CUISR:

Community – University Institute for Social Research

DEVELOPMENT OF NEIGHBOURHOOD

QUALITY OF LIFE INDICATORS

by Yinshe Sun

Building Healthy Sustainable Communities

Community-University Institute for Social Research

CUISR is a partnership between a set of community-based organizations (including Saskatoon District Health, the City of Saskatoon, Quint Development Corporation, the Saskatoon Regional Intersectoral Committee on Human Services) and a large number of faculty and graduate students from the University of Saskatchewan. CUISR's mission is "to serve as a focal point for community-based research and to integrate the various social research needs and experiential knowledge of the community-based organizations with the technical expertise available at the University. It promotes, undertakes, and critically evaluates applied social research for community-based organizations, and serves as a data clearinghouse for applied and community-based social research. The overall goal of CUISR is to build the capacity of researchers, community-based organizations and citizenry to enhance community quality of life."

This mission is reflected in the following objectives: (1) to build capacity within CBOs to conduct their own applied social research and write grant proposals; (2) to serve as a conduit for the transfer of experientially-based knowledge from the community to the University classroom, and transfer technical expertise from the University to the community and CBOs; (3) to provide CBOs with assistance in the areas of survey sample design, estimation and data analysis, or, where necessary, to undertake survey research that is timely, accurate and reliable; (4) to serve as a central clearinghouse, or data warehouse, for community-based and applied social research findings; and (5) to allow members of the University and CBOs to access a broad range of data over a long time period.

As a starting point, CUISR has established three focused research modules in the areas of Community Health Determinants and Health Policy, Community Economic Development, and Quality of Life Indicators. The three-pronged research thrust underlying the proposed Institute is, in operational terms, highly integrated. The central questions in the three modules—community quality of life, health, and economy—are so interdependent that many of the projects and partners already span and work in more than one module. All of this research is focused on creating and maintaining healthy, sustainable communities.

Research is the driving force that cements the partnership between universities, CBOs, and government in acquiring, transferring, and applying knowledge in the form of policy and programs. Researchers within each of the modules examine these dimensions from their particular perspective, and the results are integrated at the level of the Institute, thus providing a rich, multi-faceted analysis of the common social and economic issues. The integrated results are then communicated to the Community and the University in a number of ways to ensure that research makes a difference in the development of services, implementation of policy, and lives of the people of Saskatoon and Saskatchewan.

Development of Neighbourhood Quality of Life Indicators

by
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ABSTRACT

Although sometimes regarded as a subjective or perceptual concept, quality of life (QOL) can be measured by objective indicators. Neighbourhood QOL measures the "liveability" of residential neighbourhoods. Based on a literature review, this study identifies eight quality of life domains and their subordinate dimensions. Considering data availability and applicability for the neighbourhood, a suite of indicators is suggested for Saskatoon neighbourhoods. A few housing indicators are examined for relevance to the study. Five other indicators are applied to a cluster analysis to identify groups of Saskatoon neighborhoods, revealing that a process of spatial polarization in the city during the early 1990s resulted in peripherally located middle class families and a disadvantaged inner city lower income group.

This study's results suggest that neighbourhood QOL indicators may be used to measure specific attributes and the overall status of liveability of neighbourhoods. Monitoring these measurements aids the planning and building of healthy communities. Use of such indicators allow comparison of different neighbourhoods by assessing their relative strengths and weaknesses. While the development of a neighbourhood QOL indicator system would greatly benefit the City of Saskatoon, this study indicates that some issues, such as how best to characterize the indicators and how to incorporate subjective measures, require further attention.

INTRODUCTION

Quality of life is both an old and new theme to individuals and society. Since the 1990s, quality of life has not only been an increasing concern to more Canadians, but also a goal that governments of different levels endeavour to achieve. As a notable example, the Speech from the Throne to open the Second Session of the 36th Parliament was titled "Building a Higher Quality of Life for All Canadians" (Governor General of Canada, 1999). While it was perhaps partially motivated by the United Nations' ranking of Canada as the most liveable country in the world, quality of life research has drawn much attention from research institutes to various organizations. For example, the Federation of Canadian Municipalities has developed the "FCM Quality of Life Reporting System" and generated annual reports that provide evaluations for eighteen of the largest municipalities in the country (Federation of Canadian Municipalities (FCM), 2001). The Canada Mortgage and Housing Corporation (CMHC) has also promoted several pilot case studies from which a set of quality of life indicators was determined

(Canada Mortgage and Housing Corporation (CMHC), 1996). A number of Canadian cities have also carried out similar or related research projects. The City of Saskatoon intends to develop its own quality of life indicators to monitor progress being made in the community. The objective is that these indicators will facilitate development of safe, vibrant, and attractive communities.

RESEARCH OBJECTIVES

The City Planning Branch of the City of Saskatoon has endeavoured for many years to reflect quality of life measures in its neighbourhood profiles. The city published the first of its Neighbourhood Profiles in 1984, and has since produced six editions available to the public (Planning and Building Department, 1998). Those volumes contain a wide variety of objective criteria that were mainly derived from censuses and presented basic development and demographic information on the city's residential neighbourhoods. A broad base of community and commercial groups has used the information for various purposes. While a new edition of the profiles is being created, it is imperative to review the measures being used so as to better reflect the quality of life status in the neighbourhoods in a changing socio-economic context. This research project is intended to develop an evaluative system of applicable neighbourhood quality of life indicators for the City of Saskatoon.

Quality of life has been the focus of policy concern for over three decades. However, it has been interpreted in a variety of ways by researchers with different perspectives and approaches. Therefore, the first objective of this research is to examine the nature of quality of life in a neighbourhood setting from the perspective of city planning and community development. This examination not only needs to investigate the themes and general approaches of quality of life, but to also recognize neighbourhood constraints. Only after the concept of neighbourhood quality of life is explicitly defined and well understood is it possible to further identify its domains and individual indicators.

The second and perhaps most important objective of this research is to create an evaluative suite of neighbourhood quality of life indicators. Although previous researchers have suggested several hundred indicators, how best to measure quality of life remains the central enquiry in the study. For this reason, the Community-University Institute for Social Research (CUISR) at the University of Saskatchewan has sought to develop its quality of life module, producing a number of interim reports. Meanwhile, the City of Saskatoon also intends to improve the indicator category to reflect changes in its neighbourhoods. It is expected that the indicators suggested in this research will better reflect Saskatoon's reality and provide valuable choices for the 7th edition of neighbourhood profiles.

The third objective consists of creating a database for data analysis and generating neighbourhood quality of life indicators. Given the availability of data sources, the census data for the 1990s were reorganized into a Microsoft Access database. Using

existing data, this research tests the appropriateness of some suggested indicators and analyzes their distribution in Saskatoon neighbourhoods. A comparison of some indicators between 1991 and 1996 was also made, identifying changing trends in the city. Meanwhile, this comparative analysis contains strong implications for necessary public policies and programs.

Structure of the Report

Neighbourhood quality of life indicators are developed so that city planners and other researchers can conduct data inquiries, mapping, and decision-making. However, the process of indicator development involves several aspects of inquiries, including conception of QOL model and domains, investigation of data availability, indicator construction, QOL data modeling, and database building. These components can be assembled into a diagram of research framework that explains the indicator development process (**Figure 1**).

