapter II

VULNERABILITY AND IMPACT INDICES

2.1 INTRODUCTION

Vulnerability and impact are not new terms with respect to single-industry communities. Vulnerability has been used primarily to describe the inability of single-industry communities to control external factors affecting local companies and industries that have provided, in many circumstances, the communities' "raison d'etre", the impetus for their growth and the reason for their decline. Impact had been primarily reserved for use within the context of new resource developments and the effects of rapid development. The recession of the early 1980's and its effects on resource industries and the people living in resource-based single-industry communities served to give vulnerability and impact new relevance and meaning.

Three areas of vulnerability with respect to single-industry communities emerged in the 1980's. First, it is difficult to second-guess corporate decisions affecting industries in single-industry communities. It is possible, however, to look at the single industry and identify characteristics that contribute directly to its own vulnerability. This area of vulnerability may be referred to as vulnerability of the community's single industry.

Second, high unemployment rates in the majority of Canada's industrial sectors during the last recession made it very difficult for unemployed miners to obtain employment in other mining operations, as well as other sectors of the economy. It became in vogue to assume that many single-industry communities could not provide alternative employment opportunities because the pursuit of community economic development and diversification had not been given much attention, let alone a priority, in the community planning process. The ability of some communities to cope more successfully than others with decline in their single industry makes it useful to look at how a community has developed over time and how its own economic strengths can mitigate the impact of loss of its single industry. The vulnerability of a community to loss of its single industry is, therefore, considered a second component of vulnerability relating to single-industry communities.

It has also became more apparent that there is a need for communities to plan for their future. In particular, this decade has likely seen the establishment of more economic development organizations and corporations and hiring of economic development officers than ever before. With the establishment of these organizations, a new importance has been imparted to entrepreneurs and the creation of small businesses, constraints to their development, and the role they can play in diversifying a small and overspecialized economy. The third area of vulnerability therefore emphasizes the physical and human aspects of economic development in single-industry communities. This aspect of vulnerability may be referred to as a community's amenity to economic diversification.

The meaning of impact has also gone through a contextual change. Early studies focused most often on the impact of new resource developments. More recently, impact assessments have attempted to forecast specific impacts resulting from industrial decline after the fact (i.e. decision to close a mine). If, however, the potential severity of impact from decline in a community's single industry can be identified in advance of the actual impact, advanced planning can take place for the purpose of minimizing potential problems associated with social and economic adjustment.

This chapter presents an overview of the vulnerability and impact indices in terms of their structure and rationale for indicator selection. Organizational charts have been provided to illustrate the major components (or levels) of the indices, the specific vulnerability and impact indicators and the indicators' respective measurements.

The rationale for selecting the various vulnerability and impact indicators was developed on the basis of supportive literature and logic (face validity). The selected indicators are considered to be, for the most part, objective, in that they represent factual or descriptive information that serves to define their respective vulnerability or impact component. It is important to note that the indicators presented are not inclusive, only indicators thought to be of significant areas of study in comparative analyses were included.

It is also important to note that vulnerability and impact are not mutually exclusive community dimensions. As time affects the components of vulnerability, so will impact be affected. Using an updated

model showing the sequence of stages in community development, the time relationship between vulnerability and impact is presented. Finally, limitations and utility of the indices are discussed.

2.2 VULNERABILITY INDEX

As shown in Figure 1, the first component of vulnerability, vulnerability of a community's mining industry, has three indicators; company, mine and mineral complexity, mine competitiveness, and mine production period. Indicative of the second component, a community's vulnerability to loss of its mining sector, is the presence of economic activities that can function in the absence of the single industry (i.e. residual economic base). The last component of vulnerability, community amenity to economic diversification, deals with a community's economic isolation, current ability to diversify, and the level of local leadership, initiative and financial support in the economic planning process. Each of these components of vulnerability is discussed separately with reference to the rationale behind indicator selection and a detailed description of specific indicator measurements.

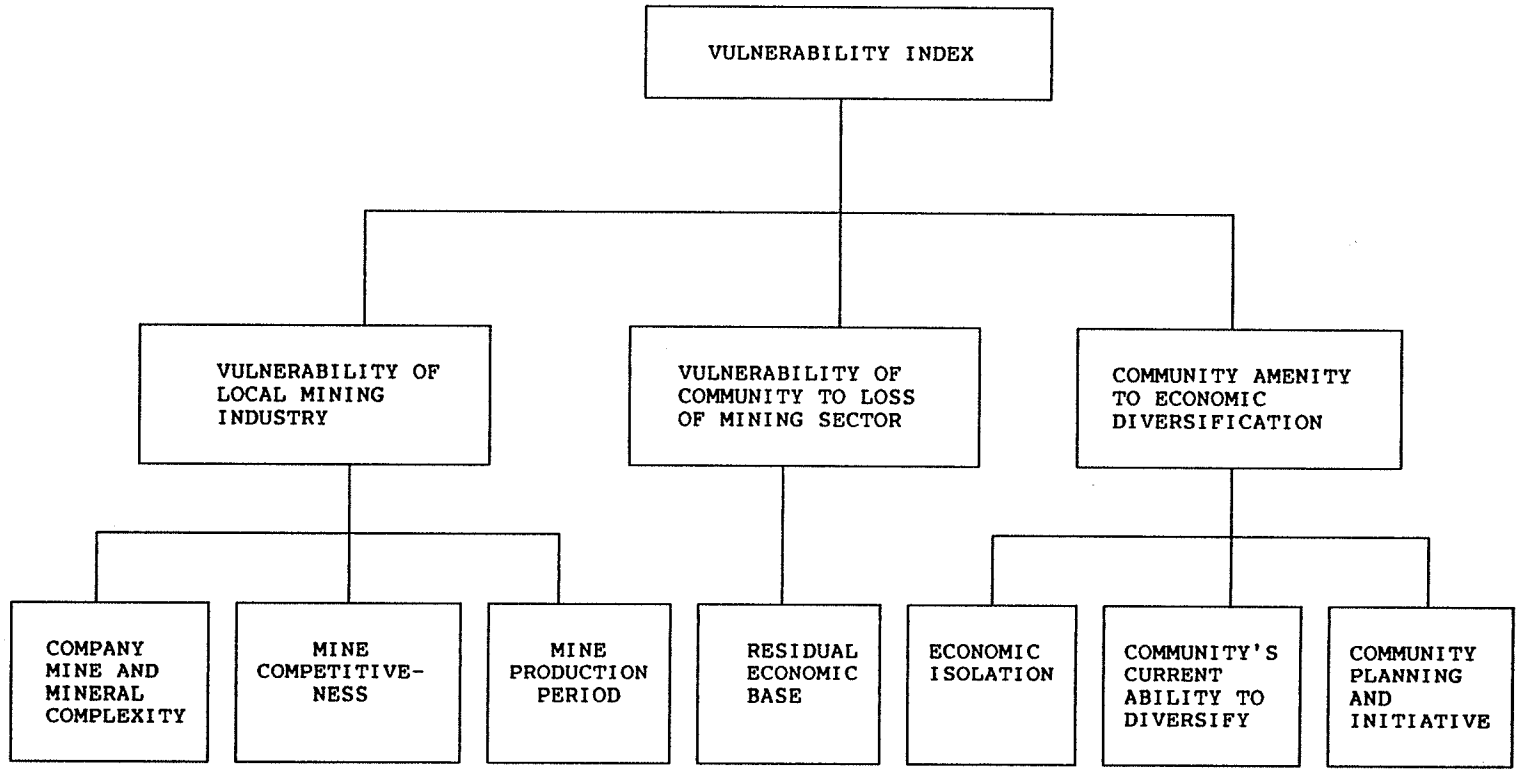

Figure 1: VULNERABILITY INDEX - COMPONENTS & INDICATORS

2.2.1 VULNERABILITY OF LOCAL MINING INDUSTRY

The relationship between a primary resource company and a resource-based community can be described as a filtering process (Robinson,1984,p.6). The process begins with external market forces, including technological change (i.e. metal substitutes, new mine technology), discovery of new supply sources, labour unrest, industrial disruptions, and exchange rate variations that cause fluctuations in the prices of primary resources and their derivative products. The impacts of these market forces, although they are first felt by the primary producers and their suppliers, are subsequently filtered down to the towns where the extraction of the resources takes place.

The nature of a particular resource development, in terms of mineral markets, mine competitiveness, and time will have a direct effect on the vulnerability of a community's local mining industry. Collectively, these indicators will provide a "snapshot in time" measure of stability (or risk) associated with the community's single industry. Figure 2 summarizes the indicators and measurements that serve to represent this vulnerability component. It is important to note that the mining industry, as applied here, involves only the actual extraction of ore and initial milling process. Further refining of minerals is considered as a separate economic activity and, therefore, represents a separate industry within the more broadly defined mining sector.

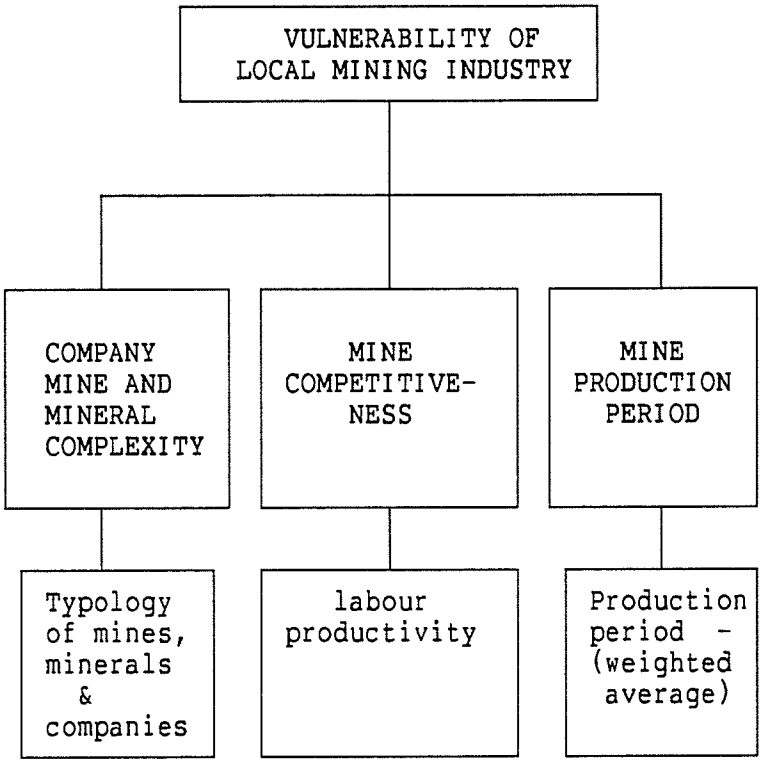

Figure 2: VULNERABILITY OF THE LOCAL MINING INDUSTRY

2.2.1.1 Company, Mine and Mineral Complexity

The complexity of a particular orebody, with respect to the number of primary minerals and by-products produced, is one method of measuring the stability of a mining operation. The Task Force on Mining Communities (Canada,1982) suggested that a polymetallic orebody producing a diversity of mineral products would be less likely to be affected by a downturn in the mineral cycle than one limited to an ore with few by-products. The rationale for this lies in the potential of an orebody to produce more than one product and thus, having a greater probability of having at least one product with favourable markets and prices.

The number of different mining companies operating within the vicinity of a community complicates the use of "number of minerals present" as an indicator of vulnerability. With more than one company operating, it is possible that the stability of the mineral base would be improved because the probability of one operation closing would be greater than the case of two or more operations closing. It also follows that stability of the mineral base would be greater if the different mining operations produced more than one type of mineral commodity.

The different variations of number of mines, minerals produced and companies are presented below in Table 1 as a "Typology of Mines, Minerals and Companies". This typology assumes that the vulnerability of a community's mining industry will decrease as the number of mines, minerals, and companies increases. As the mining industry becomes more complex (i.e. moves from Type A to Type F), the community's vulnerability to mineral markets and single company employers decreases. A value from 1 to 6 is assigned to each community, according to its specific "Mining Industry Type". It should be noted that this typology could be expanded to acknowledge a larger array of minerals mined or the relative importance of the mineral by-products produced in terms of their market value.

2.2.1.2 Mine Competitiveness

Competitiveness between mines producing similar mineral products can be measured in terms of productivity or profitability. Richardson (1985), in his discussion on measures of mining productivity, notes

TABLE 1

TYPOLOGY OF MINES, MINERALS AND COMPANIES

		NUMBER OF		
MINING INDUSTRY TYPE	VALUE	Mines	Minerals *	Companies
TYPE A	1	one	one	one
TYPE B	2	one	two or more	one
TYPE C	3	two or more	one	one
TYPE D	4	two or more	one	two or more
TYPE E	5	two or more	two or more	one
TYPE F	6	two or more	two or more	two or more

* includes marketable byproducts

that "Productivity is the single most important determinant of competitiveness that firms in the mining industry can control"(p.2). Specifically, Mackenzie (1985) notes that the term 'productivity' "encompasses a variety of measures which may be applied to evaluate the efficiency of production" (p.65).

Productivity may be simply defined as "output/input" (where input is a function of labour, capital, natural resources and other factors such as technology or management) and can be classified by level of aggregation (e.g. industry, firm, or department) and by type of measure (e.g. complex, total, or partial). Richardson considers partial measures of comparative productivity the most common at the firm level. Partial measures of productivity, in contrast to complex or total, measure only one input in terms of output (e.g. tons per man-

hour, return on investment, or revenues per dollar of invested capital).

Labour productivity is an attractive partial measure of productivity to use at the mine level because it acknowledges one of the higher priced inputs in the mine production process. Energy and transportation have been cited as other high cost inputs that affect, in particular, the viability of northern mine operations (Canada,1982). There are, however, also drawbacks to using labour as a partial productivity measure, for example, it does not take into account substitution of capital for labour or the impact of technological change (Richardson,p.4).

Profitability, in terms of the differential between unit costs and the prevailing market prices would also provide a measure of competitiveness between mines producing similar mineral products. There are two types of unit cost measurements commonly used; costs with and without debt servicing costs. For example, the new Red Dog zinc mine in Alaska has an estimated break-even point, including debt servicing at US $.33 a pound. In contrast, the mine's cash costs can be recouped at a price of around US $.25 a pound (Financial Post, 1987). There are, however, some practical constraints in obtaining comparative cost figures at the mine level: first, due to confidentially, companies are not required to publish operating costs of their mines; and second, when costs are actually quoted for different mines, there is not always an accompanying description of what costs have been accounted for (e.g cash or operating costs versus cash plus capital costs).

While profitability of a particular mine may fluctuate from day-to-day, depending on conditions in world mineral markets, a mine's labour productivity may be affected in the short-term by temporary lay-offs and shutdowns and in the long-term through the replacement of labour with new capital-intensive technology. In either case, the need to update the indicators on a regular basis becomes apparent. Labour productivity, however, for the purposes of this study will be used as a measure of mine competitiveness because of the relative reliability and access to necessary data.

2.2.1.3 Mine Production Period

In spite of changing market forces, one of the most common measures of a mine's production period is the "projected last year of production" which, in turn, is based on the most recent estimate of ore reserves. Although the life span of a mining operation may be determined on the basis of known and proven reserves, it should be noted that exploration efforts which result in the discovery of new orebodies and extensions to known orebodies will cause the tonnage and dimensions of an economically extractable orebody to vary over time.

In general, the duration of a mining project is a useful measure of the period of industrial operation when the community is relatively sure of a viable economic base. To acknowledge the presence of more than one mine operating in the local area and the different scales of mine operation (i.e. number of employees), the production period for each mine may be weighted using the number of mine employees. This produces the number of person-years associated with mining. The final

measurement is the total of the weighted production periods (in person-years) averaged by the total number of mine employees.

2.2.2 VULNERABILITY OF THE COMMUNITY TO LOSS OF MINING SECTOR

Mining communities that were built with the purpose of instilling a sense of permanence for the mining labour force (e.g. to reduce labour turnover, improve quality of life, etc.) appear to have achieved this objective up to the point in time where the mining activity is ended. The problem of permanency does not seem to lie in the ability of town planners to provide for the physical amenities and lifestyles of urban living, but in the inability of the communities to evolve an economic development process with a high degree of success. Each individual community will have developed in accordance to its unique strengths and weaknesses. How "threatened" a community is regarding its future viability really becomes a function of its historical development, current status, and potential for new developments.

Savoie (1986) notes that "many observers have pointed to urbanization as one of the key factors influencing economic growth, earned per capital income and employment opportunities" (p.165). Successful economic development, however, is attributed to many factors, the least not being location and local resources. Blishen et al. (1979) assert that

> "...a community that is entirely, or very largely, dependent upon one or two large, externally controlled sources of economic survival tends to lose or be unable to develop, the ability to generate internal alternatives" ..."the very fact of dependency tends to undercut the development or maintenance of processes by which the community can evolve a sense of collective security, initiative, and potency." (p.54)

Building mining communities that only create an "illusion of permanency" does not guarantee the development of entrepreneurial skills or sectorial interlinkages of production. Without these two ingredients, Blishen et al. believe that the ability of the community to initiate independent economic growth is inhibited. It is also suggested that the atmosphere of a community in which there is only one main employer serves to inhibit the creativity and natural initiatives of community members, sometimes to the extent where community members chose to establish satellite communities some distant away from the main community. Data collected by Blishen et al. indicates that improved labour relations and labour stability results if a community is able to respond to the changing needs and aspirations of its labour force. This situation, however, is usually only possible if a more diversified economic base is developed and is able to offer more opportunities to the local labour force. Robinson (1984) also supports the view that the establishment of a diversified and expanding local economy will provide insulation to external economic shocks and contribute to a stable social and political environment.