This report's organization follows the development process. One part examines several fundamental concepts and determines the QOL domains. Another part reviews quality of life indicators suggested in existing studies and data availability, and then proposes a suite of neighbourhood QOL indicators for the City of Saskatoon. The third part focuses on trend analyses of selected indicators. While home ownership and housing affordability are examined, a number of identified socio-economic factors/indicators are employed in a cluster analysis to explore the pattern and change in the city's residential neighbourhoods. Finally, a concluding section summarizes this research and puts forward some issues that should be given attention in future study.

Neighbourhood Quality of Life: Basic Concepts

Neighbourhood quality of life studies must first examine two interconnected concepts that constrain indicator development: quality of life as the research theme to be investigated, and neighbourhood as a target or physical carrier of the theme. Scholars from different fields have variously interpreted this research theme in the literature. Quality of life is often examined in association with "community." Therefore, it is necessary to examine these fundamental concepts and the difference between community and neighbourhood before developing indicators.

Community

The prevalent use of community in quality of life research, perhaps, is because everyone belongs to a community of some sort. A sense of attachment to a particular community gives people an initial understanding of what the term means and helps them recognize the community's characteristics. The Merriam-Webster dictionary definition of community refers to "a unified body of individuals or nations having common social, economic and

Figure 1. The Framework for Understanding the Neighbourhood Quality of Life Research Project.
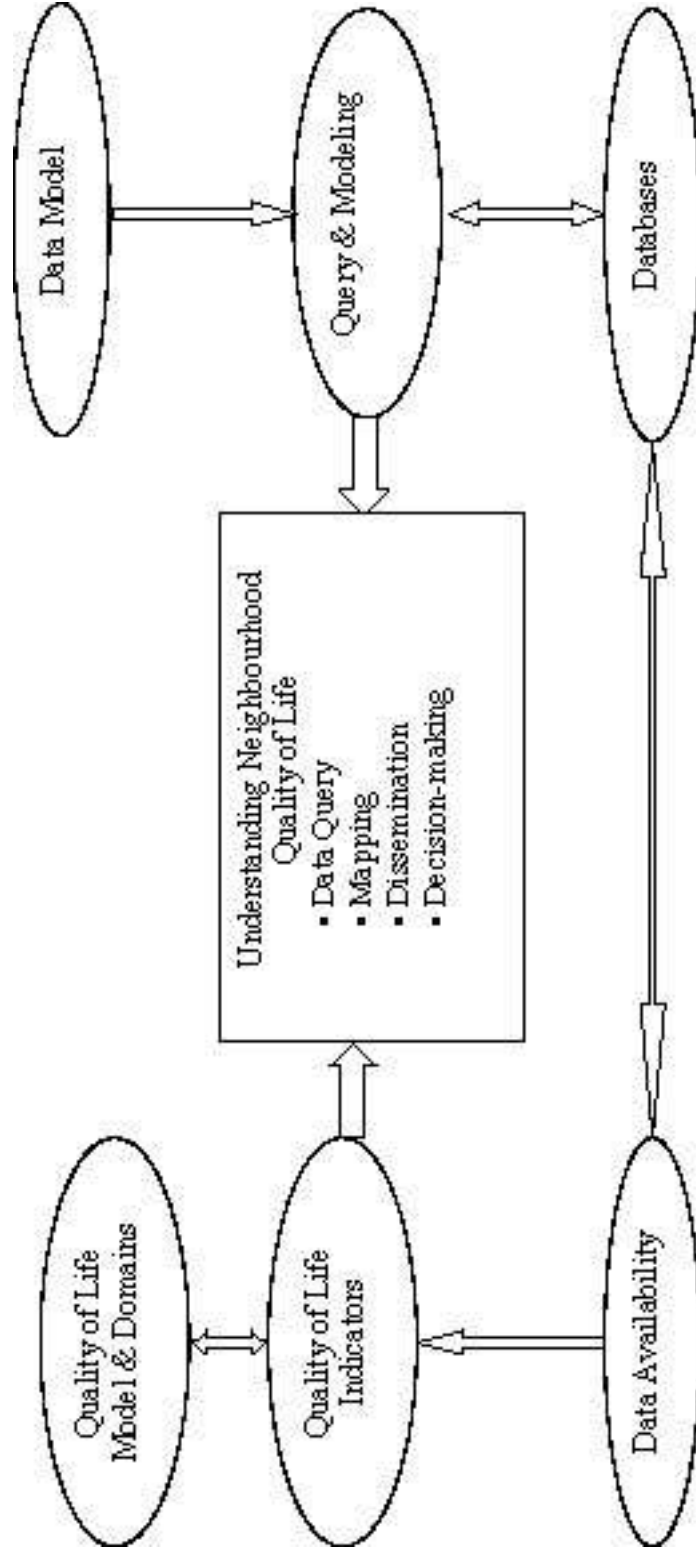
political interests." In the social sciences, a community usually denotes an interacting population of various kinds of individuals living in a particular area.

Still, the meaning of community is ambiguous, with numerous interpretations of the term. Sociologists consider it to be a society where people's relations with each other are direct and personal and where a complex web of ties links people in mutual bonds of emotion and obligation (Online Dictionary of the Social Sciences, n.d.). From the perspective of sustainable development, a community is defined as "a social group of any size whose members reside in a specific locality, share government, and often have a common cultural and historical heritage" (Hart Environmental Data, 1998). Contrary to social scientists who view the community as a non-spatial body of individuals with common interests or social concerns, geographers and urban planners often emphasize the spatial attributes of the community and examine the entity's spatial pattern and structure. Thus, cities and urban regions such as Census Metropolitan Areas are regarded as individual communities. More simply, this concept can be defined as "a group of people who live and interact in a specific geographic area" (Hart, 1999: 14).

More than forty years ago, George Hillery unearthed over ninety definitions of community in the social sciences, but found that the nearest he could get to a common agreement was the presence of some reference to: (1) area; (2) common ties; and (3) social interaction (Knox, 1987: 76). Given the multidimensional nature of this local social organization, communities exist where a degree of social coherence develops on the basis of interdependence, which in turn produces a uniformity of custom, taste, and mode of thought and speech. Hence, communities can be defined by reference groups that may be locality-, school-, or work-based. An alternative way of approaching communities is to focus on their functions. For example, the locational function of a community is related to the social and material benefits of its relative location, while its structural function is geared to the social outcomes of the community design. Therefore, community functions may be used to measure the well-being of its citizens.

While a community can be understood as a spatial or aspatial entity, community boundaries as a spatial entity may be of different forms—political, perceptual, functional, structural, or natural. Different types of community boundaries may overlap, and as a result individuals possibly find themselves living in many different types of communities at the same time (Hancock, Labonte, and Edwards, 2000: 5). Nevertheless, recognition of the geographic boundary as a property of the community is significant in policy-oriented studies because policies are always developed for and implemented within such boundaries.