To summarize, a lack of economic diversification can be seen as both a short-term and long-term limitation to a community's viability. There is a short-term limitation to viability if the community is not able to offer satisfying employment opportunities outside of the traditional mining occupations, especially if this results in workers and workers' children moving away. The long-term limitation to community viability is reached when the mining activity is terminated and there is either no other type of economic activity present to absorb

the unemployed workers or if available jobs are unacceptable in terms of work involved or wages paid. A community's economic base that is independent of the mining sector (i.e. residual economic base) provides one measure of a community's vulnerability to the sudden loss of its mining sector.

2.2.2.1 Residual Economic Base

Employment in a community that is independent of the single industry provides a different perspective on a community's single industry dependency. This "residual" employment is identified by looking at a community's economy in the absence of the single industry. As a community's residual economic base (i.e. fish or fur farming, forestry, regional services) becomes larger and more diverse, there will be a corresponding movement towards independency from the single industry. While a community's economic dependency can be defined either in terms of the single industry or in terms of its residual economic base, the latter measurement offers a more uniform measurement of vulnerability for different mining communities and could be extended to use in other types of single-industry communities.

In order to define a mining community's residual economic base, it is necessary to clearly delineate the community's economic structure into its underlying sectors. These sectors may be defined as the mining, residual, and locally-consumed community services (or supportive industries) sectors. Employment figures in the mining and residual sectors would include all associated jobs, that is:

- jobs directly involved in the mining and residual sectors;
- jobs involved in supplying the mining and residual industries with goods and services (i.e. backward-linked jobs); and
- jobs involved in bringing goods and services from the mining and residual sectors to market or to further processing (i.e. forward-linked jobs).

Jobs in the locally-consumed community services would include only those that provide supportive services to workers with jobs in and linked to the mining and residual sectors and their dependent family members (i.e. barber shops, banks, grocery shops, etc.) In accordance with the study of regional economics and economic base theory, the residual economic base would be considered part of a region's "basic" economy, that is, economic activities that lead and determine a regions's overall development. This is to be contrasted with economic activities in the locally-consumed community service sector or "nonbasic" activities, which are simply consequences of an area's overall development (Hoover, 1975, p.218-222).

Employment in the mining sector will vary depending on the complexity of the mining operations in the area and the extent of locally developed backward and forward linkages to mining. Specifically, jobs in the mining sector will be the local, direct mining jobs (e.g. miners, supervisors, and administrative workers employed locally by the mining company) and local jobs in forward and backward - linked industries (e.g. business services, transportation, mineral processing and refining).

Within the residual sector, two distinct categories, "industrial" and "service-export" have been identified. Employment in the first, industrial, is relatively straightforward to measure as it deals with clearly distinct industries, for example, fishing or forestry. Employment in the service-export category is more difficult to delineate as it is represented by several service industries that are typically used by people living both inside and outside a community. Utilization of services offered by the various industries that comprise this category, as shown in Table 2, is, however, considered more regionally oriented than locally. The most important service-export industries would include educational institutions, such as universities and colleges offering post-secondary education services, provincial and federal government services, retail and wholesale trade, tourism, and specialized health services.

In order to estimate the number of jobs in the service-export industries that are solely for the purpose of providing "services for export" (provide services for people outside of the community), an estimate of service utilization by non-residents must be obtained and then subsequently translated into a corresponding proportion of workers in the particular service area. The underlying assumption in this methodology is that the proportion of services utilized by non-residents is in equal proportion to the industry's number of employees. Thus, if three-quarters of the enrollment in a community's college comes from non-residents, it is assumed an equal proportion of the college's employees, three-quarters, are involved in the service-export component of the college's educational services. This methodology can also be applied to specialized health services.

TABLE 2

RESIDUAL SECTOR - INDUSTRIES

INDUSTRIAL	SERVICE-EXPORT
Forestry	Post-secondary education
Trapping	Trade (retail & wholesale)
Fishing	Federal & Provincial government services
Agriculture	Specialized Health Services **
Independent Manufacturing*	Tourism

* Not related to local mining activity, e.g. textiles, automobile.
** Hospitals, nursing homes.

In estimating the number of residual jobs in retail and wholesale trade and government services, a different method is adopted. Initially, the community's service area population is determined by identifying communities within commuteable distance whose members use services in the export-service industries (e.g. retail and wholesale trade or government services) offered by the study community. A local person (or persons) highly knowledgeable about the area would have to be consulted when these "user" communities are identified. Once identified, the communities' populations may be summed together to determine an estimate of the study community's regional service area population. (This procedure is used in Chapter 3 in the identification of Kirkland Lake's Regional Service Area - see Table 25).

Once the community's service area population has been determined, it is divided by the combined service area and community population to identify a representative proportion of services that are "export-oriented". This proportion is then applied (i.e. multiplied) to the total employment figure in trade or government services to obtain the final employment figure estimated to be involved in the service-export component of the industry.

Estimating employment in a community's tourist industry presents a particular challenge because many businesses that make up the tourist industry are closely intertwined with local utilization patterns. Employment in the tourist industry may, however, be significant to a particular community and should be incorporated into the number of jobs in the community's residual sector.

It is possible to isolate business types that provide goods and services to the typical tourist, whether he or she is staying in the local area or is travelling through to other points of interest. These business types can be classified as primary, secondary, and tertiary tourist establishments. Each of these types is described in more detail below.

- Primary tourist establishments - specialized businesses that cater almost exclusively to the tourist or traveller, such as motels, hotels, camping grounds, and museums.
- Secondary tourist establishments - businesses that are closely intertwined with local utilization patterns, but which also provide essential goods for the tourist or traveller, such as restaurants, gas stations, and food stores.

- Tertiary tourist establishments - businesses that provide occasional goods and services to tourists, such as hospitals, clothing stores, hardware stores, banks, and automobile service centres.

Knowledge of a community's tourist industry would lead to the identification of primary tourist establishments and the number of associated jobs. While a business survey would provide an estimate of tourist-related jobs in the secondary and tertiary tourist establishments, in larger communities this type of survey could become a costly procedure in terms of money and time. While it is acknowledged that employment in a community's primary tourist establishments is not a precise number of tourist-related jobs in a community, it does provide an indication of the industry's importance to the community.

In Table 3, specific measurements from which estimates of employment can be determined for the service-export industries in a community's residual sector are listed. Once estimates of employment figures are determined from these measurements, employment estimates from other residual sector industries can be added together to produce the total residual sector employment figure. To reflect the importance of a community's single industry relative to its residual economic base, the ratio of a community's mining sector employment to its residual sector employment will be used as the final indicator measurement.

The diversification of the residual sector is also an important, if not complex, factor that should be acknowledged when analyzing the

TABLE 3

RESIDUAL SECTOR - MEASURE OF IMPORTANCE

SERVICE-EXPORT INDUSTRIES	MEASUREMENT
Post-Secondary Education	Enrollment by non-residents
Specialized Health Services	Hospital discharge rates for service-utilization by non-residents or Bed utilization rates by non-residents
Provincial and Federal Government Services & Trade (retail & wholesale)	Service area population divided by combined service area population and community population
Tourism	Number of jobs in primary tourist establishments

stability, or resilience, of the community's residual economic base. As illustrated in Figure 3, the resilience of a community's residual sector is expected to increase as its size and level of diversification increases (i.e. moves from 1 to 6 on a scale of vulnerability). The development of this matrix would, however, be best developed with empirical data.

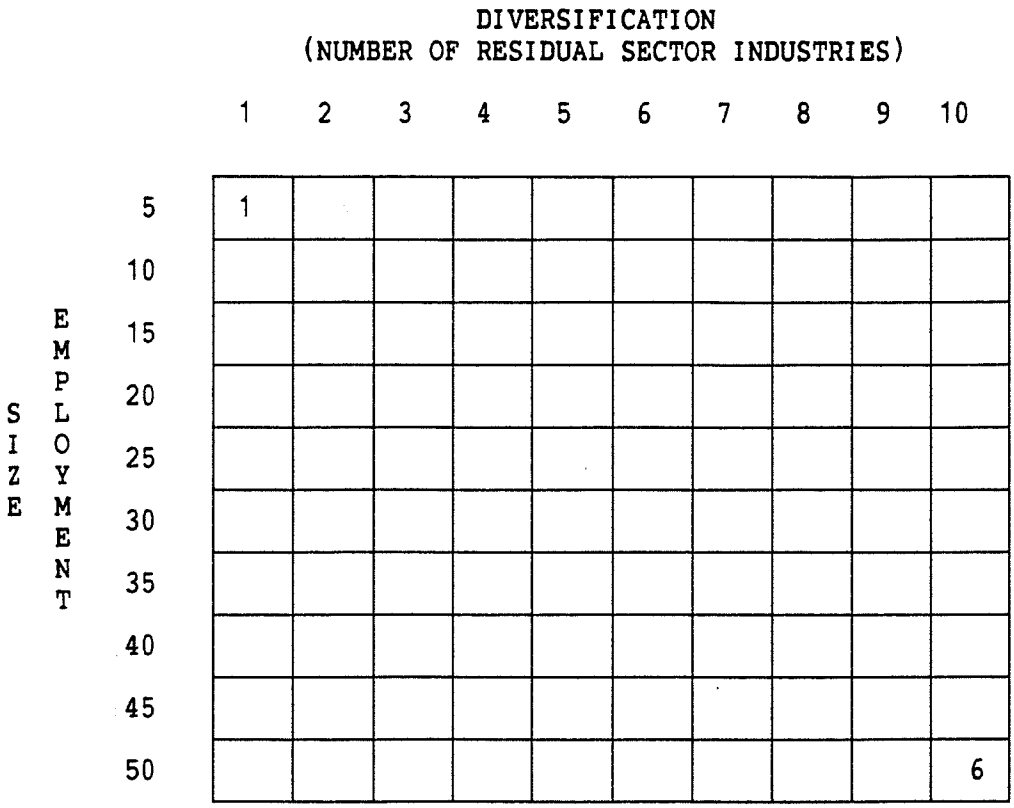

Figure 3: MATRIX OF RESIDUAL SECTOR RESILIENCE

2.2.3 COMMUNITY AMENITY TO DIVERSIFICATION

Warrack (1986) points out that a prosperous but precarious economy is a weak economy and only economic activity that reduces the vulnerability of such an economy constitutes economic development (p.29). A community's ability to reduce its dependence on the mining sector and improve its ability to adjust to a "no mining" scenario can be determined in part by the potential of the community to develop new avenues of development. Development can take many forms, including expansion of existing mineral projects, additional mineral development projects,

utilization of the community's infrastructure for fly-in, fly-out mining camps, renewable resource-based developments, and other types of non-resource related developments. A community, however, even if it has considerable potential to develop alternative economic activities, may fail to do so unless there is community leadership, planning and initiative.

There is also an element of "personal choice" involved in a community's amenity to diversification. For example, community leaders in business and government who are long-standing community members with business or financial investments in the community may provide more moral and financial support in diversification initiatives than those of short-term residency and no local investment. People's attitudes towards the need for diversification and the physical isolation of a community will also have some influence over the community's ability to develop new economic activities.

Figure 4 illustrates the three indicators that have been selected to represent this particular component of vulnerability - economic isolation, community's current ability to diversify, and community planning and initiative. These indicators and their respective measurements are discussed below.

2.2.3.1 Economic Isolation

This indicator of a community's amenity to economic diversification, economic isolation, looks at a community's proximity to a major metropolitan centre. (In accordance with Statistics Canada's defini-

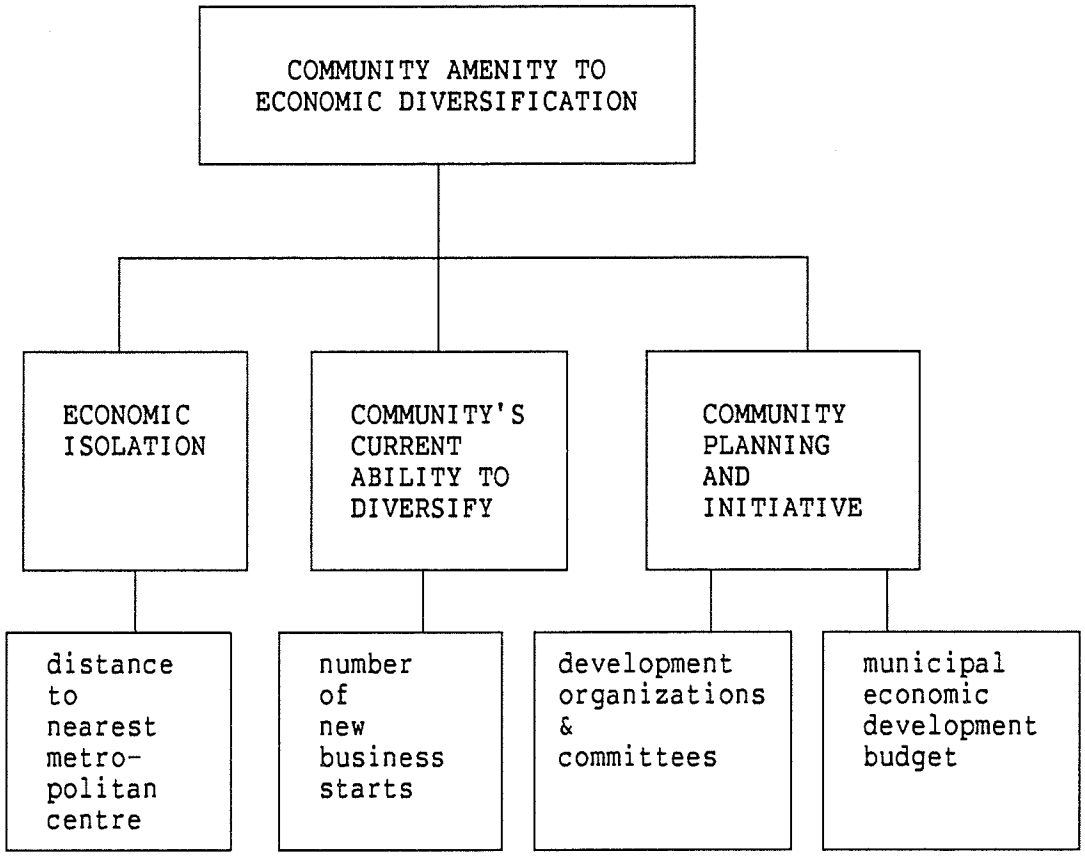

Figure 4: COMMUNITY AMENITY TO ECONOMIC DIVERSIFICATION

tion, a census metropolitan centre must have a population of at least 100,000.) Metropolitan centres may exert an influence over the potential development of a community in several ways by providing:

- a market for goods and services produced;
- transportation linkages to other markets; and
- access to technology and other inputs such as investment capital.

It is expected that distance to a metropolitan centre will be inversely related to the potential of a community to attract and maintain businesses. For example, it is expected that the number of tourist

visits, while affected by numerous other factors (e.g. disposable income, access roads, tastes, etc.), would decline as distance to the metropolitan centre increases.

Taking into consideration Canada's vast and diversified geographic coverage, a weighting system will be used to take into account that two communities may be a similar distance to a metropolitan area but the ability of one of them to obtain supplies, ship goods, or provide human travel is limited. This weighting system, as shown in Table 5, will allocate points in accordance to the number of transportation modes available for both passengers and freight. The minimum and maximum weights possible are 1 and 6 respectively. Once the distance from a study community to the nearest metropolitan area has been determined, the weighting factor (i.e. from 1 to 6) is divided into the distance value to produce the final distance measurement.

TABLE 5

NUMBER OF TRANSPORTATION MODES - WEIGHTING SYSTEM

TRANSPORTATION MODE	SERVICE OFFERED	WEIGHTING FACTOR Minimum	Maximum
AIR	Passenger Freight	0	2
RAIL	Passenger Freight	0	2
ROAD	Major Provincial Highway Trunk Highway	0	2
MINIMUM & MAXIMUM SCORE		1*	6

*There must be, at least, one transportation service offered.

2.2.3.2 Community's Current Ability to Diversify

Insight into a single-industry's current ability to diversify its economic base can be gained by assessing the level of entrepreneurial spirit and skills within the community. Indicative of this spirit is the number of new business starts in a community that can function independent of the single industry. These independent businesses would have to fall into one of the industrial classifications identified to be within the residual economic base of a community.

2.2.3.3 Community Planning and Initiative

The last indicator, community planning and initiative, reflects a community's ability to plan and take initiative in the pursuit of economic development. This potential can be measured by identifying the various local development organizations and committees that contribute to the process of local economic development. For example, in a study on the economic development of the Balmertown and Red Lake Area in northwestern Ontario, it was considered a weakness of the area not to have a driving force or co-ordinating body in the area with respect to economic development (Anderson,1980,p.3-4). In Lynn Lake in northern Manitoba, the economic development officer was instrumental in providing enthusiasm, continuity, and energy in order to develop community initiative and volunteer support in planning for economic development (Barrett,1986,p.84-86).

It is important to note that influential organizational leaders may also be present within the circle of the community's municipal government. While it may be difficult to accurately quantify the role of these people in economic development, it is possible to quantify the commitment of the municipality to economic development initiatives through allocation of funds in its annual municipal budget. While a simple number reflecting the number of development organizations and committees may be used as a measurement of community planning and initiative, the percentage of the municipal budget allocated to economic development initiatives serves as a measure of the financial commitment of local government. It should be noted, however, that the effectiveness of the different organizations and development funds is not neccesarily reflected in these measures.

2.3 IMPACT INDEX

Two levels of impact, Community and Regional, serve to illustrate the extent of impact resulting from the decline in a community's single industry. A provincial and even national level could have been included, but at these higher levels, the impact becomes diffused and more difficult to accurately identify (e.g. a mine's contribution to the provincial or national gross income). It is important, however, to note that for relatively simple economies, such as in Northwest Territories, the impact would be significant at a higher level as well as the community and regional levels. The specific impact indicators and their associated measures are discussed below in more detail.