NEIGHBOURHOOD

A neighbourhood can be defined as "what its inhabitants think it is" (U.S. National Commission of Neighbourhoods quoted in Knox, 1987: 78). An example of such an approach can be found in the *1991 American Housing Survey Questionnaires*, which

required respondents to define their neighbourhoods. The interviewee was asked to mark, based on personal observation, certain categories that described the area within 300 feet of the building in which the sample unit was located (United States Census Bureau, 1996: A-14). Some scholars insist that using this approach prohibits creation of a universal means of delineating the neighbourhood as a unit. Instead, neighbourhoods are identified for specific programmatic aims and by residents, local organizations, and government officials.

Like a community, a neighbourhood may be defined in a variety of contexts, but the common agreement of those definitions suggests the following properties:

> (1) a neighbourhood can be delineated, even though this delineation may be "a negotiated process" or merely perceived (Ley, 1983: 87-88);

> (2) a neighbourhood functions as an "open system" that links both horizontally and vertically to other systems;

> (3) instrumental relationships among neighbourhoods remain common and are fostered by residential stability. Such relationships in turn foster a sense of attachment to and participation in the neighbourhood; and

> (4) a neighbourhood is experienced and used differently by different populations (Hancock et al, 2000: 5-6).

Given these properties, neighbourhoods can be classified into different types. Immediate neighbourhoods are small and characterized by personal association, rather than interaction through formal groups or organizations. Traditional neighbourhoods are characterized by social interaction that is consolidated by the sharing of local facilities and use of local organizations. Emergent neighbourhoods are large, diverse, and characterized by relatively low levels of social interaction (Knox, 1987: 78).

It is clear that the above discussion suggests that both neighbourhood and community should be regarded principally as general terms for a cluster of interrelated situations referring to specific aspects of social organization (Knox, 1987: 76). Nonetheless, a neighbourhood is a place-based, local community that functions as "a forum for relationships through which information, services, and connection to broader networks and systems are shared" (Chaskin, 1997, quoted in Hancock et al, 1998: 5). In this sense, a neighbourhood is clearly a spatial construction or structure. Semantically, a neighbourhood possesses a greater degree of spatial quality than a community. It would be problematical for most people to think of the neighbourhood as a non-spatial term, but a community may refer to both spatial and non-spatial entity. Even though perceptions of neighbourhood may vary enormously among individuals in the size, density, and extent of participation, due to individuals' socio-demographic statuses and interpersonal

networks, they can always be delineated spatially. Moreover, this interpretation also denotes that a neighbourhood, when compared spatially to a community, tends to be associated with a locality in a smaller geographic scale. In summary, neighbourhoods are geographically localized communities that serve as the base for social and political action with respect to issues that affect quality of life.

It would also be more meaningful to define and measure the neighbourhood spatially. Indeed, neighbourhoods have been widely used in this way. In city planning, a neighbourhood is a small but relatively independent area where leisure services and schools are usually provided. It is also used as an official or semi-official term in government statistics. In the United States, it was defined as "a special-purpose entity delineated for the Census Bureau's 1980 Neighbourhood Statistics Program. Neighbourhoods have locally defined boundaries, and the Census Bureau treated them as sub-areas within a legally defined governmental unit" (United States Census Bureau, 1994: G-35). In Canada, though lacking an official definition, urban neighbourhoods usually refer to small communities whose geographic extents approximately match the Census Tracts (CTs) within a Census Metropolitan Area (CMA) or Census Agglomeration (CA). Such Census Tracts are initially delineated by a committee of local specialists, including planners, health and social workers, and educators, in conjunction with Statistics Canada (Statistics Canada, 1996b).

The above comparison suggests that the concepts of community and neighbourhood are common in the reflection of social interactions in certain areas, and that both can be spatially defined by their residents. Meanwhile, they should be distinguished in certain research contexts. Although exploration of the concepts perhaps increases the complexity for developing community quality of life measures, it surely enriches and strengthens our understanding that the neighbourhood, as a place-based local community, is the appropriate locus for such indicator development. At the same time, delineation of the neighbourhood by either official criteria or in consultation with the residents provides a means of bridging subjective and objective measures of quality of life.

QUALITY OF LIFE

Quality of life is to what everyone aspires and can be assessed on the basis of one's value and expectations. It has been widely used by professionals, governments, and local advocates to describe a variety of issues. The term quality of life usually refers to the degree to which a person enjoys the important possibilities of his/her life (Raphael, Brown, Renwick, Cava, Weir, and Heathcote, 1995). According to the Centre for Health Promotion (2001) at the University of Toronto, it includes three main areas:

Being: who one is, with physical, psychological and spiritual components

Belonging: connections to one's physical, social and community environments

Becoming: the day-to-day activities that a person carries out to achieve goals, hopes, and aspirations with practical, leisure, and growth aspects.

Cutter (1985) also defines quality of life as "an individual's happiness or satisfaction with life and environment including needs and desires, aspirations, lifestyle preferences, and other tangible and intangible factors" (Cutter, 1985: 1). In other words, quality of life is the extent to which an individual feels satisfied and is able to pursue and achieve those things that are important to him or her. In this sense, quality of life is determined by individuals' perceptions of their living environment.

In addition to the general definition, community or neighbourhood quality of life defines the examination within the context of a community or neighbourhood. This concept is often used to explore community factors, resources, and services that are observed by community members as factors influencing their life quality or assisting them in coping with each other (Raphael et al, 1995, quoted in Legowski, 2000: 113). Myers (1987: 108-109) writes that "a community quality of life is constructed of the shared characteristics residents experience in places (for example, air and water quality, traffic or recreational opportunities), and the subjective evaluations residents make of these conditions." Although individuals' subjective evaluations on the social and physical environments in which they live vary, their perceptions collectively or statistically reflect the level of environment conditions. Therefore, it is possible to use objective criteria to substitute subjective perceptions of individuals in the measurement of the overall environment conditions.

Quality of life is often used as synonymous to liveability (Myers, 1987:108). Using standardized data for comparing certain commonalities, many recent studies concentrate on comparisons of quality of life between cities. Liveability comparisons are valuable for serving the interests of citizens and businesses who are seeking prosperous locations. For example, *Today's Parents* ranked major Canadian cities by five criteria in terms of their relative suitability to raise a family (Waytiuk, 2001). In another well known study, the *Places Rated Almanac* employed twelve criteria to evaluate the livability of North American cities, and ranked Saskatoon the best small city in Canada (fifteenth in North America) (Savageau, 2000). It should be noted that such indicator-based studies essentially represent a means of measuring the quality of a place that can be used for city planning and policy-making purposes. Using these indicators, city planners could monitor the growth and conditions of neighbourhood, highlight the directions in which a course of action is needed, and formulate appropriate planning strategies and urban polices to improve neighbourhoods.

The significance of neighbourhood quality of life studies lies in policy-oriented decision-making. According to Myers (1987), the values in such studies are to provide: (1) citizens and businesses with comparisons of locations' liveability; (2) local governments and institutions with information for attracting new business; (3) local political debates with insight into over desired futures for a community quality of life; and (4) advocacy groups, and community groups, and associations with information on the quality of life of their members. In practice, local governments often use quality of life

research to develop a policy of positive territorial discrimination, by which the most deprived areas are designated to receive priority attention.