2.3.1 COMMUNITY LEVEL

At the community level, impact can be defined in terms of the personal social and economic adjustment that would follow the loss of a community's major economic sector. The degree of social and economic adjustment in the community will be, to some extent, a function of the level of attachment that has developed between community members and their community over time. Figure 5 illustrates the indicators of social adjustment, social maturity and a mobility factor, indicators of economic adjustment, home equity and municipal economic dependency, and the indicators' respective measurements.

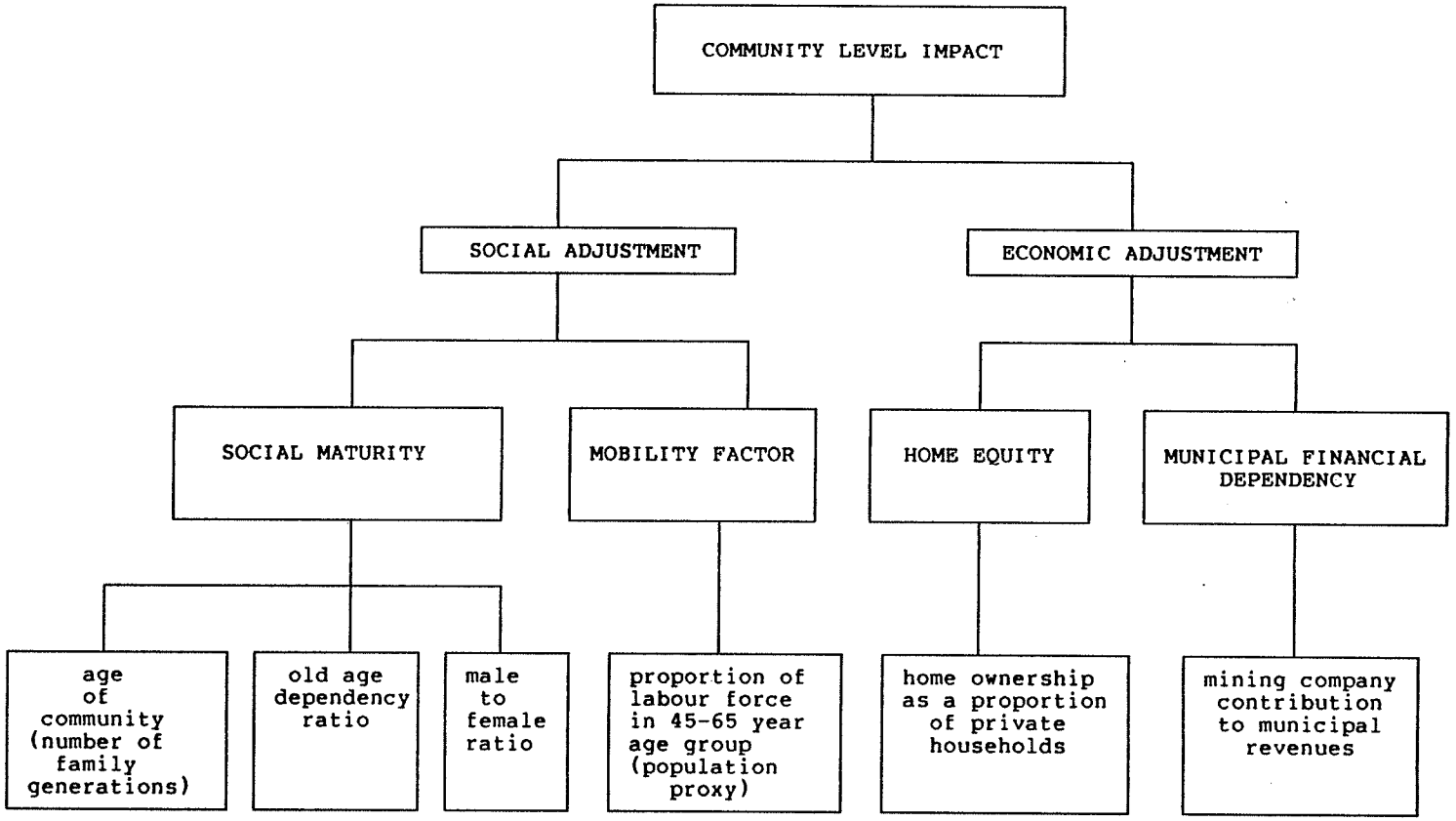

Figure 5: IMPACT - COMMUNITY LEVEL

2.3.1.1 Social Adjustment

There are two indicators that represent the impact component "social adjustment" - social maturity and a mobility factor. Social maturity addresses the level of attachment that could develop over time between community members and the community. The specific measurements representing social maturity are age of the community in number of family generations, old age dependency ratio, and male to female ratio.

The age of a community provides a general measure of the level of attachment a person could potentially develop in a community. For example, the possibility of developing social and economic ties in a mining community that has been in existence for over fifty years will be greater than in one built only 15 years ago. Himelfarb (1976) explains that employees reach a point where they

> "... have invested a good deal of their lives in the company, not only in terms of seniority and benefits achieved, but also in terms of the skills developed which may be obsolescent elsewhere." (p.10)

In addition, people in single industry communities will have invested in homes and private businesses, some will have been raised in the community and may be raising their own families, and others may be second or third generation workers in the community's major company. On the other hand, other people may be new to the community and indifferent to the community's future.

It is expected that the impact of the loss of a community's mining sector would be greater in an older and more established community. Based on the age of a community, the number of family generations

(i.e. 20-year period) can be determined and used as the indicator measurement.

While the age of a community, in terms of number of family generations, provides a general measure of attachment community members could develop over time, male to female and old age dependency ratios provide a more descriptive overview of the actual demographic composition of a community. Within the context of the stages of community development, a more even male to female ratio indicates that a community has reached the point of social maturity - a stage in which there is little mobility in the adult workforce and families predominate private households (Lucas, 1971, pp.89-112). The old age dependency ratio indicates the number of people who have chosen to live in the community after retirement age in relation to the community's labour force.

An even male to female ratio and a relatively high old age dependency ratio would, therefore, indicate the situation in which community ties have been allowed to strengthen. In contrast, a community with a predominate male population indicates the presence of a more mobile population because of fewer married couples and less family responsibilities. The impact of the loss of the community's major economic sector in this latter example is assumed to impact on people's lives less and, therefore, require less adjustment.

Within the general impact component of social adjustment, a mobility factor has also been identified. Specifically, the percentage of the community's labour force falling in the 45 to 65 years age group

serves to illustrate the more severe adjustment problems encountered by older workers when they lose their jobs. Often, older workers that are displaced in their work places are forced to seek employment in alternative areas of work where they must compete against younger, and often, more highly-skilled workers. In addition, the Canada Employment and Immigration Advisory Council (1985) has reported that older workers do not usually want to move to a job elsewhere in the country because their homes, families, friends and roots are in their present location (p.12). Anderson (1985) also notes that the 55 to 65 year age group with less than 20 years of service in a company will have difficulty securing alternative employment and, unless they have planned for their retirement, may have insufficient pensions to maintain their standards of living (p.69). A proxy that could be used for this measure is the proportion of a community's population falling into the 45-65 year age group.

It is noteworthy to mention that the various social adjustment indicators, because they are derived from descriptive demographic information, can only infer the level of impact on the general community populace. This should be taken into account when interpreting the social adjustment indicators and their respective measurements, as well as those selected to represent impact resulting from economic adjustment.

2.3.1.2 Economic Adjustment

Also of significant importance at the community level is the degree of economic adjustment faced by community members when the value of

homes become greatly reduced after the major employer in town closes down or reduces its level of operation. Loss of house value reduces the ability of people to recapture the money that has been invested and can leave home-owners in a disadvantaged position if they wish to start over in another community. This situation would also be true of private business people who stand to lose their capital business investments. However, in the absence of a detailed community business survey in which business ownership characteristics can be determined, only private households owned as a percentage of the total number of private households in the community will be used as an indicator of the degree of economic adjustment in the community.

The community, as a municipality, may also experience problems of economic adjustment if a local mining company discontinues financial contributions to its municipal revenues. This form of support is often provided through grants in lieu of taxes to the local School Board, the property tax, or other special taxes. It should be noted that in some cases, where the mine is not located within municipal boundaries, the province may provide financial grants to the community to help in the cost of service provision to the mining labour force and their families.

In a study on the impact of Griffith Mine closure on the Township of Earfalls in northwestern Ontario, it was noted that the mine represented 66% of the taxable assessment base in the community and 37% of municipal revenue from all sources, including grants and local service charges (Anderson, 1985,p.xi). The findings from the Atikokan monitoring program between 1978 and 1982 also showed that the major trends

and issues facing Atikokan in the years following the closure of the Steep Rock and Caland iron ore mines were; vulnerability of revenue sources, potential shift of revenue burden to a declining residential assessment base, and potential difficulty in maintaining services (CIMP, 1979,p.29).

Declining municipal revenues implies that the level of municipal services may have to decline as well. If the community's population over time also declines, cost per capita of services may become too high for service provision. Declining municipal services may serve to discourage some types of businesses to locate in the community and possibly encourage outmigration of residents. In turn, this may contribute to the decline of the community.

The method in which a company contributes to municipal revenues will vary from province to province and even from community to community within a province. Although the various financial contributions from a mining company to a municipality may be allocated in different ways, it is possible to express them in final form as a proportion of total municipal revenues.

2.3.2 REGIONAL LEVEL

Mining communities, over time, may become part of a regional system of communities that provide and obtain goods and services from one another. At one end of the spectrum there are communities such as Sudbury, Ontario which have developed into major, northern regional centres. At the other end of the spectrum there are communities, such as

Cassiar, British Columbia, which still function largely as mining camps. There will be a range of community types that have to be considered when determining the extent of regional impact. It should be noted that there will be an inverse relationship between the size of a community's residual sector and regional impact. That is, if a community has a residual sector that has developed to the point where it is more important than the mining sector in terms of providing employment, then the regional impact of mine closure will be minimized. At this point, however, one must ask if the mining sector is, in fact, the single industry in the community. A possible range of community types are suggested below.

- Regional Service Centre

A regional service centre provides the majority of services that were identified in the export-service category of a community's residual sector to surrounding communities (see Table 2). The size of a regional service centre will vary in terms of the number and size of communities served (i.e. number of people), and the number and types of services provided. One could envisage a hierarchy of regional centres, based on community population and population of the regional service area. For example, Sudbury, Ontario would be considered at the apex of a regional centre hierarchy for single-industry mining communities, while Thompson, Manitoba would be near its base.

- Specialized Service Centre

A specialized service centre would be a community that offers only a few types of services. For example, several small communities in

close proximity ("cluster of communities") may share hospital or educational services, although the hospital or school is located in only one of the communities. Communities located in the Elkford Valley in British Columbia (Elkford, Fernie and Sparwood) represent this type of situation.

- Native Service Centre

Especially in northern and isolated areas of Canada, single-industry communities may provide essential services to native people living in nearby Indian Reserves or communities.

- Localized Service Centre

Local trappers and fisherman sometimes utilize a community's services on an occasionally basis. In the event these services are no longer available, it would be necessary for the individuals to travel longer distances to replenish food stores or to receive medical attention. Leaf Rapids, Manitoba would represent this type of localized service centre.

- Mining Camp

This type of settlement is merely a working camp, such as a fly-in fly-out mining operation, in which workers do not live on a permanent basis (e.g. Cullaton Lake, Northwest Territory). Services would not be developed enough to provide them to individuals on a permanent basis.

2.3.2.1 Regional Service Dependency

In order to provide a comparative measurement of regional impact, the service-export component in a community's residual sector and the communities comprising the regional service system are first identified. A dependency scale (percentage of usage) between 1 and 6 is then constructed that corresponds to the degree of dependency communities may have on an export-service provided by the community under study (see Table 6). The scaling numbers for each service category are then weighted using population figures from the dependent communities, added together, and averaged with the combined population of the communities to provide the individual service category scores. The individual service category scores are then added together and averaged with the total number of service categories to provide the final "regional service impact measurement". It is expected that the degree of dependency a community has on other communities within the region for each of the service areas can be estimated by either a community's Economic Development Officer, Municipal Planner or Town Administrator.

TABLE 6

REGIONAL SERVICE DEPENDENCY

REGIONAL SERVICE AREA COMMUNITIES	RETAIL TRADE	WHOLESALE TRADE	HOSPITAL SERVICE	POST - SECONDARY EDUCATION	PROV/ FEDERAL GOV'T SERVICES	COMMUNITY POPULATION
COMMUNITY 1						
COMMUNITY 2						
COMMUNITY 3						
COMMUNITY 4						
COMMUNITY 5						
COMMUNITY 6						
COMMUNITY 7						
COMMUNITY 8						
COMMUNITY 9						
COMMUNITY 10						
SERVICE CATEGORY SCORE *						TOTAL

REGIONAL SERVICE IMPACT MEASUREMENT **

DEPENDENCY SCALE:

0 - 9 percent dependent	-	6
10 - 24 percent dependent	-	5
25 - 49 percent dependent	-	4
50 - 74 percent dependent	-	3
75 - 89 percent dependent	-	2
90 - 100 percent dependent	-	1

* SERVICE CATEGORY SCORE = $\frac{\text{SUM OF (COMMUNITY SCORES X COMMUNITY POPULATION)}}{\text{TOTAL POPULATION OF ALL COMMUNITIES}}$

** REGIONAL SERVICE IMPACT MEASUREMENT = $\frac{\text{SUM OF SERVICE CATEGORY SCORES}}{\text{TOTAL NUMBER OF SERVICE CATEGORIES}}$

2.3.3 SINGLE-INDUSTRY DEPENDENCY AND EFFECT ON LEVEL OF IMPACT

Contemporary impact assessments in communities generally look, initially, at the number of jobs that will be lost directly in the community and then estimate, from this baseline figure, the total number of jobs that will be lost (e.g. direct, backward and forward-linked, and induced) eventually in the community and the potential decline in total community population. This method of conducting an impact assessment looks primarily at the impending weakness (i.e. lost jobs) that will be imparted to the local economy and does not incorporate, initially at least, any mitigative effect from the existence of a local residual economic base.

At this stage in index development, the indicator measurements are not sensitive to a community's dependency on the mining sector, the strength of its residual sector, and the corresponding employment relationship these sectors have on the community's locally-consumed service sector. It is, however, essential that the final impact index be sensitive to this relativity between communities. For example, the fact that two mining communities have a 60% home ownership rate does not necessary mean that they will experience the same difficulties following a decline in their single industry. In comparison to a community that is heavily dependent on the mining sector (e.g. Pine Point, Northwest Territory), it is expected that the risk associated with losing one's home equity would be less in a community with a more diversified economy (e.g. Kirkland Lake, Ontario) because of the greater ability of a community with a diversified economy to remain viable following loss of the mining activity.

To acknowledge the dependency of the community on the mining sector and the possibility of a mitigative effect from jobs in a residual sector, a Comprehensive Community Impact Factor (C.C.I.F.) has been determined. This C.C.I.F. measures the relative importance of mining sector jobs (that is, the jobs involved directly in mining and those involved in forward and backward-linked industries to the mining sector) to residual sector jobs (that is, jobs involved directly in residual sector industries and those involved in forward and backward-linked industries to the residual sector) and the proportional relationship these jobs have to the number of jobs in the community's locally-consumed service sector (jobs that are dependent on the existence of mining and residual sectors employment). This factor assumes that the number of mining jobs relative to residual jobs are in proportion to the number of service jobs in the community. For example, if there are three mining jobs to every one residual job, it is assumed that three out of four jobs in the community's locally-consumed service sector are dependent on the mining sector and one out of four jobs is dependent on the residual sector. In this example, if all of the community's mining jobs were lost, three-quarters of all community jobs would be lost. In general, the greater (smaller) the proportion of mining jobs relative to the existing number of jobs in residual industries, the greater (smaller) the impact on the community. In practice, however, this underlying assumption of proportionality may not be entirely accurate because some types of service industries will require some threshold population in order to maintain operations (e.g. specialty store). It is expected, however, that these types of businesses will be averaged out with other types of businesses that are able to exist with a reduced population level (e.g. food stores).

The C.C.I.F. is calculated by taking the number of mining jobs lost divided by the total number of mining and residual jobs in a community. A number between 0.0 and 1.0 is produced, with 0.0 representing the situation in which there are no mining jobs to lose (no impact) and 1.0 representing the situation in which there are no residual jobs in the community and therefore no mitigative effect against lost of mining jobs (i.e. maximum impact). Based on the assumption that the number of mining and residual jobs are proportional to the number of service jobs in the community, a C.C.I.F. of .5 would mean that approximately 50 percent of jobs in the community would be affected by the loss of the mining sector and so on.

2.3.3.1 Using the Comprehensive Community Impact Factor

The C.C.I.F. is applied to the final indicator measurements for Community Impact -

- age of community (in family generations),
- old age dependency ratio,
- male/female ratio,
- proportion of population in 45-65 year age group,
- home ownership as proportion of private households, and
- mining company contribution to municipal revenues;

and to the indicator of Regional Impact -

- regional service impact measurement.

Applying the C.C.I.F. will sensitize the final indicator measurements to a community's dependency on the mining sector, the strength of its residual sector, and the corresponding relationship these sectors have on the community's locally-consumed service sector. For example, if 60% of the households in a community own their homes and the C.C.I.F. is .4, the final measurement for the indicator of home equity would be .24. In contrast, a community with only 20% of its homes owned and with the same C.C.I.F. (.4), the final measurement would be .08, indicating a comparatively smaller impact. When percentages are used, the final impact measurement that has been sensitized by applying the C.C.I.F. must fall between 0.00 and 1.00, with 0.00 being the smallest and 1.00 the largest impact possible. In the case of regional impact, the C.C.I.F. is divided into the final regional service impact measurement.