QUALITY OF LIFE MODELS AND DOMAINS

There are different approaches to quality of life study that represent varied understandings of the concept. These understandings provide alternative ways of generating and measuring quality of life domains and indicators, resulting in a number of quality of life models. Three such models can be identified from the existing literature. This section looks at the approaches and measurements presented in those models and evaluates their suitability for developing neighbourhood quality of life indicators in Saskatoon.

QUALITY OF LIFE APPROACHES AND MEASUREMENTS

Quality of life has been an interesting research theme in a number of disciplines for several decades, but it means different things for people from different areas (Morton, 1999: 7). A critical difference lies in the way that the concept is understood or the approach taken, which necessarily results in different content. Most quality of life studies have a focus of inquiry in economics, sociology, environmental science, psychology, and/or urban planning. The economic approach focuses on determining quality of life in terms of income and its impacts, while the psychological approach intends to evaluate individual perceptions on many aspects of life. The sociological approach is common to the psychological approach in many aspects, but it is also concerned with individuals' life satisfaction. Urban planners usually emphasize the overall quality of life in a community or neighbourhood, often comparing different urban areas according to a number of indicators that reflect the quality of life of urban residents.

Quality of life approaches are often simply grouped into two types with regard to their uses of objective or subjective indicators. Promoted by the introduction of quantitative methods and the social indicator movement during the second half of the twentieth century, the objective approach has been widely applied to quality of life research. This approach attempts to use "unbiased" objective criteria and quantitative data to measure the status of people's lives over time. Mostly using census and statistical data, the objective approach has obvious advantages, including data availability, comprehensiveness, and inter-community comparability. However, it is an indirect measuring method and the result depends on interpretation of the indicators. In contrast, a subjective approach uses direct measures on what people experience and perceive in their environment. Without an available data source, subjective approaches usually require greater effort in data collection.

The major difference between these two approaches is that objective indicators seek to indicate the material living conditions whereas subjective indicators measure people's perceptions of those conditions. Even though researchers may have a favourite approach,

most accept the basic assumption of behaviourism, that people's perceptions and their material conditions normally correspond to each other. However, a few researchers argue that quality of life is a subjective phenomenon and may or may not be related to desirable objective characteristics of the urban environment (Grayson, 1998: 1). They insist that quality of life is more appropriately measured by people's evaluation in the social and physical realms of their urban environments. Nonetheless, the subjective approach is imperfect. People being interviewed may have their own interpretations on the same subject and measure it with different emphases. Indeed, most researchers now believe that these two approaches can make up for the defects of the other, and that both are integral parts of the overall measurement. It would be more appropriate that the neighbourhood quality of life study combines residents' subjective evaluation of their places and the objective measurement of the utilitarian criteria (Cobb, 2000: 27).

QUALITY OF LIFE DOMAINS

The concern about the objective approach is not the method itself, but what aspect of the environment is to be measured. Good objective indicators should collectively describe the most important dimensions of the environment in which people live and work. The environment that people experience can be depicted from various perspectives, each representing a specific facet of their lives. Therefore, quality of life domains should be defined broadly enough to include the most important aspects of the living environment.

The domains can usually be determined through a logical process of decomposing the general goal of quality of life. Indicators can then be developed by further breaking those domains down into measurable elements. While each indicator is a specific measure of an identified domain that represents a major area of people's life, together they systematically depict the overall status of quality of life. One such example can be found in *The Geography of Social Well-Being in the United States* (Smith, 1973). Using an urban social geography perspective, Smith identified six major criteria/domains of quality of life—economic status, environment, health, education, social disorganization, and participation and equality (**Table 1**). He further broke these domains into more detailed concerns and finally developed forty-eight quality of life indicators.

Drawing from a variety of sources, Beesley and Russwurm (cited in Morton, 1999) identified a number of domains common to most quality of life studies. The literature that they referenced included the United Nations' level of living; Drewnoski's development of living index; Smith's criteria; Harvey's list of needs; Hagerstrand's notion on liveability; and Shulman's study on quality of life of Canadian medium-sized cities (see Morton, 1999: 24-25). To distinguish the two major approaches employed in those studies, they used objective QOL criteria and subjective QOL domains. The identified criteria or domains included education, leisure, health, employment, transportation, social environment, security, physical environment, and social opportunity/participation. It is interesting that they ranked those criteria and domains according to their use in the

literature—that is, some domains are often considered to be more important than others (**Table 2**). These statistics imply that quality of life domains have unequal significance to the overall evaluation, and should be weighted differently if they are to be aggregated into one measure.

Table 1. Smith's (1973) Criteria/Domains of Social Well-Being.

Economic Status	Environment	Health	Education	Social Disorganization	Participation and Equality
• Income • Employment • Welfare	• Housing • Streets and sewers • Air pollution • Open space	• General mortality • Chronic diseases	• Duration	• Personal pathologies • Family breakdown • Overcrowding • Public order and safety • Delinquency	• Democratic participation • Equality

Source: Simplified from Knox (1987:142).

Table 2. Major Quality of Life Objective Criteria and Subjective Domains.

Rank	Criteria	Rank	Domain
1	Education Leisure	1	Housing Health Job Leisure/Spare time Activities
2	Health, Medical Care	2	Neighbourhood Standard of Living
3	Work Employment Transportation Social environment	3	Family Life
4	Consumption, Savings Physical Environment	4	Education National Government Financial Situation
5	Food, Nutrition Social Security Safety, Justice Social Opportunity/Participation	5	Friendship Marriage Life in Nation
		6	Housework Town/City

Source: Beesley and Russwurm, from Morton (1999: 24).

THREE QUALITY OF LIFE DOMAIN MODELS

Varied approaches for determining quality of life domains and indicators result in different models. Depending on the determining process and what data are being generated, three typical models can be identified from the literature. The first and most frequently used one is a systematic-theme quality of life domain model. This model represents a top-down process through which quality of life domains can be systematically decomposed from the general goal. In this model, each domain corresponds to a compensatory theme or dimension of the goal of life, and together they completely make up the general goal of life. Therefore, development of the domains involves a process to disaggregate the components of quality of life and reorganize them into a hierarchical system. Most existing studies can be ascribed to this model. Rooted in psychology and sociology, this model has an advantage in its potential to develop a generally applicable domain system and universal indicators. However, it also risks mechanically introducing some unnecessary domains and indicators when being applied to a specific area.

Quality of life domains can also be developed on a citizen-driven public concerns model. This model sifts and generalizes public opinions on a wide array of issues and defines and utilizes only those most importantly concerned as quality of life domains. A recently released case study by the Canadian Policy Research Network exemplifies this model (Canadian Policy Research Networks (CPRN), 2001). Using qualitative surveys and interviews, the CPRN study identified nine domains through sifting from issues with the greatest public concern (**Table 3**). In contrast to those developed with the systematic-theme model, this model's domains reflect a society's imperative matters, but they are not necessarily compensatory to make up the general quality of life goal. Besides, the issues of public concerns with higher weights are given more attention in a QOL study.

Different from these other two, the Community-Oriented Model of the Lived Environment (COMLE) was developed by CMHC in 1992 (revised in 1996). As a more workable alternative, the COMLE model was derived from a study, "Towards a Liveable Metropolis," by the Metropolitan Toronto Planning Department (CMHC, 1996: 3). Acquired from the Liveable Metropolis, this model incorporates four interrelated components of liveability: economic vitality; social well-being; environment integrity; and cultural congruence. These are utilized in eight domains of the conceptual framework (**Figure 2**). Essentially, the COMLE model is based on an assumption that government functions to improve the overall quality of life for all citizens, and it looks at the ways that secotoral policies and programs initiated by the government are accomplished. The policies and programs referred to in this model are typical functions of and executed by separate departments within a municipal government.

OPTIONS FOR THE CITY OF SASKATOON

The three models are distinct from one another in the way that quality of life domains and indicators are generated, but they provide valuable options. Their advantages and disad-

vantages are obvious and each is more suitable than the others in specific circumstances. Targeting hot issues via public opinions, the citizen-driven public concerns model has the advantage of revealing and facilitating the solving of current problems. Therefore, it is very useful for policy-oriented study and relevant policy making. The systematic-themes model determines quality of life domains through a top-down decomposing process, by which it intends to develop a system of universal indicators. Given its completeness in covering all dimensions of human needs, it has an integrated theoretical framework and more significance for academic purposes. Unlike the other two, the COMLE model intends to match government agencies/programs to quality of life domains. Because it emphasizes the government's functionality for improving quality of life, the COMLE model appears to be more workable than the other two for this study.

Table 3 summarizes the quality of life domains in six selected prototype studies that exemplify all three models. The first three, which are similar and can be categorized into the COMLE model, resulted in compatible quality of life domains, although they have modified the model in the case studies to reflect their socio-economic contexts and local concerns. The FCM report and Morton's study are closer to the systematic-theme model, even though they proposed incomplete domain categories, perhaps due to data unavailability. Together with the CPRN study, a typical public-concerns model, they all provide interesting results. Comparison of these studies found that several quality of life domains, such as housing, employment, and health, which were unexceptionally selected in all cases, reflected people's common recognition in the understanding of quality of life. Safety and education are also well-accepted domains in most studies. Therefore, these quality of life domains were also chosen for this study. Meanwhile, those studies disagreed in other aspects, as various terms were used to describe similar things or like terms referred to different things. The disagreement requires compromises to be made among them to generalize new themes, which are expected to include all-important subjects and develop more systematic quality of life domains. For example, environment and land-use are often considered separately. But at the neighbourhood level, land-use as an immediate environment factor has more significant impacts on people's living than those indicating ecosystem or environment pollutions. Through comparison and generalization, eight quality of life domains were chosen for the study of Saskatoon neighbourhoods, including housing, health, employment and income, land-use and environment, crime and safety, education, social environment and services, and community participation. It should be noted that these domains might not have exactly the same contents and meaning as those used in other literature, even though the same term might be used. Determination of quality of life domains provides the content for indicator development, but it also requires reviewing the necessity and availability of individual indicators.

Table 3. Quality of Life Domains Defined in the Selected Prototype Studies.

CMHC (1996)	Quebec City (1993) (CMHC, 1996)	City of Toronto (1993) (CMHC, 1996)	FCM (2001)	Morton (1999)	CPRN (2001)
• Housing • Recreation • Crime and Safety • Employment /Commerce • Health • Education • Environment • Social Welfare • Community Life	• Housing • Land Use • Transportation • Recreation and Culture • Public Security • Employment and Commerce • Health • Education • Natural Environment • Social Well-Being	• Housing • Transportation • Safety and Security • Economic Life • Community Health • Education • Environment	• Quality of Housing • Community Safety • Quality of Employment • Health of Community • Community Stress • Community Participation • Community Affordability • Population Resources	• Housing • Access / Mobility • Leisure / Spare Time • Security • Work / Employment • Health • Education • Environment Quality / Neighbourhood • Social Environment / Stability • Social Opportunity / Participation • Consumption / Financial	• Political Rights and General Values • Economy and Employment • Health • Education • Environment • Personal Well-Being • Community • Social Programs • Government

Quality of Life Indicators: A Review

Quality of life indicators are a useful monitoring tool and have been widely used for various purposes. Because numerous studies have involved quality of life indicator development, it is necessary to review the literature, in particular those closely related to this study, including Guide to Sustainable Community Indicators (Hart, 1999), the FCM Report (FCM, 2001), the COMLE Model (CMHC, 1996), and Housing Indicators Study (City of Saskatoon, 2001). For each of the identified quality of life domain categories, this section reviews those objective measures that have been suggested in the literature. The primary objective of this review is to find the common dimensions and criteria of each domain addressed in those studies, from which preferable candidate indicators would be suggested for this research.

Housing Indicators

Housing is one of the basic human needs for well-being, the securing of which is fundamental to our quality of life. In many communities, including Saskatoon, housing issues continue to be identified as key concerns from a variety of sectors and interests.
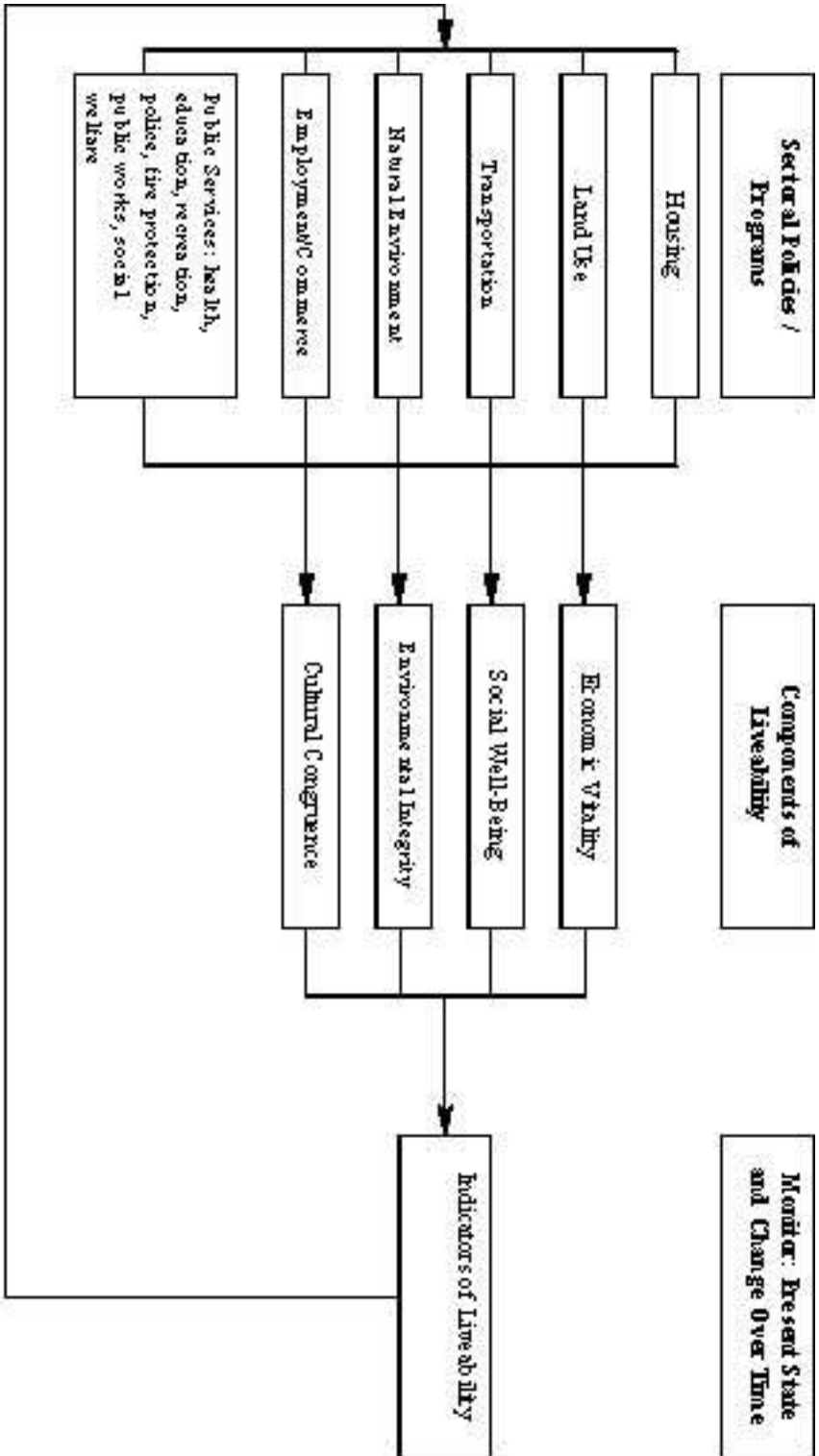
Figure 2. A Community-Oriented Model of the Lived Environment.