2.4 THE RELATIONSHIP OF VULNERABILITY AND IMPACT WITHIN THE CONTEXT OF STAGES IN COMMUNITY DEVELOPMENT

Using stages in community development as a time reference to the community dimensions of vulnerability and impact, it is possible to explain the relationship between vulnerability and impact over time. There have been several interpretative models of development proposed to describe the development process early resource-based communities would typically experience. Lucas (1971) identified four stages of community development; construction, recruitment of citizens, transition, and maturity. Riffel (1975) refers to seven stages of resource community development; natural or prediscovery, prospecting to survey, industrial and town construction, industrial operation and

community improvement, industrial and community operation, community diversification, and finally, community maturity. These early discussions on community development stages did not, however, acknowledge the latter stages of development. Bradbury and St. Martin (1983), with reference to mining communities, have termed these latter stages of development, "winding-down" and "closure". Figure 6, "The Route of Community Development", illustrates an updated sequence of stages in community development within the context of the mining process.

In Figure 6, Lucas's first stage of the community development process, "construction", corresponds to the latter part of the pre-production stage of the mining process with construction of the industrial plants and facilities and community infrastructure. The next stages of development, "recruitment", "transition", and "maturity", correspond to the production period of the mining process. During the "recruitment" stage, temporary construction workers are replaced with citizens who are considered more permanent community members. Himelfarb (1976) explains that, during the stage of "transition", "control of non-industrial facilities and community responsibilities are gradually passed from company or provincial administrators to the citizens of the community". (p.9). "Maturity" of the community, because it implies the passing of time, serves to strengthen social and economic ties to the community that were initiated in the stage of "transition".

It can be argued that community maturity has both a social and economic dimension. As social maturity must be preceded by the initiation and strengthening of personal ties to the community, economic ma-

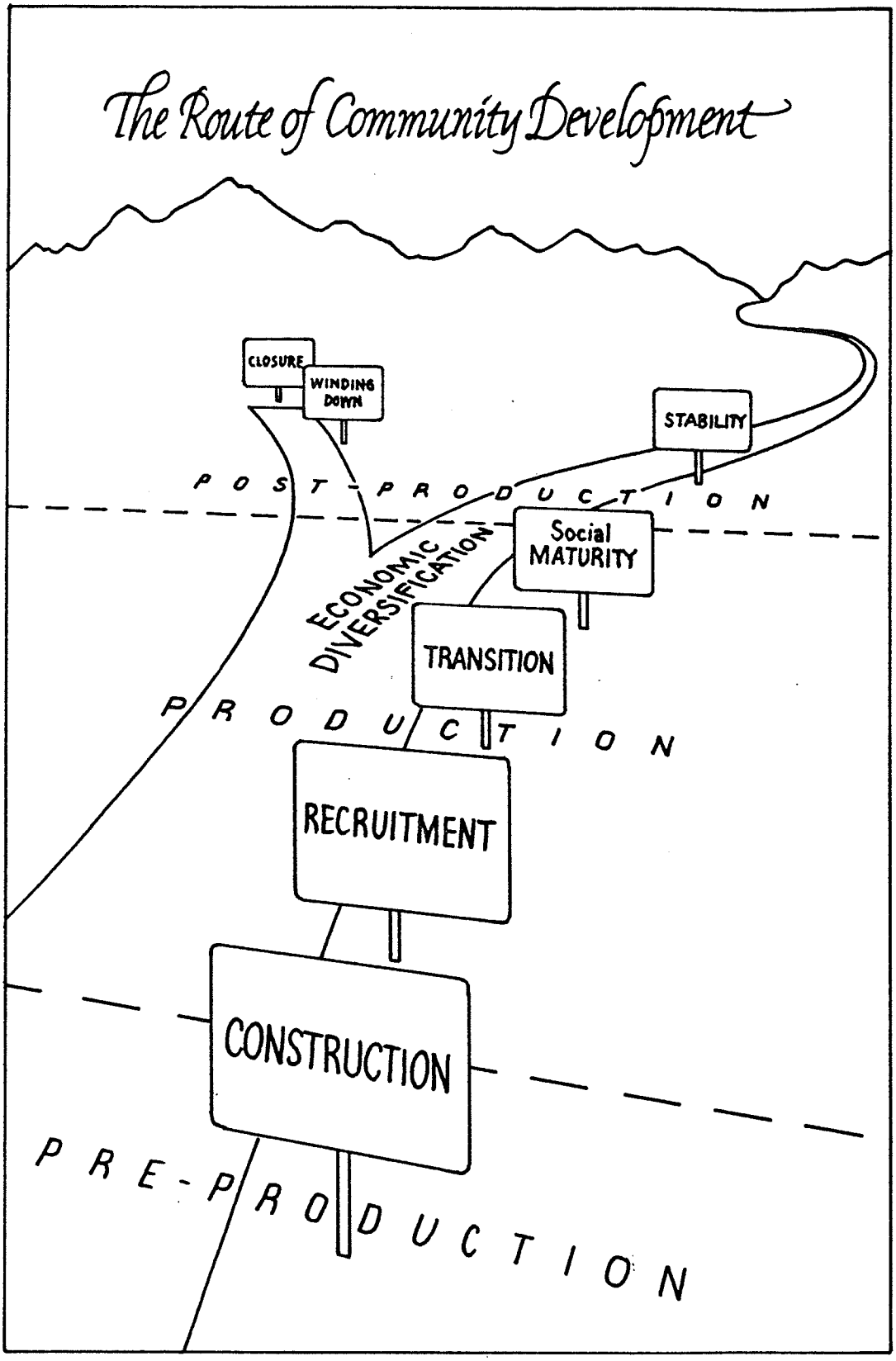

Figure 6: THE ROUTE OF COMMUNITY DEVELOPMENT

turity must be preceded by economic diversification of the local economy. Futhermore, it can be argued that only when both social and economic maturity have been achieved will it be possible for a community to enter the stage of "stability". For communities based on non-renewable resources, if diversification of the economy does not take place prior to the end of the mining production period, the probability of the community taking the route to the stages of "winding down" and "closure" increases.

2.4.1 VULNERABILITY AND THE STAGES OF COMMUNITY DEVELOPMENT

With respect to the first component of vulnerability, "vulnerability of the local mining industry", the complexity of the local mining activity and the competitiveness of the mines will influence the length of the production period. In turn, the length of the production period will determine the length of time in which social and economic ties to the community can be initiated and strengthened (i.e. achievement of social maturity) and will put a time limitation on the ability of the community to develop its residual economic base prior to mine closure.

The ability of a community to develop a residual economic base before the post-production period commences will directly affect the second component of vulnerability - "the community's vulnerability to loss of the mining sector". If economic diversification away from the single industry is achieved to the point where it fulfills a community's needs and aspirations, then it can be said that the community has matured in an economic sense, and is well on the way to the stage of

stability. It should be pointed out that stability in a community does not mean that its population would be maintained from previous development stages. It must be expected that some proportion of mining employees would not be able to be absorbed into other sectors of the community, while still others would not be willing to stay and work in another industry or for wages less than previously received.

The third component of vulnerability, "amenity of the community to diversification", while dependent on the community's physical locational attributes, will also become a function of changes in the community throughout the production period - most notably the attachment developed between the community members and the community and the corresponding level of local commitment for diversification initiatives (e.g. entrepreneurial spirit, planning, and finances). At the point of social maturity, it would be expected that a community's amenity to diversification would be at a maximum as people would have more incentive to work towards staying in their home town.

2.4.2 IMPACT AND THE STAGES OF COMMUNITY DEVELOPMENT

If a community has reached the point of social maturity with no diversification of its economy, it is expected that the impact of the loss of the mining sector on the community as it enters the "winding-down" and "closure" stages will be greater than in the case where social maturity has not been fully achieved. Riffel (1975) notes that "It seems paradoxical that the quality of living in a town would become most satisfying at the time when one would expect that resources around which the town was built become depleted." (p.11). It should

be pointed out that closure, as depicted in Figure 6 as a final stage of development, need not be a finite stage. Although some communities may be "bulldozed away", the existence of a small-scale residual economic base, subsistence activities (e.g. hunting, fishing, gardening), and/or government transfer payments and make-work programs may all contribute to a number of people deciding to stay in the community. The length of stay, however, will depend on an individual's quality of life requirements and opportunities elsewhere. It is also possible that people may remain in the community in the belief that, at some point in the foreseeable future, the cycle of development will repeat itself.

2.5 FUTURE REFINEMENTS OF INDICES

Three components of vulnerability were identified, "vulnerability of the mining industry", "vulnerability of community to loss of mining sector", and "community amenity to diversification". Seven vulnerability indicators were selected and quantified using eight measurements. With respect to impact, two levels of impact were identified, Community and Regional, and seven measurements were used to quantify the five impact indicators selected.

At this point in index construction, each indicator has been quantified using specific measurements (e.g. years, proportions, etc.). Subsequent stages in index development are discussed briefly below. The methodology that is suggested has not been used here, but rather, has been left to interested groups to implement.

- A representative sample of mining communities is selected and empirical data collected to satisfy each of the indicator measurement requirements.

- Through a comparative analysis of data from the sample mining communities, ranges of indicator measurements are identified and established as benchmark measurements indicating levels of vulnerability and impact. It is suggested that a scale of 6, with 1 and 6 corresponding to the highest and lowest levels of vulnerability and impact respectively, be established for each of the fifteen indicator measurements. These indicator scales may be referred to as "subscales". (In Chapter 3, preliminary subscales have been developed for several of the indicator measurements.)

- Where there is more than one measure per indicator, the scaling scores (i.e. 1 - 6) are summed together to produce a combined score. For example, in the case of the impact indicator, social maturity, where three measures were used (age of community, old age dependency ratio, and male to female ratio), the minimum and maximum combined scaling scores 3 (i.e. 3 scales X 1 minimum score) and 18 (i.e. 3 scales X 6 maximum score) serve as the lower and higher limits of a combined measurement scale. The possible ranges of combined scores are then broken down into benchmark measurements that define six (impact) levels.

- After combining the individual measurements as described above, the indicator subscales must go through a similar combining process to produce final scales for vulnerability and impact. The final scale for vulnerability will have 7 (7 indicators X 1 minimum score) and 42 (7 indicators X 6 maximum score) as its lowest and highest score respectively. With respect to the final scale for impact, 5 (5 indicators X 1 score) and 30 (5 indicators X 6 maximum score) represent the lowest and highest scores possible.

- Finally, the possible ranges of combined scores for vulnerability and impact are broken down into benchmark measurements indicating the final levels of vulnerability and impact.

Final levels of vulnerability and impact may be referred to numerically, for example levels 1 to 6, or grouped together to produce simple high, medium, and low levels. In the case shown in Figure 7, the final levels of vulnerability and impact have been simply referred to as high, medium, and low. This matrix illustrates the possible combinations of vulnerability and impact that are possible for a community (e.g. high vulnerability, high impact; low vulnerability, high im-

pact, etc.) It must be emphasized, however, that before this matrix

IMPACT \ VULNERABILITY	HIGH	MEDIUM	LOW
HIGH			
MEDIUM			
LOW			

Figure 7: MATRIX OF VULNERABILITY AND IMPACT

can be used, the indices must be made fully operational.

2.6 LIMITATIONS OF INDICES

There are a number of limitations that should be noted regarding the indices.

- First, the indices provide only a "snapshot" look at a community and must, therefore, be updated, at least on an yearly basis. The need to update the indices has, however, the benefit of providing a community with a "time-series" of its progress over time in relation not only to itself but also to other communities.
- Second, the indices are not inclusive - they have been selected to illustrate areas of vulnerability and impact that are considered to be significant areas of comparison between communities. There are, however, numerous other indicators that could provide supplementary insight into the community dimensions of vulnerability and impact. For example, the impact index would not directly reflect the level of human anxiety or stress (e.g. crime rates, alcoholism, etc.) associated with a community losing its major source of employment and income.

- Third, the indices require an extensive data base. If, however, the communities themselves were to develop the necessary data base, it is expected that costs would be minimized.

- Fourth, the indices have not been validated using information from mining communities that have already experienced decline in their mining industry.

- Last, each individual indicator is assumed to be of equal importance in determining levels of vulnerability and impact. In practice, some indicators may play a more important role than others.

2.7 UTILITY OF INDICES

The seriousness of problems associated with industrial decline in single-industry communities has led to questions regarding their futures and how best to deal with ensuing problems of social and economic decline. The indices presented in this chapter, by providing a systematic method of analyzing single-industry mining communities in terms of their vulnerability to decline and the extent to which this decline would impact a community and surrounding area, provide considerable information regarding the reasons and consequences of such decline.

As presented in this chapter, the level of risk associated with being a single-industry community was considered to be a function of three vulnerability factors - the stability of the local single industry, the presence of economic activities that are able to function independent of the single industry, and the community's physical and human amenity to economic diversification. It was also shown that, depending on the development of regional service linkages between communities, the impact of decline in a single-industry community would have implications beyond the community level.

The indices are expected to have two major uses; an early-warning system for community and government use, and for program development. The methodology used in impact assessments may also benefit from use of particular concepts developed in the process of establishing the indices. Each of these specific and "spin-off" uses is discussed below.

2.7.1 AN EARLY-WARNING SYSTEM

2.7.1.1 Community Awareness and Planning Program

The indices, because they require the establishment of a comprehensive community data base, also provide considerable information regarding a community's social and economic characteristics. This information base would allow community members to become more aware of their community's strengths (e.g. residual sector jobs, organizational ability, etc.) and weaknesses (e.g. short production period and/or instability in mining industry, no local initiative, etc.) and assist in the task of planning for adjustment to decline in the mining sector (i.e. minimize impact and/or reduce vulnerability). When a community is aware of potential community and regional level impacts associated with decline and the seriousness of these impacts, community leaders are better prepared to discuss adjustment plans with companies, unions, and government. The Canadian Association of Single Industry Towns would be considered an appropriate co-ordinating agency for this type of program.

The need to update the indicators on a regular basis (i.e. annually) will also provide a time-series of a community's situation rela-

tive to itself and to other communities. Not only does this allow a community to identify hot-spots in its development (e.g. declining business starts, increased vulnerability in the single industry, etc.), the analysis of a larger data base for communities over time would enable one to identify emerging trends.

2.7.1.2 Government Monitoring Program

The ability of the indices to measure the relative vulnerability of a single-industry community to decline and the severity of impact from industrial decline in advance of the actual demise of the major industry provides government a tool to monitor a community's situation over time and in relation to other communities. It is expected that both levels of government would have some interest in developing a time-series of this type. To minimize costs and duplication of efforts by different levels of government, this program could be developed in conjunction with the community awareness and planning program. A national committee could assist in the start-up phase, with government supporting each community in the development of their vulnerability and impact profiles. Government departments at the Provincial, Territorial, and Federal levels could use the results of this type of monitoring program to support their own analysis, policy and program development.

2.7.2 PROGRAM CRITERIA

The monitoring program discussed above would provide working data bases for communities thought to be of a single industry nature. The indices, by providing an informational framework from which a better understanding of community vulnerability and impact can be ascertained would, undoubtly, lead to improved approaches in the development of programs of community diversification and advanced planning action for community adjustment during the stages of winding down and closure. By providing a mechanism for making comparisons between communities, the indices would also assist in the difficult task of assigning priority of assistance amongst communities in need.

2.7.3 OTHER USES

2.7.3.1 Impact Assessments

For use in impact assessments dealing with industry closure, the identification of a community's residual economic base provides an clear statement of the community's economic independency from the single industry and, therefore, provides an employment estimate from which future job and population scenarios of the community may be predicted. Per capita increases in service provision (e.g. school, medical, municipal. etc.) could be estimated using these future population scenarios.

2.7.3.2 On Defining a Single-Industry Community

One of the distinct advantages of the indices is that there is no need to predefine a single-industry community. The indices provide an unique method of defining a community in terms of the risk associated with being a community of single industry.

2.8 SUMMARY

This Chapter has provided an overview of the vulnerability and impact indicators in terms of their underlying structure, rationale for indicator selection and methodologies for quantifying indicator measurements. An updated model of sequences of stages of community development illustrated the time relationship between vulnerability and impact and provided a more theoretical background to the concepts of the community dimensions. Finally, a methodology for producing final indices for vulnerability and impact was suggested and limitations and utility of the indices discussed. In the next chapter, a case study of Kirkland Lake, Ontario illustrates the feasibility of implementing the indices.

Chapter III

COMMUNITY CASE STUDY - RESULTS

3.1 INTRODUCTION

The purpose of this case study is to determine the feasibility of implementing the indices as presented in Chapter 2. Specifically, factual information is obtained for each of the indicator measurements and the source of information documented. In several instances, a methodology for ranking an indicator measurement is suggested and implemented using either the measurement itself or by using empirical data. These ranking systems, despite their preliminary nature, provide insight into making the indices operational.

Summary tables are provided for each of the indices, showing their components, indicators, measurements, measurement values, and vulnerability or impact level if available. Finally, observations regarding the feasibility of implementing the indices are made and suggestions for refinements offered.

3.2 KIRKLAND LAKE, ONTARIO - BACKGROUND

Figure 8 shows the location of Kirkland Lake within Canada. Gold was first discovered in the vicinity of Kirkland Lake in 1911 and then iron-ore in 1963. During the 1930's, the combined force of six local gold mines employed approximately 5,000 men.