Source: CMHC (1996: 5)

Because housing costs remain the single largest ongoing expense for most families, the availability and quality of housing are vital to their personal and family decisions and therefore will influence their quality of life.

The housing domain consists of several dimensions that reflect different facets of the housing issue. Most studies emphasize the dimensions of affordability, availability (or adequacy), and quality (or liveability), which together are essential to measure whether and how people's housing needs have been matched. Affordability measures the average cost of accessing a house related to available income, while availability intends to provide the capacity of existing housing stock to meet demographic need. Quality or liveability usually refers to the condition of and amenities provided by existing housing stock. A few studies also draw attention to environmental integrity, safety, stability, and accessibility. These dimensions are indeed important with regard to human need for housing, and should be considered if information can be obtained and more indicators selected. The COMLE model regards the "vitality of housing" as an important housing dimension, intending to interpret the role that housing plays in a community's economy. This dimension is suitable to inter-city comparison or historical trend analysis at the municipal level because housing is an important sector of the local economy. However, it would not be appropriate for use at the neighbourhood level because most housing construction usually occurs in newly developed fringe areas. Therefore, this dimension (as well as its comprised indicators) often has more impact on suburban neighbourhoods than those of the inner city.

Table 4. Dimensions and Indicators of Housing Domain.

The COMLE Model (1997) (CMHC, 1996)	FCM (2001)	Morton (1999)	City of Saskatoon (2001)
Economic Vitality - Housing Social Well-Being - Affordability; Liveability; Quality; Accessibility Environment Integrity Density	Affordability Availability Quality	Availability and Incidence of Housing Types Quality and Liveability of Housing	Safety - Housing in compliance Stability - Availability of social housing Stability - Availability of rental housing Stability - Economic segregation Adequacy - Overcrowding Adequacy - Age of housing

HEALTH INDICATORS

Health status is vital to human beings and has direct impacts on their quality of life. Most studies focus on two dimensions, health statistics of the population and health service provision. However, researchers often give more attention to the former than the latter,

which can be found in those referenced literature as well as other studies (**Table 6**). A recent study conducted jointly by Statistics Canada and the Canadian Institute for Health Information identified a multi-dimensional framework for health indicators. To support

Table 5. Housing Indicators Chosen in the Prototype Studies.

FCM (2001)
1. Average rent of a 2-bedroom apartment as a percentage of median non-family person income 2. Average rent of a 2-bedroom apartment as a percentage of median family income 3. Vacancy rate (%) 4. Housing starts 5. Average price of single family dwelling 6. % Households whose gross rent >= 30% of income 7. % Substandard units in total occupied private dwellings 8. Real estate sales per capita
COMLE Model (CMHC, 1996)
1. Employment: Housing units built per annum 2. Employment: Value of building permits-average value per capita per annum 3. Affordability: % tenants who spend 30% or more household income on gross rent 4. Affordability: % owner occupants who spend 30% or more of household income on principal, interest, taxes, and utilities 5. Affordability: Average price of serviced residential lots ($ and % of average price of house) 6. Suitability: Average # of persons per bedroom, or below the more refined National Occupancy Standard 7. Adequacy: % dwellings in need of major repair 8. Accessibility: Waiting time for those in need - access to subsidized housing 9. Accessibility: % total stock made up of social housing units 10. Accessibility: Vacancy rates, especially if available by price range of stock 11. Accessibility: Supply of serviced residential land coming on stream to meet future demand 12. Homeless: Any available estimates of homeless persons (taking into account weaknesses in data) 13. Homeless: Changes in occupancy rates of shelter beds, using a moving 12 month average for example 14. Advocacy: % Households participating in residents or ratepayers associations 15. Density/Design: Population density - # of persons per sq. km in residential areas 16. Density/Design: Gradient density - difference in density between inner and outer suburban areas 17. Density/Design: Average lot size
City of Toronto (1993) (CMHC, 1996)
1. Value of building permits: Residential and mixed use 2. Renters who cannot afford to live in the city 3. Owners who cannot afford to live in the city 4. Percentage of dwellings in need of major repair 5. Waiting time for subsidized housing 6. Number of homeless people 7. Percentage of households participating in residents or rate payers associations 8. Population density 9. Heat loss of residential building

Table 5. Housing Indicators Chosen in the Prototype Studies (cont'd).

Morton (1999)
1. % rental housing 2. % owned housing 3. % single-detached housing 4. % semi-detached housing 5. % row housing 6. % apartment, detached duplex 7. % apartment building with greater than five stories 8. % apartment building less than five stories 9. Average value of dwelling 10. % housing requiring regular maintenance 11. % housing requiring minor repairs 12. % housing requiring major repairs 13. Average number of rooms per dwelling
City of Saskatoon (2001)
1. Safety-Housing in Compliance: Total housing stock within Saskatoon in compliance with current regulations over total housing stock 2. Stability-Availability of Social Housing: Number of subsidized housing units/ person *or* number of singles and families on waiting lists for social housing/ subsidized housing. 3. Stability-Availability of Rental Housing: CMHC vacancy rates 4. Stability-Economic Segregation: Change in average household income by neighbourhood compared to change in income for City *or* change in household population by neighbourhood compared to City as ranked by average income 5. Adequacy-Overcrowding: Median floor area (sq.)/ average number of persons per room 6. Adequacy-Age of Housing: Age of housing 7. Affordability-Ownership: Median house price over median income 8. Affordability-Rental: Median priced 2 bedroom apartment rent over median tenant income 9. Affordability-Low-Income: Percentage of social assistance recipients paying rent in excess of shelter allowances

health regions in monitoring the health system, the framework contains four dimensions: (1) the overall health status of the population served—well-being, health conditions, human functions, and deaths; (2) non-medical determinants of health—health behaviour, living and working conditions, personal resources, and environmental factors; (3) health system performance—accessibility, appropriateness, effectiveness, efficiency, and safety; and (4) community and health system characteristics (Statistics Canada, 2000).

EMPLOYMENT/INCOME INDICATORS

Employment and income are interlinked issues and are therefore defined as one domain. From the economic perspective, employment is the most important component toward quality of life because it provides the source of income or economic base for people's lives. Low income or insufficient financial provision directly leads to deprived quality of life because it is a barrier for people to acquire adequate housing, obtain better health

and education, and participate in entertainment and other social activities. Employment is also an important means for people to develop social networks and be involved in society. For many, employment may also bring them psychological satisfaction in terms of providing an opportunity to demonstrate their abilities and have a feeling of achievement.

Table 6. Health Indicators Suggested in Prototype Studies.

FCM (2001)
1. Infant mortality rate per 1,000 live birth
2. % of single births less than 2,500 grams to total single births
3. Crude premature mortality rate per 100, 000 population
4. Hospital discharges: Crude rate per 100,000 population
5. Hours lost due to illness or disability as a percentage of total actual hours worked at all jobs

COMLE Model (CMHC, 1996)
1. Availability: # hospital beds per capita
2. Availability: % acute & chronic care hospital beds per capita
3. Availability: # physicians per capita
4. Availability: # community care centres or beds per capita
5. Availability: # public health workers per capita
6. Incidence: Infant mortality rate
7. Incidence: % low birth rate -infant born weighing <2500gm
8. Incidence: Age adjusted mortality rates for men and women
9. Incidence: Suicide rate
10. Incidence: # worker compensation claims
11. Advocacy: % community representatives on local health boards

City of Toronto (1993) (CMHC, 1996)
1. % households using food banks
2. Mortality by neighbourhood
3. % activities limited by disability
4. % who missed work for health reasons
5. % who identified obstacles to health care
6. Infant mortality rate
7. Potential years of life lost (PYLL)
8. % community reps on health beds
9. % who smoke
10. % who consume alcohol
11. % who abuse drug
12. % who practicing safe sex
13. % physically active

Hancock et al (2000)
1. Health Promoting Behaviour: Proportion of regular smoker over age 12
2. Disability/ Morbidity: Low birth weight
3. Mortality: Life Expectancy
4. Mortality: Infant mortality rate
5. Mortality: Suicide rate

Table 6. Health Indicators Suggested in Prototype Studies (cont'd).

Sustainable Community (Hart, 1999)

1. Access to Care: Emergency room use for non-emergency purposes
2. Access to Care: Percentage of people identifying obstacles to obtaining health care
3. Children: Asthma hospitalization rate for children
4. Children: Infant mortality
5. Cost: Health care as percent of income
6. Cost: Health care cost relative to total state/local expenditure
7. Cost: Total health care expenditures
8. Disease: Death from stroke per 100,000 population
9. Disease: Deaths from lung cancer per 100,000 population
10. Disease: Deaths from stress and immune system failures
11. Disease: Health limitations on school/work/activity
12. Disease: Deaths from heart disease per 100,000 population
13. Disease: Deaths from all cancers per 100,000 population
14. Disease: Syphilis cases per 100,000
15. Disease: AIDS cases per 100,000
16. Disease: Breast cancer deaths per 100,000 women
17. Disease: Tuberculosis cases reported/100,000 population
18. Drug Use: Density of alcohol outlets in certain areas
19. Drug Use: Number of alcohol outlets per capita
20. Drug Use: Percent of population who smoke
21. Drug Use: Alcohol and drug use reported by youths
22. Drug Use: Cigarette use by youth at grades 5, 7, 9, 12
23. Drug Use: Cocaine use by youth at grades 5, 7, 9, 12
24. Drug Use: Death rate per 100,000 related to tobacco and alcohol
25. Drug Use: Percent of population who use illicit drugs
26. Drug Use: Police incidents related to alcohol & other drugs
27. Fitness: Healthy diets for children
28. Fitness: Life expectancy
29. Fitness: Perceived quality of life
30. Fitness: Percent of population who are physically active
31. Fitness: Student fitness test scores
32. Fitness: Percent of people who eat 5 or more servings of fruits and vegetables per day
33. Insurance: Percent of population covered by health insurance
34. Insurance: Number of households with at least 1 uninsured member
35. Insurance: Number of children without health insurance
36. Mortality: Deaths per 100,000 population ages 0:64
37. Pregnancy/Birth: Percent of women receiving adequate prenatal care
38. Pregnancy/Birth: Low birth weight infants

Existing studies usually devise indicators of this domain in four dimensions: employment rate; type of employment; employment equity; and income status. Employment/unemployment rate is often used to indicate labour force participation in various socio-economic activities. Different types of employment, such as permanent, temporary, self-employed, full-time and part-time, and/or occupation composition reflect the population's employment structure. Employment and income equity is often concerned with particular measures of "minor" groups—youth, women, visible minority, and Aboriginal. A few studies also consider the absolute and relative income levels, low-income families, hourly earnings, and employment insurance earnings.

LAND-USE AND ENVIRONMENT INDICATORS

Land-use and environment domain indicators aim to depict the physical environment of target areas. The physical environment is the space where people's working, living, and social networks develop. People have their activities in the space, use and interact with this space, and also perceive the space. The conditions of the space are external factors, but they have positive or negative impacts on people's perception and feeling.

Most case studies emphasize the natural environment of communities, and usually give more attention to a broad range of environmental indicators, including those of natural resources, biodiversity, conservation, and natural hazards. Community-level studies that view the city as a whole usually concentrate on environmental pollution—qualities of air and water and consumptions of resources and energy. In particular, these indicators are certainly suitable for large geographical scales for an inter-city comparison of environment quality, but they would be difficult to apply to localized small areas for intra-city comparison. Indicators applicable to local scales within an urban setting involve measuring two subjects of the environment: land-use structure and accessibility to leisure and recreation facilities. The former mainly includes the composition of residential, commercial, and industrial land-uses, while a few also take into account lot size, land cost, population density, and accommodation condition. The latter consists of proximity to recreation centres, parks, and leisure facilities and services.

CRIME AND SAFETY INDICATORS

Like housing and health, safety is another basic need as everyone desires to live in a crime-free and safe neighbourhood. Crime is a violation of law and order, usually against a person or property. A high crime rate and unsafe environment can only result in fear and worry about the neighbourhood. It is impossible to bring about a good quality of life in an area with a high crime rate, even if other living conditions are satisfied. Indicators of crime and safety domain are expected to measure a neighbourhood's safety level.

Indicators of the safety domain can be grouped into three types of measures. Almost all case studies use crime rate to indicate the frequency of crime in an area. This measure is often applied to different types of crime, including violence, homicide, property crime, sexual assaults, and child abuse. Incidents of injuries/accidents and

Table 7. Employment and Income Indicators Proposed in the Prototype Studies.