In 1939, the population of Kirkland Lake peaked at approximately 25,000. During the years following, however, the Town's population steadily declined until when, in the early 1980's, the population began to stabilize around 12,000. Today, only the Macassa gold mine and the Adams iron-ore mine remain in operation.

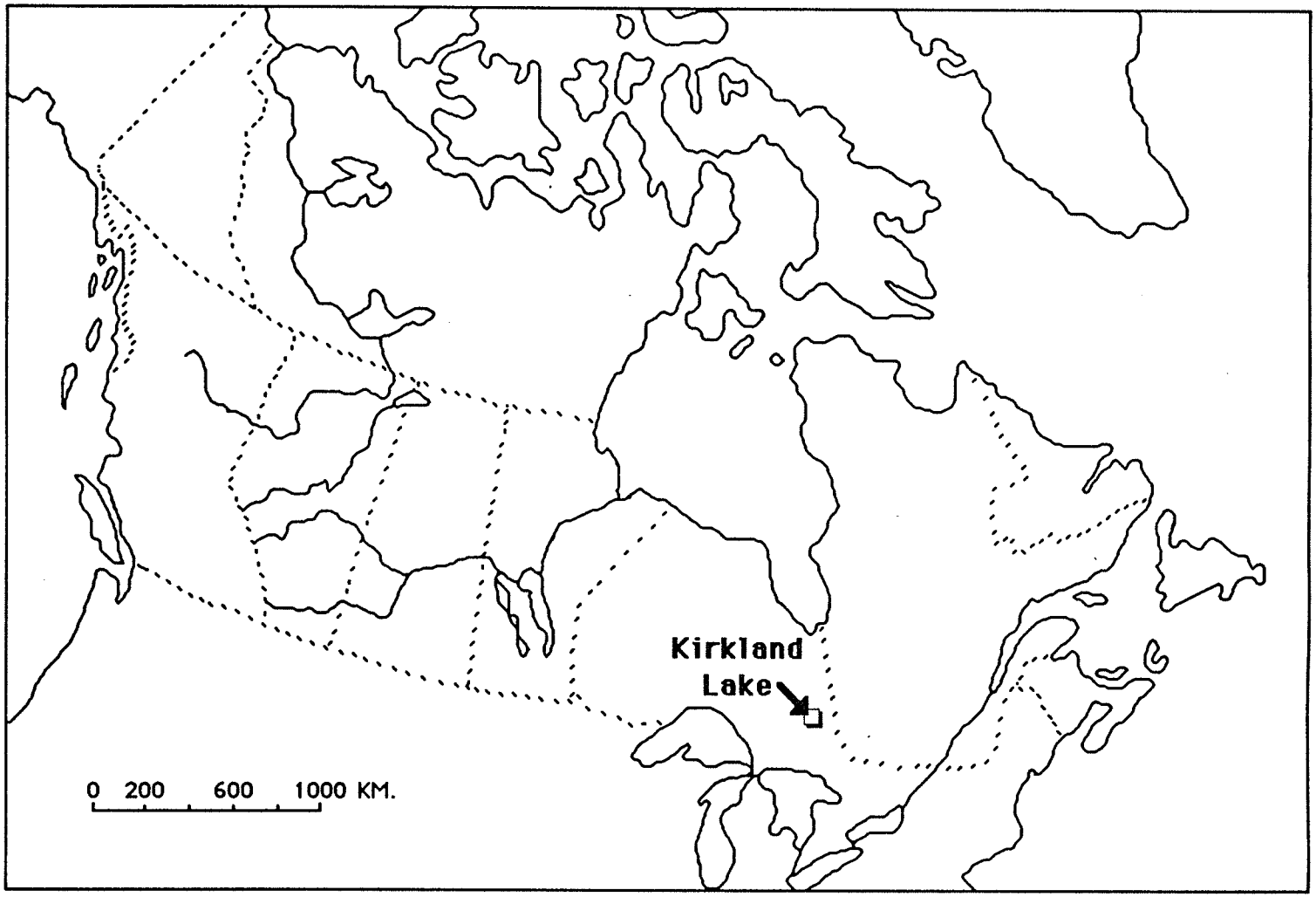

Figure 8: TOWN OF KIRKLAND LAKE - LOCATION IN CANADA

3.3 SOURCES OF DATA

Letters of introduction were sent initially to inform the Town's Mayor of the study and to request the assistance of the Director of Kirkland Lake Economic Development Commission (KLEDC). The Director, because of his extensive knowledge of the community and surrounding area, proved to be an excellent liaison with the community. A set of information tables and questions was subsequently sent to the Director to obtain the relevant community and regional information. Clarification of information received and requests for additional information was made through follow-up phone calls. It was necessary to speak personally with several people in specialized organizations in order to obtain specific data requirements. Tables 7 and 8 summarize the sources from which community information was obtained for each vulnerability and impact indicator measurement, as well as an alternative or follow-up source if known.

A review of Tables 7 and 8 shows that all data requirements for the vulnerability and impact indicator measurements were obtained from community sources, with the exception of labour productivity (mine competitiveness, Table 7) and home ownership (home equity, Table 8). While information for labour productivity was obtained from a published document (Canadian Mines Handbook), the case of home ownership ilustrates the situation were the community does not maintain the necessary information records. If information regarding community characteristics of home ownership was to be collected in the Town's annual municipal census, the need to use Statistics Canada Census data, which is collected only once every five years, would be avoided.

TABLE 7

SOURCES OF INFORMATION FOR MEASURES OF VULNERABILITY

COMPONENT	INDICATOR	MEASUREMENT	SOURCE OF INFORMATION	ALTERNATIVE SOURCE
VULNERABILITY OF MINING INDUSTRY	Company, Mine & Mineral Complexity	typology of mines, minerals & companies	KLEDC *	Map 900A, Canada (current year)
	Mine Competitiveness	labour productivity	Canadian Mines Handbook, 1986-87	Mine Manager
	Mine Production Period	production period (weighted average)	KLEDC	Mine manager, Canadian Mines Handbook, 1986-87
VULNERABILITY OF COMMUNITY TO LOSS OF MINING SECTOR	Residual Economic Base	ratio of mining sector employment to total residual sector employment	KLEDC - Business Directory Hospital - Director Extendicare - Administrator	
COMMUNITY AMENITY TO ECONOMIC DIVERSIF-CATION	Economic Isolation	distance to nearest metro-politan centre	KLEDC - Kirkland Lake Fact Book, 1987	Travel Map
	Community's Ability to Diversify	number of new business starts	KLEDC - annual survey of business starts & closures	Chamber of Commerce
	Community Planning & Initiative	development organizations & committees	KLEDC	Town Hall
		municipal economic development	KLEDC - Fact Book 1987	Town Hall

* Kirkland Lake Economic Development Commission

TABLE 8

SOURCES OF INFORMATION FOR MEASURES OF IMPACT

LEVEL	COMPONENT	INDICATOR	MEASUREMENT	SOURCE OF INFORMATION	ALTERNATIVE SOURCE
COMMUNITY	SOCIAL ADJUSTMENT	Social Maturity	age of community (family generations)	KLEDC - Fact Book, 1987	Town Hall
			old age dependency ratio	Town Hall, town census	Statistics Canada
			male/female ratio	Town Hall, town census	Statistics Canada
		Mobility Factor	proportion of labour force in 45-65 year age group (population proxy)	Town Hall, town census	Statistics Canada
	ECONOMIC ADJUSTMENT	Home Equity	home ownership as a proportion of private households	Statistics Canada	
		Municipal Financial Dependency	mining company contribution to municipal revenues	Town Hall	Mine Manager
REGIONAL		Regional Service Dependency	regional service impact measurement	KLEDC	Community Surveys

3.4 VULNERABILITY MEASUREMENTS

3.4.1 VULNERABILITY OF THE COMMUNITY'S MINING INDUSTRY

3.4.1.1 Company, Mine and Mineral Complexity

Kirkland Lake's mining industry, as shown in Table 9, is comprised of two mining companies operating two mines that produce, collectively, three marketable mineral products. In accordance with the Typology of Mines, Minerals and Companies established in Chapter 2, the Town

TABLE 9

KIRKLAND LAKE - COMPOSITION OF THE LOCAL MINING INDUSTRY

COMPANY	MINE	MINERALS	
		PRIMARY	BY-PRODUCTS
Lac Minerals, Macassa Division	Macassa	gold	silver
Dofasco Inc., Cliffs of Canada	Adams Mine	magnetite iron-ore	
MINING INDUSTRY TYPE F			

has a Type F mining industry.

A preliminary scale for this measure of vulnerability can be determined directly from the values given to the six mining industry types

identified in the Typology. This scale directly corresponds levels of vulnerability (1-6) to a community's determined industry type (A - F), with 1 and 6 corresponding to the highest and lowest vulnerable situation respectively. In accordance with this scale, Kirkland Lake would fall in the category in which the mining industry is least vulnerable (6).

3.4.1.2 Mine Competitiveness

The two mines in Kirkland Lake, Macassa and Adams, produce, respectively, gold and iron ore. Labour productivity in similar mine types (i.e. gold and iron ore) in Canada was calculated initially from data obtained from the Canadian Mines Handbook, 1986-87. Productivity measures (i.e. tons of ore per day per number of employees) for each of the mines identified were then averaged over the total number of mines of similar type. Table 10 shows that the average labour productivity in the fourteen gold mines identified was 5.43 in 1986-87, meaning that each worker at these mines produced, on average, approximately 5 1/2 tons of ore per day. Workers in the Macassa mine in Kirkland Lake, in comparison, produced 1.7 tons per day (tpd) per worker, approximately 31% of the Canadian average (.31). If labour productivity at the new gold mine at Marathon, Ontario is considered a upper limit on productivity (13.3 tpd per worker), the Macassa mine in Kirkland Lake must be considered near the lower limits of labour productivity.

With respect to iron ore mines, Table 11 shows that the average labour productivity in three Canadian iron mines to be 10.05 tpd per

TABLE 10

LABOUR PRODUCTIVITY IN CANADIAN GOLD MINES - AVERAGE, 1986-87

COMPANY	MINE (location)	MINE TYPE*	NUMBER OF EMPLOYEES (1)	CAPACITY (tpd**) (2)	LABOUR PRODUCTIVITY (2/1)	PROPORTION OF AVERAGE
Aiguebelle Resources Inc.	Yvan Vezina (Destor,PQ)	U/G	120	861	7.18	1.32
American Barrick Resources Corp.	Campflo Mine (Malartic,PQ)	U/G	187	1300	6.95	1.28
Bachelor Lake Cold Mines Inc.	(Desmaraisville PQ)	U/G	115	500	4.35	0.80
Dome Mines Ltd.	(South Porcupine Ont)	U/G	772	3000	3.89	0.72
Kerr Addison Mines Ltd.	Kerr Addison (Virginiatown, Ont)	U/G	330	1100	3.33	0.61
Kiena Gold Mines Ltd.	(Val d'Or,PQ)	U/G	190	1133	5.96	1.10
Muscocho Explorations Ltd.	Montauban Mine (Montauban,PQ)	U/G	97	380	3.92	0.72
Pamour Porcupine Mines Ltd.	Pamour (No.1) (Timmons,Ont)	U/G	690	2800	4.06	0.75
Societe Miniere Louvem Inc.	Chimo Mine (Val d'Or,PQ)	U/G	225	750	3.33	0.61
Taurus Resources Inc.	(Cassiar,BC)	U/G	30	170	5.67	1.04
Lac Minerals Ltd.	Doyon Mine (Rouyn,Ont)	U/G & O/P	254	1355	5.34	0.98
Lac Minerals Ltd.	Bousquet Mine (Malartic,PQ)	U/G	212	1500	7.08	1.30
Lac Minerals Ltd.	Page-Williams (Marathon,Ont)	U/G & O/P	225	2992	13.30	2.45
Lac Minerals Ltd.	Macassa (Kirkland Lake)	U/G	285	480	1.68	0.31
				T O T A L	76.04	13.99
				A V E R A G E	5.43	1.00

SOURCE: Canadian Mines Handbook, 1986-87, calculations are the author's
* U/G - Underground, O/P - Open Pit
** tons per day

worker. Adams Mine in Kirkland Lake is 81% of the average (.81), indicating that it is near the middle range of labour productivity for

TABLE 11

LABOUR PRODUCTIVITY IN CANADIAN IRON ORE MINES - AVERAGE, 1986-87

COMPANY	MINE (location)	MINE TYPE*	NUMBER OF EMPLOYEES (1)	CAPACITY (tpd**) (2)	LABOUR PRODUCTIVITY (2/1)
Dofasco Inc.	Sherman Mine (Temagami,Ont)	O/P	398	3173	7.97
	Adams Mine (Kirkland Lake)	O/P	388	3173	8.18
Algoma Steel	(Wawa,Ont)	U/G	500	7000	14.00
			T O T A L		30.15
			A V E R A G E		10.05

SOURCE: Canadian Mines Handbook, 1986-87
* U/G - Underground, O/P - Open Pit
** tpd - tons per day

this particular type of mine.

Based on the productivity measures determined for the different gold mines, it is possible to develop a preliminary scale that corresponds to six levels of vulnerability with respect to gold mine competitiveness. As shown in Table 10, each labour productivity measure has been taken as a proportion of average productivity. These figures were then averaged to provide a middle measure for a scale of vulnerability (.99 or 1.00). Maintaining a six level vulnerability scale,

six ranges of measurements were established using .99 and 1.00 as the high and low measures for the middle ranges of measurements. Table 12 illustrates these measurement ranges. In accordance to this scale, gold production in Kirkland Lake from the Macassa mine would rank 1 (highest vulnerability). If additional empirical information for iron ore mines was obtained, a scale for iron ore mines could also be determined. It should be noted that the accuracy of the subscale developed for labour productivity for gold mines (and for other types of mines) would be improved if labour productivity data from foreign

TABLE 12

VULNERABILITY SCALE FOR GOLD MINE COMPETITIVENESS

VULNERABILITY SCALE					
HIGH		MEDIUM		LOW	
1	2	3	4	5	6
< .33	.33-.66	.67-.99	1.00-1.33	1.34-1.66	>1.66
INDICATOR MEASUREMENT RANGES					

mines was incorporated.

3.4.1.3 Mine Production Period

The third indicator, mine production period, is calculated by converting the number of mine employees and the time remaining in the

production period to number of person-years remaining. Table 13 shows these calculations for Kirkland Lake's two mines. The total person-years remaining, 9,549, is then divided by the total number of mine workers to produce the final average production period for the local mining industry. For Kirkland Lake, the resultant weighted average is 14 years.

TABLE 13

MINE PRODUCTION PERIOD, KIRKLAND LAKE, 1987

Mine	Number of Employees (1986) (1)	Production Period (Time remaining) (2)	Person -years remaining (1X2)
Macassa	285	8-10 yrs (9)	2,565
Adams	388	18 yrs	6,984
MINE TOTAL	673		9,549
WEIGHTED AVERAGE = 14 years			

3.4.2 VULNERABILITY OF COMMUNITY TO LOSS OF MINING SECTOR

3.4.2.1 Residual Economic Base - size and diversification

There are two categories of industries within the residual economic base of a community, "industrial" and "service - export". Within the Industrial category of Kirkland Lake's residual sector, the industries of forestry, trapping, and independent manufacturing are represented.

Table 14 shows that employment in the forest industry is clearly the largest employer. Within the scope of this study, it was not possible to trace backward and forward - linked employment to these industries and as as consequence, these "linked" jobs will be picked up in the

TABLE 14

RESIDUAL ECONOMIC BASE - INDUSTRIAL CATEGORY EMPLOYMENT, KIRKLAND LAKE, 1986

INDUSTRIAL	EMPLOYMENT
Forestry	92
Trapping	15
Independent Manufacturing - textiles	2
TOTAL	109

SOURCE: KLEDC and KLEDC Business Directory, 1986

locally-consumed community service sector.

As pointed out earlier, estimating employment in the "export-service" industries in a community's residual sector is complicated by the fact that these industries provide services to people living both in and outside the local municipality's boundaries. As with the industries in the industrial category of the residual sector, there will also be some jobs linked to the service-export industries (e.g. business services, financial services, etc.).

Table 15 provides a summary of Kirkland Lake's Service-Export industries in terms of total employment (i.e. includes employment in the locally-consumed community services sector) and estimates for employment providing services for export only. Employment that could be contributed to services for export in the Town's post-secondary educational institution, the Northern College of Applied Arts and Technology, was determined by taken the proportion of enrollment from students outside of Kirkland Lake (.67) With respect to Kirkland Lake and District Hospital in the specialized health services industry, the most recent annual discharge rate for non-residents was identified (.36). Bed utilization rates for non-residents (.57) were used in the case of Extendicare, a home for the care of the elderly and developmentally handicapped. For the industries, provincial and federal government services and retail and wholesale trade, Kirkland Lake's service area population (5,202 - see Table 23) was divided by the combined service area population and that of Kirkland Lake (17,056) to produce a proportion of service utilization from outside of the Town (.30). These proportions were then multiplied by the different industries' total employment figures to provide an estimate of employment that could be attributed to providing "services for export". In total, 528 jobs were determined using this method.

A review of the businesses listed in Kirkland Lake's Business Directory for 1986 revealed that businesses in at least 35 different 1970 Standard Industrial Classifications (SICs) would be typically used by tourists. Table 16 provides a summary of these businesses according to their 1970 SICs and number of employees. Two distinct pri-

TABLE 15

SERVICE - EXPORT INDUSTRIES - DERIVATION OF RELATED EMPLOYMENT, KIRKLAND LAKE, 1986-87

SERVICE-EXPORT INDUSTRY	TOTAL EMPLOYMENT (F.T.E.*) 1986 (1)	MEASUREMENT (2)	EMPLOYMENT ESTIMATE (1X2)
POST-SECONDARY EDUCATION		(enrollment from outside community)	
- Northern College of Applied Arts & Technology	98	.67	66
SPECIALIZED HEALTH SERVICES		(discharge/ utilization rates for non-residents)	
- Kirkland Lake & District Hospital	280	.36**	101
- Extendicare	104	.57***	59
PROVINCIAL & FEDERAL GOVERNMENT SERVICES	294	(community population divided by combined service area and community population. .30	88
TRADE (RETAIL & WHOLESALE)	713	.30	214
T O T A L E M P L O Y M E N T			528

* For purposes of this study, a F.T.E. (Full Time Equivalent) = 2 Part Time = 4 Seasonal

** Based on total hospital discharge number of 3,495 patients between April, 1986 and March, 1987

*** Based on bed utilization rates, November, 1987

mary tourist establishments were identified from this list - motels and hotels and camping grounds. In total, these establishments provided 148 full-time positions. Within the scope of this study, however, it was not possible to directly survey the remaining secondary and tertiary tourist establishments to determine estimates of tourist-related jobs. As a result, the final estimate for Kirkland Lake's tourist industry will be underestimated, further inflating the employment figure in the locally-consumed community services sector.

In Table 17, a summary of employment in Kirkland Lake's various residual industries is provided. This Table shows that Kirkland Lake's residual sector is represented by eight industries, although two of these are only weakly represented (i.e. trapping, 15 and independent manufacturing, 2). Regardless, it appears that Kirkland Lake has a relatively large and diversified residual sector. As noted earlier, it was not possible to estimate the number of local jobs linked to the Town's residual industries (e.g. business services, further manufacturing) within the scope of this study. For this reason, the total employment estimate for Kirkland Lake's residual economic base (785) will be underestimated.

In 1981, Kirkland Lake had a labour force of 5,305, of which 4,975 were employed (Statistics Canada, 1981). As the figures used in this study are in terms of number of jobs, the number of people employed in the labour force is used as the Town's total employment figure. Based on this total employment figure, it is possible to estimate the number of people employed in the locally- consumed community services sector. First, however, employment in the Town's mining sector must be determined.

TABLE 16

CHARACTERISTICS OF TOURIST-RELATED BUSINESSES IN KIRKLAND LAKE, 1986

DIVISION		MAJOR GROUP		SIC*		NUMBER OF EMPLOYEES
NO.	DESCRIPTION	NO.	DESCRIPTION	NO.	DESCRIPTION	
7	Transportation Communications & Other Utilities	1	Transpor-	501	Air transport	2
				503	Railway transport	4
				508-509	Bus transport interurban & rural	46
				512	Taxi Cabs	21
8	Trade	2	Retail	631	Food stores	181
				642	General merch.	85
				652	Tires, battery & accessories	50
				654	Gasoline service stations	30
				658	Motor vehicle repair shops	8
				663	Shoe stores	11
				665	Men's clothing	2
				667	Women's clothing	10
				669	Clothing & dry goods	46
				673	Hardware stores	31
				681	Drug stores	28
				691	Book & stationary	10
				694	Jewellry	13
				696	Liquor,wine & beer	10
				697	Tobaccanists	13
				699	Retail stores,NES	25
9	Finance, Insurance & Real Estate	1	Finance	701	Banks & other depository accepting	71
10	Community, Business & Personal Services	1	Education & Related Services	807	Libraries, Museums	25
		2	Health & Welfare Services	821	Hospitals	280
		4	Amusement & Recreation	841	Motion Picture theatres	13
				843	Bowing alleys & billiards	4
				849	Misc. Amusements	44
		6	Personal Services	871	Shoe repair shops	2
				872	Barber & beauty	28
				874	Laundries, cleaners & pressers	18
				876	Self-service laundries	4
		7	Accomoda-tions & Food Services	881	Hotel & motels	147
				884	Camping grounds & trailer parks	1
				886	Restaurants, caterers, & taverns	115
		8	Misc. Services	894	Automobile & truck repair	22

* Standard Industrial Classification - 1970 (Statistics Canada, 1971)

SOURCE: KLEDC Business Directory, 1986

TABLE 17

KIRKLAND LAKE'S RESIDUAL SECTOR - EMPLOYMENT SUMMARY, 1986

RESIDUAL ECONOMIC BASE							
INDUSTRIAL			SERVICE - EXPORT				
FORESTRY	TRAPPING	INDEPENDENT MANUFAC-TURING	POST-SECONDARY EDUCATION	FED/PROV GOV'T SERVICES	TRADE RETAIL & WHOLE-SALE	SPECIAL-IZED HEALTH SERVICES	TOURISM
92	15	2	66	88	214	160	148
TOTAL EMPLOYMENT 785							

A review of Kirkland Lake's Business Directory reveals that at least 909 people were employed in the Town's mining sector in 1986. This figure, as shown in Table 18 includes both direct mining related jobs and those in local businesses that provide services to the mining industry. For example, the business found in SIC #315 is involved in the manufacture of diamond drilling, mining, milling and smelting equipment while SIC #629 is a mine, mill and laboratory supplier. There are numerous other small businesses in Kirkland Lake that provide some mining-linked jobs, but within the scope of this study, they cannot be identified with accuracy. As a consequence, employment in Kirkland Lake's mining sector will be underestimated, leading to a greater inflation of employment in the Town's locally-consumed community service sector.

TABLE 18

CHARACTERISTICS OF MINING SECTOR, KIRKLAND LAKE, 1986

DIVISION		MAJOR GROUP		SIC*		NUMBER OF EMPLOYEES **
NO.	DESCRIPTION	NO.	DESCRIPTION	NO.	DESCRIPTION	
4	Mines, Quarries & Oil Wells	1	Metal Mines	052	Gold Quartz Mines	283
				058	Iron Mines	400
		4	Metal Mines	098	Other Contract Drilling	67
		5	Services Incidental To Mining	099	Misc. services incidental to mining	24
5	Manufacturing	14	Machinery Industries	315	Misc. machinery and equipment manufacturers	70
		19	Chemical & Chemical Products Industries	379	Misc. chemical industries	19
6	Construction	1	General Contractors	409	Other construction	16
8	Trade	1	Wholesale Trade	629	Wholesalers,N.E.S.	8
10	Community,	5	Services to Business Management	864	Engineering and scientific services	22
			T O T A L E M P L O Y M E N T			909

* Standard Industrial Classification - 1970 (Statistics Canada, 1971)
** Employment figures for SIC #052 &#058 refer to the Macassa and Adams mines respectively. These figures differ slightly from those given in the Canadian Mines Handbook, 1986-87.

SOURCE: KLEDC Business Directory, 1986

This estimate of employment in the Town's mining sector (909 people) may now be added to employment in the Town's residual sector (785). This total, 1,694, is then subtracted from the Town's total employment figure, 4,975 to produce an employment estimate of 3,281 in

the locally-consumed community service sector. It is important to interpret the employment estimates given in Table 19 for Kirkland Lake's three underlying sectors within the limitations of this study; locally-consumed community services will be overestimated by secondary and tertiary tourist-related jobs and the number of jobs linked to the mining and residual sectors which were not identified within the scope

TABLE 19

RESIDUAL ECONOMIC BASE - TOTAL EMPLOYMENT, KIRKLAND LAKE

SECTORS	EMPLOYMENT
Mining	909
Residual	785
Locally-Consumed Community Services	3,281 *
TOTAL	4,975

* NOTE: This figure is overestimated by number of jobs in community that are linked to the residual and mining sectors.

of this study. Using these estimated final employment figures, it is possible to calculate a preliminary Comprehensive Community Impact Factor (C.C.I.F.) for use in the impact index.

It will be recalled that the final measurement value selected to represent the size and extent of a community's residual economic base

is the ratio of employment in the mining sector to that of the residual sector. Based on the figures given in Table 19, this ratio for the Town of Kirkland Lake is 1.16 (909/785).

3.4.3 COMMUNITY AMENITY FOR DIVERSIFICATION

3.4.3.1 Economic Isolation

Kirkland Lake is located on Provincial Highway 66, connecting the Town to Rouyn/Noranda to the east in Quebec (97 kilometers), Timmons to the north (137 kilometers), and North Bay and Toronto to the southeast (249 and 576 kilometers respectively) (see Figure 8). Toronto is considered the nearest metropolitan centre to the Town.

Kirkland Lake also has the six types of transportation that were outlined in the distance weighting system in Chapter 2. The distance to Toronto, in kilometers (576) is therefore divided by a factor of 6, resulting in a final measurement of 96.

3.4.3.2 Community's Current Ability to Diversify

The businesses that are included in this measure reflect only those that can operate independently of the mining sector. Five new independent businesses have started up in Kirkland Lake within the last twelve months. Four of these are manufacturing businesses, two in the area of wood items, one of dental instruments, and one of small leather accessories such as leather key chains. The fifth business is found in the Town's primary Tourist and Traveller industry - a new sixty-five room motel.

3.4.3.3 Community Planning and Initiative - development organizations and committees

Table 20 shows that Kirkland Lake has eight development organizations and committees. These organizations, while based in Kirkland Lake, are not limited to the development of Kirkland Lake itself - development efforts reach out and involve the smaller communities surrounding the Town. This type of "regional" development can be considered advantageous over development efforts at the local level because human, physical and financial resources may be pooled together and used more effectively.

It is noteworthy to mention that various roles in the community also contribute significantly to economic development and diversification in Kirkland Lake. For example, the Director of Planning and Engineering for the Town maintains the quality of the Town's infrastructure (e.g. roads, sewers, etc.) that in turn, plays a role in attracting and keeping businesses. The Museum Curator/Director also serves an important role in promoting tourism by bringing in people to view the Town's Museum of Northern History.

3.4.3.4 Community Planning and Initiative - municipal economic development budget

The Corporation of the Town of Kirkland Lake administers three Fund Operations - Revenue, Capital, and Reserve. The Reserve Fund, because its funds are channelled to the other Funds, is not included in the determination of the municipality's economic development budget.

TABLE 20

DEVELOPMENT ORGANIZATIONS & COMMITTEES IN KIRKLAND LAKE, 1987

DEVELOPMENT ORGANIZATIONS AND COMMITTEES	RESPONSIBILITY
KLEDA (Kirkland Lake Economic Development) Corporation	Federal Government
Community Futures	Federal Government
Futures Program	Provincial Government
Ministry of Northern Development and Mines	Provincial Government
Chamber of Commerce	Town of Kirkland Lake (members)
Tourist Committee	Town of Kirkland Lake (volunteer)
Economic Development Councils	Town of Kirkland Lake (volunteer)
Economic Development Commission	Town of Kirkland Lake (municipality)
T O T A L	8

The financial summary of Kirkland Lake's Revenue Fund Operations indicates that the actual budgeted funds for "Planning and Economic Development" in 1985 was $166,187.00. This money was used in the administration of the Town's Official Plan and zoning by-laws as well as the Economic Development Commission and Business Improvement Area. Miscellaneous funds of $169,181.00 were also made to various community

groups, including the Tourist Committee and in the operation of the Museum of Northern History. These funds together represented approximately 3% (.03) of the Town's Revenue Fund Operations.

With respect to the Capital Fund Operations, $14,776.00 was used for the Town's Business Improvement Area, or less than half of 1% (.003) of the total $5,212,466.00 actually budgeted in 1985. Collectively, these funds represented approximately 2% of the municipal budget. It should be noted that several other budget categories, such as Parks and Recreation or Air Transportation, could, to some extent, be considered an indirect contribution to the Town's pursuit of economic development.

3.4.4 SUMMARY OF VULNERABILITY INDEX

Table 21 provides a summary of the Vulnerability Index in terms of the different vulnerability components and their respective indicators, measurements and measurement values. As shown in this Table, it was possible to provide both a indicator measurement value and a vulnerability level for the indicators "company, mine and mineral complexity" and "mine competitiveness". The vulnerability level given to the latter indicator refers only to labour productivity of the Town's gold mine. The final vulnerability level can only be determined when a subscale for the Town's iron-ore mine has been developed and aggregated together with the one for the gold mine.

For the remainder of the vulnerability indicators shown, only a summary of the measurement values are shown. Only when additional em-

pirical data has been collected and analyzed will it be possible to develop subscales for these indicators and determine their corresponding vulnerability levels.

TABLE 21

VULNERABILITY INDEX - SUMMARY

COMPONENT	INDICATOR	MEASUREMENT	MEASURE-MENT VALUE	VULNERA-BILITY LEVEL
VULNERABILITY OF MINING INDUSTRY	Company, Mine & Mineral Complexity	typology of mines, minerals & companies	6	6
	Mine Competitive-ness	labour productivity	(gold) .31	1
	Mine Production Period	production period (weighted average)	14	
VULNERABILITY OF COMMUNITY TO LOSS OF MINING SECTOR	Residual Economic Base	mining sector to residual sector employment	1.16	
COMMUNITY AMENITY TO ECONOMIC DIVERSIF-CATION	Economic Isolation	distance to nearest metro-politan centre	96	
	Community's Ability to Diversify	number of new independent business starts	5	
	Community Planning & Initiative	development organizations & committees	8	
		municipal economic development budget	.02	

3.5 IMPACT MEASUREMENTS

3.5.1 COMMUNITY LEVEL

At the community level of impact, two components were identified - social and economic adjustment. Two indicators of social adjustment were identified - social maturity and a mobility factor. With respect to social maturity, three measures were selected; community age in family generations, old age dependency ratio, and male to female ratio. With respect to the mobility factor, the proportion of the community population falling into the 45-64 year age group was identified as a proxy measure of people's inertia to move away from the community. Each of these indicator measurements is identified below.

3.5.1.1 Social Adjustment - social maturity

Kirkland Lake was incorporated as the Township of Teck in 1919. Fifty-three years later, it was incorporated as the Town of Kirkland Lake. Consequently, there is the possibility of having at least three generations of a family living in Kirkland Lake. This is consistent with information obtained from KLEDC that indicates approximately 10% of the people in the community have been there for three generations, 30% for two generations, and 60% less than two generations.

Eighteen other mining communities in Canada are shown in Table 22 with their corresponding age measurement. On average, these communities have the potential to have families that have lived in them for approximately two generations. If the communities' ages are taken as a proportion of the average (2.20), a scale similar to the one devel-

TABLE 22

SOCIAL MATURITY - COMMUNITY AGE IN FAMILY GENERATIONS

COMMUNITY	YEAR ESTABLISHED	YEARS	FAMILY GENERATIONS	PROPORTION OF AVERAGE
Kimberley, B.C.	1892	95	4.75	2.16
Thetford Mines, Que.	1892	95	4.75	2.16
Timmons, Ont.	1912	75	3.75	1.70
Kirkland Lake,Ont	1919	68	3.40	1.54
Flin Flon, Mb.	1927	60	3.00	1.36
Noranda, Que.	1927	60	3.00	1.36
Virginiatown, Ont.	1937	50	2.50	1.14
Manitouwadge, Ont.	1938	49	2.45	1.11
Yellowknife, NWT.	1939	48	2.40	1.09
Lynn Lake, Mb.	1950	37	1.85	0.84
Chibougamau, Que.	1952	35	1.75	0.80
Schefferville, Que.	1954	33	1.65	0.75
Thompson, Mb.	1959	28	1.40	0.64
Pine Point, NWT.	1961	26	1.30	0.59
Ear Falls, Ont.	1966	21	1.05	0.48
Faro, Yukon	1968	19	0.95	0.43
Fermont, Que.	1970	17	0.85	0.39
Leaf Rapids, Mb.	1971	16	0.80	0.36
Tumbler Ridge, B.C.	1981	6	0.30	0.14
		TOTAL	41.90	19.04
		AVERAGE	2.20	1.00

SOURCE: Data for Year Established from Robinson,I.(1962) and Pressman,N.E.P.(1975)

oped for levels of vulnerability (gold mine competitiveness) can be developed. This scale, shown in Table 23, indicates that Kirkland Lake (measure - 1.54) would fall into the second highest impact level (2) for this particular indicator measure of social maturity.

The second measure of social maturity is the old age dependency ratio. The old age dependency ratio in Kirkland Lake is .26, indicating that older people have decided to retire in the Town. As shown in Ta-

TABLE 23

IMPACT SCALE FOR COMMUNITY AGE

IMPACT LEVELS					
HIGH		MEDIUM		LOW	
1	2	3	4	5	6
>1.66	1.66-1.34	1.33-1.00	.99-.67	.66-.33	<.33
INDICATOR MEASUREMENT VALUES					

ble 24, several other mining communities in Manitoba, Lynn Lake, Leaf Rapids, Flin Flon, and Thompson have old age dependency ratios of .05, .01, .23, and .02 respectively. Kirkland Lake and Flin Flon have similar ratios that would likely rank towards the "higher impact" end of a measurement scale for this indicator. Additional empirical data would help to verify this observation.

The last measure of social maturity is the male to female ratio. In Kirkland Lake this figure is .94. Again, in comparison to the four mining communities in Manitoba (see Table 24), Kirkland Lake is the only town with more women than men and would, therefore, tend towards the "high impact" end of a measurement scale.

3.5.1.2 Social Adjustment - mobility factor

The second indicator of social adjustment is the degree of personal mobility with respect to willingness (or ability) to move to a differ-

TABLE 24

COMPARATIVE STATISTICS ON MINING COMMUNITIES, 1981*

COMMUNITY CHARACTERISTIC	LYNN LAKE	LEAF RAPIDS	FLIN FLON	THOMPSON	KIRKLAND LAKE
Age of Community (numer of family generations)	1.85	0.75	3.00	1.40	3.40
Home Ownership as a proportion of Total Occupied Dwellings	.54	.51	.69	.54	.57
Old Age Dependency Ratio **	.05	.01	.23	.02	.26
Male/Female Ratio	1.14	1.08	1.05	1.12	.94

* Except for Age of Community, which is calculated for 1987
** Community's population 65 years and over/total labour force

SOURCE: Adapted from Statistics Canada: Catalogue 93-X-943 (1981), Manitoba Department of Municipal Affairs (1982), Linn and Stabler (1978), and KLEDC 1985 Census Report.

ent community or job. A proxy of a community's labour force in the 45-64 year age group is a community's population in the same age group. In Kirkland Lake, approximately 20% of the population falls in this age group.

When demographic characteristics of the town that have been used as indicator measurements are interpreted together, Kirkland Lake appears

to be highly mature community - one in which social ties to the community have been initiated and strengthened over time. In this type of community, it is expected that the desire to remain in the town would be strong among many of the community members.

3.5.1.3 Economic Adjustment - home equity

In Kirkland Lake, just over one-half of the occupied private dwellings were owned in 1981 (Statistics Canada). As shown in Table 24, in comparison to the other mining communities, only Flin Flon has a higher proportion of home ownership. Kirkland Lake would likely tend towards the middle range of a measurement scale. Again, additional empirical data would verify this possibility.

3.5.1.4 Economic Adjustment - municipal financial dependency

The Adams mine is located outside of the Kirkland Lake's municipal boundaries and therefore, only the Macassa mine contributes to the Town's municipal revenues through the real estate and business tax, approximately $85,000 per annum or less than 1% of the Town's total revenues. It is interesting to note that the mining company contributes less to municipal revenues than Extendicare, a home for the care of the elderly and developmentally handicapped.

3.5.2 REGIONAL LEVEL

3.5.2.1 Regional Service Dependency - regional service impact measurement

Figure 9 shows the communities that have been identified to be within the regional system of communities serviced by the Town of Kirkland Lake (i.e. Kirkland Lake Regional Service Area). Table 25 lists these communities, Kirkland Lake's service-export industries, and the dependency scale used in determining the final regional service impact measurement. Averaging the service categories results in a regional service impact measurement of 3.0. This measurement is interpreted to mean that, on average, the ten communities within Kirkland Lake's Service Area depend on Kirkland Lake for between one-half and three-quarters of the export-services provided. As 1.0 and 6.0 are, respectively, the maximum and minimum measurements, an impact scale can be developed directly. This would result in Kirkland Lake ranking 3, the third highest impact level with respect to regional service dependency.

Information on the communities within the Kirkland Lake regional service area was provided by KLECD. The specific dependency scores were determined on the basis of distance, size of community, and knowledge of the area.

3.5.3 USING THE C.C.I.F.

The C.C.I.F. is calculated by taking the community's mining sector employment over the community's combined residual and mining sector employment. Using the figures estimated in this case study, Kirkland

Lake has a C.C.I.F. of .54 (909/909+785), although as mentioned earlier, this can be interpreted only as a preliminary estimate because of the inability of this study to accurate identify the total employment figure in either of these sectors.

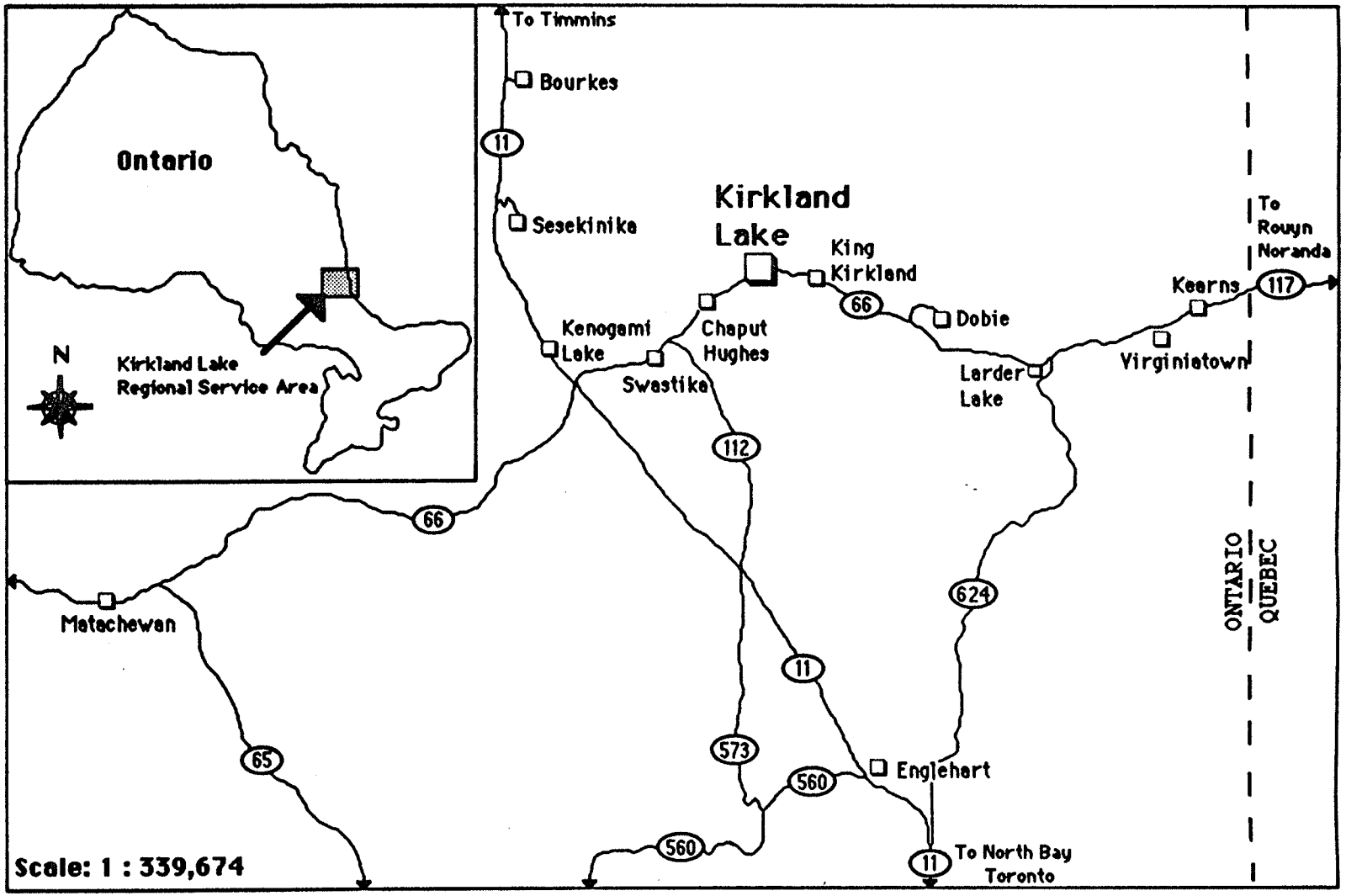

Figure 9: KIRKLAND LAKE'S REGIONAL SERVICE AREA

TABLE 25

KIRKLAND LAKE - DETERMINATION OF REGIONAL SERVICE DEPENDENCY - 1987

KIRKLAND LAKE REGIONAL SERVICE AREA -- COMMUNITIES	RETAIL TRADE	WHOLESALE TRADE	HOSPITAL SERVICE	POST - SECONDARY EDUCATION	PROV/ FEDERAL GOV'T SERVICES	COMMUNITY POPULATION (1981)
MATACHEWAN	2	1	1	6	1	444
KENOGAMI	2	1	1	6	1	105
KING KIRKLAND	2	1	1	6	1	284
DOBIE	2	1	1	6	1	146
LARDER LAKE	3	2	1	6	1	1084
ENGLEHART	4	3	4	6	1	1689
VIRGINIATOWN	4	3	1	6	1	1010
KEARNS	5	4	1	6	1	320
SESEKINIKA	2	1	1	6	1	68
BOURKES	4	3	1	6	1	52
SERVICE CATEGORY SCORE	3.5	2.5	2.0	6.0	1.0	TOTAL 5202

REGIONAL SERVICE IMPACT MEASUREMENT	3.0

DEPENDENCY SCALE:

0 - 9	percent dependent	- 6
10 - 24	percent dependent	- 5
25 - 49	percent dependent	- 4
50 - 74	percent dependent	- 3
75 - 89	percent dependent	- 2
90 - 100	percent dependent	- 1

* Dependency estimates provided by Kirkland Lake's Economic Development Commission

3.5.4 SUMMARY OF IMPACT INDEX

Table 26 provides a summary of the Impact index in terms of the two levels of impact identified, components, impact indicators, measurements, and measurement values. Where it was possible to provide a method of scaling the measurements, both a "raw" impact level and an impact level adjusted by the C.C.I.F. is given. The raw measurement given for the measurement, age of community, is the actual number of family generations possible for Kirkland Lake (3.4). It will be recalled that this figure was subsequently taken as a proportion of the average for eighteen mining communities (1.54 - see Table 22). This measurement value of 1.54 corresponds to a "raw" impact level of 2, the second highest impact level. However, after applying the C.C.I.F. to the measurement value (i.e. .54 X 1.54) an "adjusted" measurement value of .83 results. This adjustment measurement value now corresponds to a lower "adjusted" impact level of 4 (see Table 23).

It was not possible to determine an adjusted impact level for the regional service impact measurement because dividing the measurement (3) by the C.C.I.F. (.54) results in an adjusted measurement that does not conform to the original impact scale of 1 to 6. Within the scope of this study, it was not possible to develop a new scale for the range of "adjusted" measurements possible for this indicator.

At this stage in the development of the indices, the measurement values for the various other indicator measurements at the community level cannot be interpreted on a relative basis. These values only represent one of the empirical datum necessary to the development of the indicator subscales.

TABLE 26

IMPACT INDEX SUMMARY

LEVEL	COMPONENT	INDICATOR	MEASUREMENT	RAW MEASURE-MENT*	ADJUSTED MEASURE-MENT**	RAW IMPACT LEVEL***	ADJUSTED IMPACT LEVEL**
COMMUNITY	SOCIAL ADJUST-MENT	Social Maturity	age of community (family generations)	3.4	(1.54X.54) .83	2	4
			old age dependency ratio	.26			
			male/female ratio	.94			
		Mobility Factor	proportion of labour force in 45-65 year age group (population proxy)	.20			
NITY	ECONOMIC ADJUST MENT	Home Equity Base	home ownership as a proportion of private households	.57			
		Municipal Financial Dependency	mining company contribution to municipal revenues	.02			
REGIONAL		Regional Service Dependency	regional service impact measurement	3	(3/.54) 5.55	3	n/a

* Actual data for measurement
** Applying the C.C.I.F.
*** Without applying the C.C.I.F.

3.6 FEASIBILITY OF IMPLEMENTING THE INDICES

The success of implementing the indices is contingent on a community data base that is capable of providing information for the different indicator measurements. The Town of Kirkland Lake may not be representative of the typical mining community in that it has an established Economic Development Commission that maintains a detailed community data base in two documents - Kirkland Lake Business Directory and Fact Book. Moreover, these documents are updated annually. It is expected, however, that obtaining the necessary data from smaller communities would be facilitated simply because of their small size. For example, the number of new independent business starts in the community would not be difficult to identify and the identification of jobs linked to the mining and residual sectors simpler to trace.

It appears that a mail survey would be sufficient to collect the necessary information for the indicators, although there are qualifications to be made.

- Consent from a community representative would have to be obtained initially for participation in the survey. A reliable liaison person with the community is essential.
- It would likely be necessary to make follow-up phone calls to clarify information obtained. Detailed information may also have to be obtained from specialized agencies and organizations as was the case in Kirkland Lake.
- In larger communities, it may not be possible to accurately follow the linkages between industries. Every effort should, however, be made to identify the most important linkages. If linkages are not identified, this will result in an underestimation of the mining and residual sectors and corresponding overestimation of the locally-consumed community services sector. In turn, this will have implications for calculating the C.C.I.F.
- Finally, and most important, the indices cannot be implemented until the subscales have been fully developed using empirical data.

Chapter IV

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

The primary purpose of this study was to establish indices for single-industry communities that reflect the degree to which they are vulnerable to decline and the extent of impact from loss of their single industry. The study was limited to the examination of mining communities, resulting in the establishment of indices that are more suited to this particular type of single-industry community. Each of the study's four principal components is summarized briefly below, followed with general conclusions and recommendations.

4.1 SUMMARY - STUDY OBJECTIVES

OBJECTIVE 1 - IDENTIFICATION AND DESCRIPTION OF THE INDICATORS

Indicators reflecting the degree to which a single-industry mining community is vulnerable to decline and the extent to which this decline would impact the community and surrounding area were identified on the basis of supportive literature and logic (face validity). A detailed structure of the indices is presented below.

Vulnerability Index - Components & Indicators

Figure 1 illustrates the three major components that provide the basic structure of the vulnerability index:

1. vulnerability of local mining industry;
2. vulnerability of community to loss of mining sector; and
3. community amenity to economic diversification.

Each of these components of vulnerability is further defined in terms of representative indicators. The vulnerability of the local mining industry is represented by the indicators;

- company, mine and mineral complexity,
- mine competitiveness, and
- mine production period.

The existence of a

- residual economic base

was selected to represent the vulnerability of a community to loss of its mining sector. The extent of a community's residual economic base determines its ability to survive in the event of a decline in the single industry. The greater the residual economic base, the greater the community's economic resilience. Two categories of industries were identified to be within a community's residual economic base: "industrial" and "service-export".

The last component of vulnerability is represented by three indicators;

- economic isolation,
- community's current ability to diversify, and
- community planning and initiative.

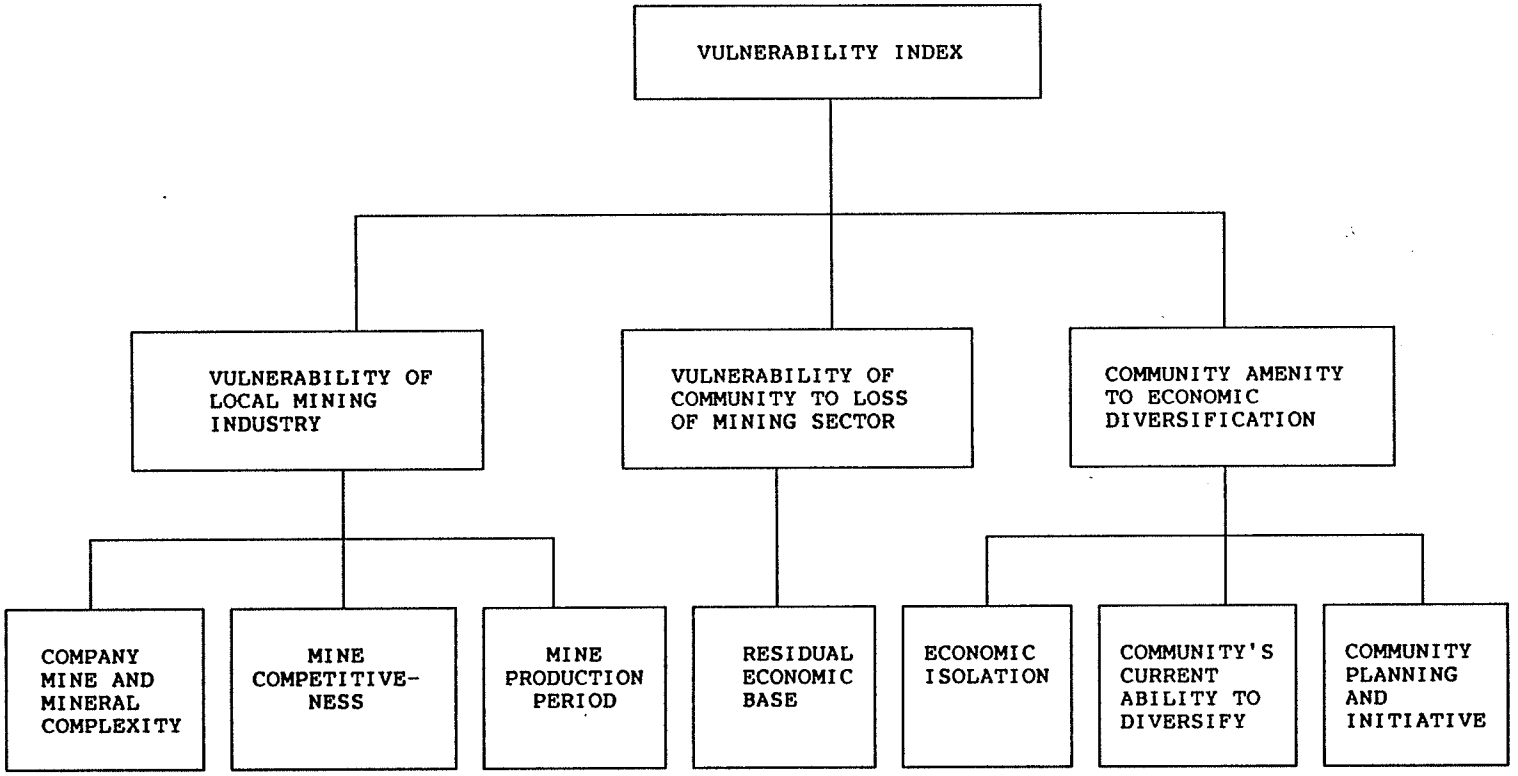

Figure 1: VULNERABILITY INDEX - COMPONENTS & INDICATORS

Impact Index - Levels, Components & Indicators

Figure 2 illustrates the structure of the impact index in terms of impact at the community and regional levels, components of community impact, and representative impact indicators. Two components of impact at the community level were identified;

1. social adjustment and
2. economic adjustment.

With respect to the first component of community impact, two indicators were selected;

- social maturity and a
- mobility factor.

Two indicators were selected to represent the second component of community impact;

- home equity and
- municipal financial dependency.

The indicator of impact at the regional level,

- regional service dependency

acknowledges the fact that a mining community, over time, may become part of a regional system of communities that provide and obtain goods and services from one another. A method for identifying a "regional service dependency measurement" was provided that incorporates the number and size of communities dependent on services offered by the mining

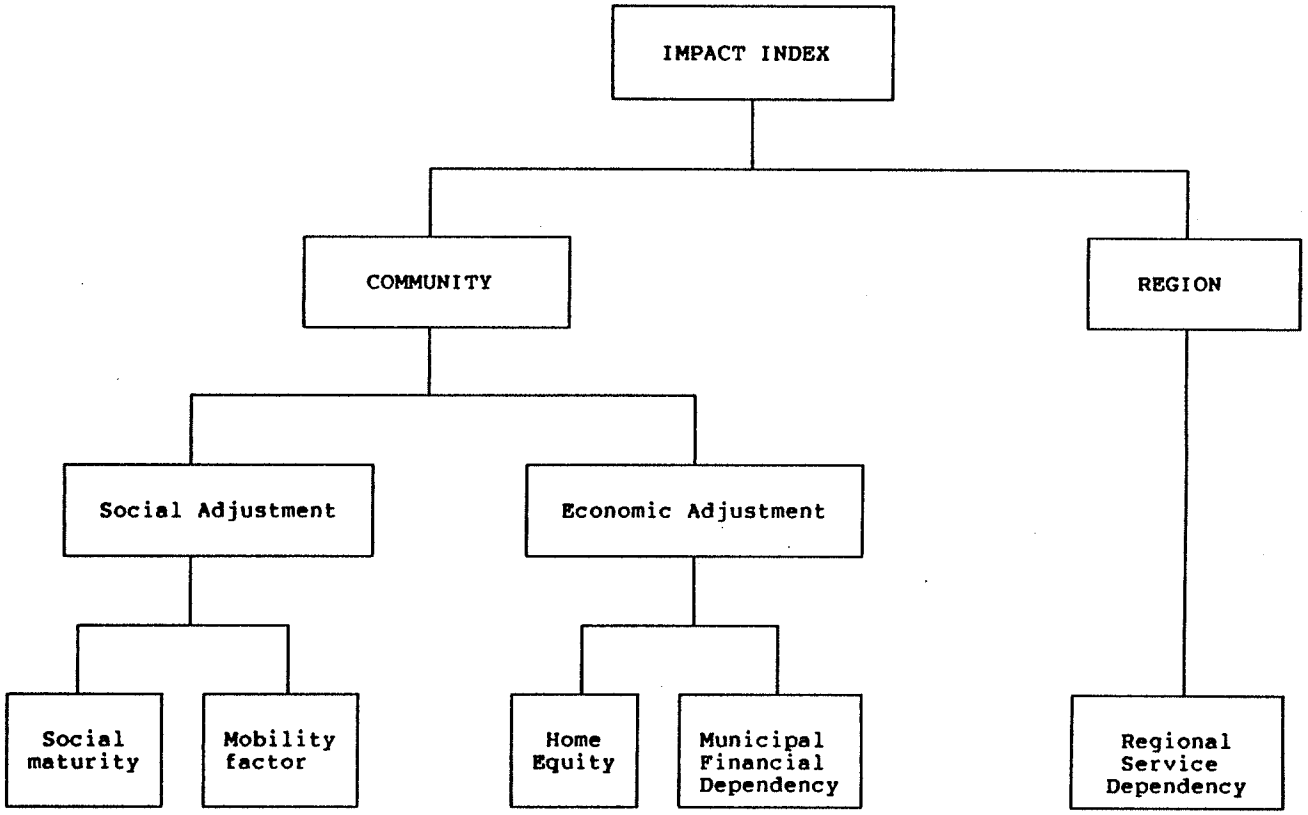

Figure 2: IMPACT INDEX - LEVELS, COMPONENTS & INDICATORS

community under study. A Comprehensive Community Impact Factor (C.C.I.F.) was determined to sensitize the various impact indicators to a community's dependency on the mining sector, the strength of its residual economic base, and the proportional employment relationship these sectors have on the locally-consumed community services sector.

The first step in making the concepts of community vulnerability and impact into operational indices was to quantify each of the indicators using one or two nominal measurements, such as years or proportions. To illustrate the time relationship between vulnerability and impact and to show that the two community dimensions are not mutually exclusive, an updated model of stages in community development was presented and is characterized in Figure 3.

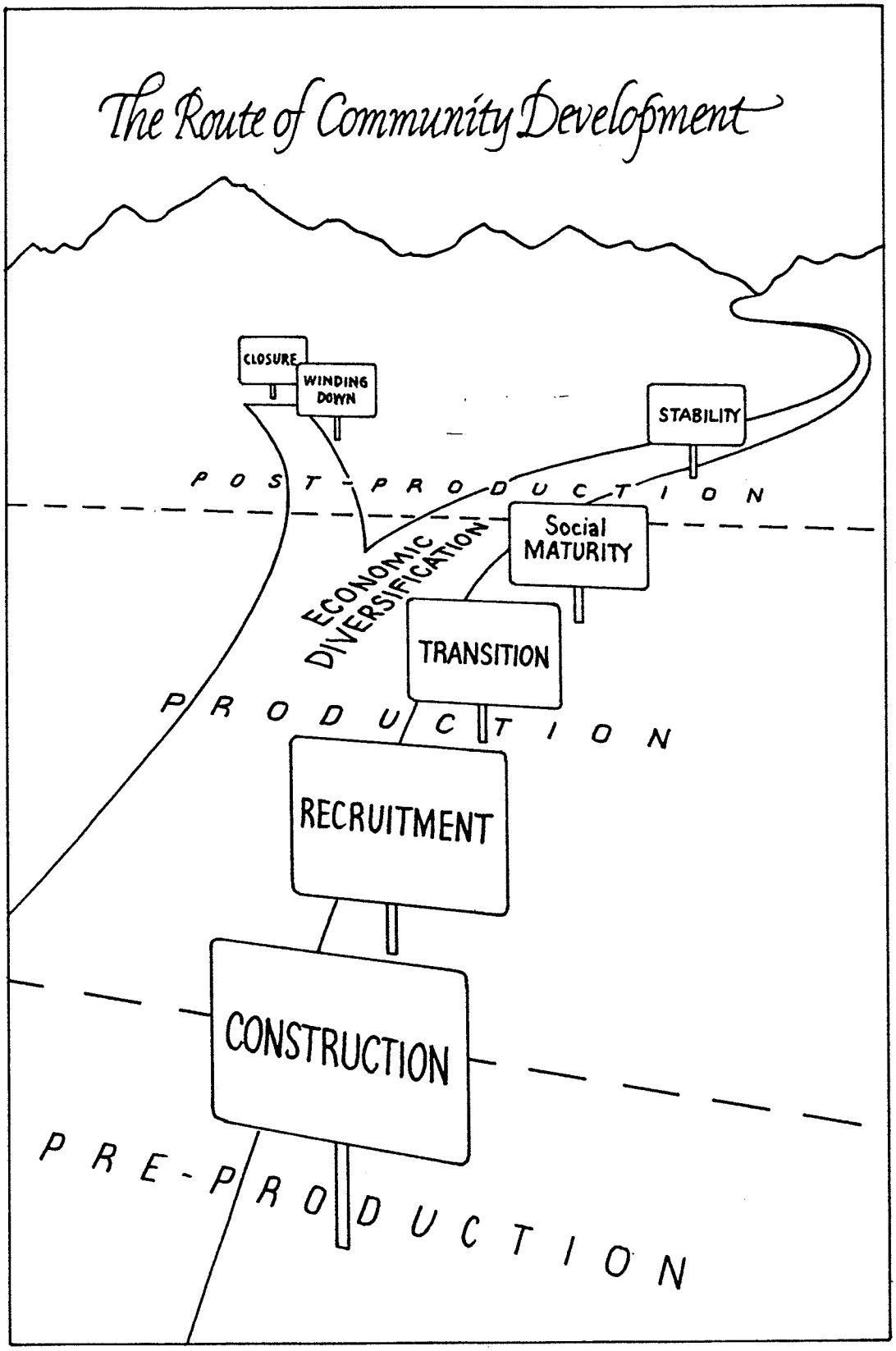

Figure 3: THE ROUTE OF COMMUNITY DEVELOPMENT

OBJECTIVE 2 - MAKING THE INDICES OPERATIONAL

A methodology for establishing levels of vulnerability and impact was suggested and left for interested groups to implement. This methodology requires additional study to determine ranges of indicator measurements (indicator scales or "subscales") that will become the benchmark measurements indicating levels of vulnerability and impact. Once the indices become fully operational, it would be possible to place a community in a vulnerability and impact matrix such as the one illustrated in Figure 4.

		VULNERABILITY		
		HIGH	MEDIUM	LOW
IMPACT	HIGH			
	MEDIUM			
	LOW			

Figure 4: MATRIX OF VULNERABILITY AND IMPACT

OBJECTIVE 3 - FEASIBILITY OF IMPLEMENTING THE INDICES

The feasibility of implementing the indices was tested using a community case study of Kirkland Lake, a mining community in northern Ontario. Factual information was obtained for each of the indicator measurements and sources of information documented. Although preliminary in nature, insight into making the indices operational was provided when, in several instances, a methodology for ranking an indicator measurement was implemented.

Based on the case study of Kirkland Lake, it was determined that it was feasible to implement the indices in terms of satisfying the data requirements for the various vulnerability and impact indicator measurements. If a mail survey is used to collect community data, it is essential that a reliable community liaison person be available. Personal phone calls may be necessary to clarify the information obtained in the survey and to obtain detailed information from specialized organizations. Community size is not expected to greatly affect the data collection process.

OBJECTIVE 4 - APPLICABILITY OF INDICES TO OTHER TYPES OF RESOURCE-BASED COMMUNITIES

As presented in this study, the indicators appear to be readily applicable to other types of resource-based, single-industry communities in all respects except for the first vulnerability component - vulnerability of the local mining industry. If appropriate indicators of

vulnerability for other industries (e.g. forestry, fishing) are established, the indices could be adapted.

4.2 CONCLUSIONS

Within the scope of this study, it was not possible to go beyond the actual identification and quantification of the vulnerability and impact indicators. Before the indices can become fully operational, it will be necessary to implement the methodology suggested for determining the indicator scales or "subscales". With further study, it may also be possible to improve on the methods used in this study for quantifying the different indicators.

4.2.1 THE INDICES - LIMITATIONS & UTILITY

The indices' limitations may be classified into two broad categories: those that are inherent in the character of the indices and those that can be eliminated with further study. All major limitations are in the latter category.

4.2.1.1 Inherent Limitations

Two inherent limitations of the indices are noteworthy. First, the measurements used to quantify the indicators are static measurements and can, therefore, provide only a snapshot picture of a particular community characteristic. This should not, however, be perceived as a major weakness of the indices because it must be expected that communities and their single industries will be continually changing over

time. In at least one way, the requirement of updating the indicators on a regular basis is actually beneficial because it provides a community with a "time series" of its progress or decline over time (i.e. development profile).

The second inherent limitation of the indices is that the various indicators may not be inclusive in one particular area, despite the fact that they are comprehensive in their coverage of community characteristics. It is important, however, to acknowledge the need to have a system that is practical from the point of manageability. For this reason, only indicators thought to be of significant areas of study in comparative analysis were considered.

4.2.1.2 Limitations Requiring Further Study

The second category of limitations refers to those that require further study. Three stand out in particular:

1. Future indices refinements - developing indicator subscales

   Before the indices can become fully operational, the fifteen indicator subscales must be developed from empirical data. Once these subscales are developed, it will then be possible to rank communities in accordance to their degree of vulnerability or impact. One of the benefits of the case study was that it provided insight into the amount of work that will be required to establish the indicator subscales.

2. Validation of indicators

   The validation of the vulnerability and impact indicators involves the study of several closed mining communities (e.g. Uranium City, Saskatchewan, Pine Point, Northwest Territories, Bissett, Manitoba, Schefferville, Quebec) to provide insight into how well the indicators actually represent the dimensions of vulnerability and impact.

3. Weighting importance of different indicators

Through the process of validating the indicators, insight into the need for a system to weigh the importance of the various indicators would be provided.

4.2.2 THE CASE STUDY - IMPLICATIONS FOR IMPLEMENTING THE INDICES

It is important to note that Kirkland Lake is a large community relative to many other mining communities. It has an Economic Development Commission that has been established for many years and which publishes, annually, a Fact Book and a Business Directory. Despite the obvious data collection advantages this level of organization has, it was still necessary for the community contact person to pull information from different community sources and for the researcher to contact specialized organizations directly. Although smaller mining communities may not have the same high level of organization regarding community information, it is expected that, because of size differences, efforts expended in data collection in smaller communities would be similar to efforts in larger communities and possibly even less complicated. This will have implications for developing specialized community data bases suited for implementing the indices - a large community would need to pull existing information from different sources while in a smaller community, the information collection process may have to be started from the beginning.

It was also noted in the case study of Kirkland Lake that not all of the community data came from the same year. This problem of time differentials between data collected for the different indicators would be avoided if communities were to establish specialized communi-

ty data bases for the data requirements of the indices. For example, if a community's annual municipal census was to include questions regarding homeownership characteristics, then the need to use Statistics Canada's census material (published every five years) would be avoided.

4.2.3 UTILITY OF THE INDICES

The purpose of establishing vulnerability and impact indices was to provide a planning tool that could analyze single-industry mining communities in terms of their vulnerability to decline and the extent to which this decline would impact a community and surrounding area. The level of risk associated with being a single-industry community was considered to be a function of three vulnerability factors - the stability of the local single industry, the presence of economic activities that are able to function independent of the single industry, and the community's physical and human amenity to economic diversification. It was also shown that, depending on the development of regional service linkages between communities, the impact of decline in a single-industry community would have implications beyond the community level.

The utility of the indices can be appreciated primarily from a planning perspective.

- First, using an index format provides a mechanism for conducting comparative community analyses that measure a community's situation relative to others.
- Second, implementation of the indices over time would produce a time series of an individual community's progress or decline in relation to both itself and to other communities.

- Third, by providing an early-warning system, the indices have the advantage of assisting in planning that can take place at either the community or government level. From the community perspective, the indices would help to increase the level of community awareness and provide lead time for planning through the early identification of community weaknesses and strengths. From the government perspective, the ability to define a community's situation relative to another would help in the difficult task of establishing priority amongst communities that are in need of social and economic adjustment assistance.

- Fourth, by utilizing the indicators, controvery over the appropriate definition of a single-industry community is avoided. Although initially, any community could be considered to be of a single-industry nature, following the application of the indices, the community would be defined in terms of its level of vulnerability and impact (i.e. level of risk associated with being a single-industry community).

4.3 RECOMMENDATIONS

RECOMMENDATION 1 - MAKING THE INDICES FULLY OPERATIONAL - TECHNICAL ASPECTS

It is recommended that further research be conducted to fully develop the indices for single-industry mining communities. In achieving this objective, empirical data would have to be collected in order to develop the fifteen subscales that constitute the underlying structure of the indices.

RECOMMENDATION 2 - INDICATOR VALIDATION

It is recommended that further research be conducted to validate the appropriateness of the indicators that were selected in this study to represent the community dimensions of vulnerability and impact. In conjunction with this task, the need to weigh the importance of the various indicators could be determined.

RECOMMENDATION 3 - PUTTING THE INDICES INTO ACTION

It is recommended that an organizational mechanism be put into effect which will facilitate the common use of the indices from both community and government planning perspectives. It is suggested that the forum for organization be used initially on mining communities and then extended for use in other types of single-industry communities. It appears highly probable that costs would be minimized and benefits maximized if the responsibility of data collection was placed in the hands of the individual communities and if co-operation between the communities using the system and the various responsible levels of government was achieved.

RECOMMENDATION 4 - FEASIBILITY OF EXPANDING THE INDICES - SOCIAL DIMENSION

It is recommended that further research be conducted to determine the feasibility of expanding the indices to include the social dimensions of industrial decline in single-industry communities, for example, unemployment and crime rates, alcoholism and drug abuse.

RECOMMENDATION 5 - APPLICATION OF THE INDICES TO OTHER TYPES OF SINGLE-INDUSTRY COMMUNITIES

It is recommended that further research be conducted to identify appropriate indicators to represent the vulnerability of other types of resource industries, to quantify these indicators and to establish their corresponding indicator subscales. Once these indicators are identified and quantified, the mining community model of vulnerability and impact indices would be fully applicable to other types of resource-based single-industry communities.

4.4 CONCLUDING REMARKS

Volatile economic conditions of the early 1980's and the impact they had on the people and fragile economies of Canada's resource-based single-industry communities clearly showed that the country was not prepared to deal with social and economic adjustment problems associated with periods of economic downturn. Current events - Canada's bargaining for a free-trade agreement with the United States, a historical crash on the world's stock markets, a sliding U.S. dollar, and the threat of another global recession just around the corner - illustrate the continued volatility of economic conditions and serve to reinforce the need to be prepared for the 1990's.

The indices that were developed in this study will assist both communities and government in planning for the future by providing a systematic method of analyzing the degree of vulnerability associated

with a single-industry community and the severity of impact from loss of the community's single industry before its actual demise. By helping to identify which "route of development" a community is taking, community leaders and government will be able to allocate scarce resources more efficiently and effectively in their efforts to minimize social and economic adjustment problems and to maximize community opportunities.

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