FCM (2001)
1. Unemployment rate 15-24
2. Unemployment rate 25-39
3. Unemployment rate 40+
4. Employment rate 15-24
5. Employment rate 25-39
6. Employment rate 40+
7. Total employed (15-24 both sexes)
8. % permanent employees (15-24 both sexes)
9. % temporary employees (15-24 both sexes)
10. % self-employed (15-24 both sexes)
11. Total employed (25-39 both sexes)
12. % permanent employees (25-39 both sexes)
13. % temporary employees (25-39 both sexes)
14. % self-employed (25-39 both sexes)
15. Total employed (40+ both sexes)
16. % permanent employees (40+ both sexes)
17. % temporary employees (40+ both sexes)
18. % self-employed (40+ both sexes)
19. Total employed (15-24 female)
20. % permanent employees (15-24 female)
21. % temporary employees (15-24 female)
22. % self-employed (15-24 female)
23. Total employed (25-39 female)
24. % permanent employees (25-39 female)
25. % temporary employees (25-39 female)
26. % self-employed (25-39 female)
27. total employed (40+ female)
28. % permanent employees (40+ female)
29. % temporary employees (40+ female)
30. % self-employed (40+ female)
31. Total employed (15-24 male)
32. % permanent employees (15-24 male)
33. % temporary employees (15-24 male)
34. % self-employed (15-24 male)
35. Total employed (25-39 male)
36. % permanent employees (25-39 male)
37. % temporary employees (25-39 male)
38. % self-employed (25-39 male)
39. Total employed (40+ male)
40. % permanent employees (40+ male)
41. % temporary employees (40+ male)
42. % self-employed (40+ male)
43. % husband and wife families receiving EI
44. EI %change of husband and wife families

Table 7. Employment and Income Indicators Proposed in the Prototype Studies (cont'd).

FCM (2001)
45. % husband and wife families receiving social assistance 46. % lone-parent families receiving EI 47. EI % change of lone-parent families 48. % lone-parent families receiving social assistance 49. % non-family persons receiving EI 50. EI % change of non-family persons 51. % non-family persons receiving social assistance 52. Median hourly wage
COMLE Model (CMHC, 1996)
1. Availability of capital: Federal and provincial investment 2. Availability of capital: incidence of low income 3. Employment: Unemployment rate 4. Employment: Average annual salaries 5. Employment: Total # job openings in local neighbourhood 6. Cost of living: Cost of living index 7. Level of business activity: Net change in # of business establishments 8. Level of business activity: Office vacancy rate 9. Level of business activity: % total tax revenue that is collected-realty tax 10. Level of business activity: % total tax revenue that is collected-business tax 11. Variety of business activity: # retail trade establishments per capita 12. Variety of business activity: Department store per capita 13. Variety of business activity: Shopping malls per capita 14. Variety of business activity: % labour force age 15+ employed in 8 major sectors 15. Employment equity: Labour force participation rate for minorities, youth, women, men 16. Employment equity: % jobs that are full-times 17. Employment equity: % jobs that are part-time 18. Employment equity: Unemployment rates-women, men, youth 19. Employment equity: % labour force unionized 20. Income equality: Average weekly wages-men 21. Income equality: Average weekly wages-women 22. Income equality: Average professional earnings as ratio of average earnings 23. Income equality: Incidence of low income 24. Income equality: # of welfare cases 25. Employment: # "green jobs" 26. Resource consumption: Volume of city waste generated by industrial sectors 27. Resource consumption: Commercial water consumption-litres of water consumed per annum
Quebec City (1993) (CMHC, 1996)
1. Federal and provincial investments in the municipality (in millions of dollars) 2. Incidence of low income (%) 3. Household income per capita (average income) 4. Unemployment rate 5. Average annual salaries 6. Numbers of social welfare cases 7. Cost of living

Table 7. Employment and Income Indicators Proposed in the Prototype Studies (cont'd).

Quebec City (1993) (CMHC, 1996)
8. Number of retail business by residents
9. Shopping malls per city
10. % of labour force by activity sector
11. Primary industry
12. Manufacturing
13. Construction
14. Transportation, storage, communication, and other utilities
15. Finance, insurance, and real estate
16. Government service industries
17. Retail sales per capita
18. Net variation in number of business establishments of places of business
19. Participating rate: Women
20. Participating rate: Man
21. Participating rate: Youth 15-24 years
22 % full-time jobs
23. Unemployment rate: Men
24. Unemployment rate: Women
25. Unemployment rate: Youth 15-24 years
26. Average weekly salaries
27. Average weekly salaries: Men
28. Average weekly salaries: Women
Morton (1999)
1. % of males self-employed
2. % of females self-employed.
3. Average employment income (males/females)
4. % worked part-time or part year (male/females)
5. % of employment income
6. % of income from government transfer payments
7. % of other income
8. % of employees (male/female)
9. % of female unemployment rate
10. % of male unemployment rate

Table 8. Land-Use and Environment Indicators.

COMLE Model (CMHC, 1996)
1. Amount of vacant serviced land for commercial and industrial use
2. Average time of approval for building permits
3. Average cost of serviced commercial and industrial lots
4. Average cost of serviced residential lots
5. Average lot levy
6. # and hectares of park and recreation areas per 1,000 population
7. Average block length
8. Mix of building ages, dwellings only
9. # dwellings per hectares
10. Air Quality: # 24 hour periods when total suspended particles exceed maximum acceptable level.
11. Air Quality: # 24 hour periods when PM10s exceed maximum acceptable level.
12. Air Quality: # one hour period when ground level ozone exceeds maximum acceptable level
13. Air Quality: Average air quality index
14. Water Quality: # days per annum when beaches are closed
15. Water Quality: Level of suspended solids in lakes and streams
16. Water Quality: Level of oxygen concentrations at bottom of lakes or streams
17. Resource Consumption: # kilos of waste per person per annum
18. Resource Consumption:% city waste recycled and marketed
19. Resource Consumption: # litres of water consumed per person per annum
20. Resource Consumption: # kilojoules of energy consumed per person per annum
21. Conservation: % land area retained in 'nature' state
Quebec City (1993) (CMHC, 1996)
1. Employment: Quality of vacant serviced land for commercial and industrial use
2. Employment: Average approval time for building permits
3. Affordability: Average cost of serviced commercial and industrial lots
4. Affordability: Average cost of serviced residential lots
5. Affordability: Lot levy
6. Proximity: Average distance from green spaces /parks
7. Proximity: Difference in relation to green spaces /parks
8. Proximity: Households within 1 km of playground, primary school, local services
9. Availability: Number and area of parks and recreation space by resident
10. Variety: Average length of block
11. Variety: Index land use mix
12. Variety: Mix of building ages, dwellings only
13. Density: Number of units/hectare
14. Availability: Particles suspended in air
15. Availability: NO_2, SO_2, and CO_2 concentrations in atmosphere
16. Availability: Quality of water
17. Resource Consumption: Kg waste material per resident per year
18. Resource Consumption: Volume of urban waste material produced by industrial sectors
19. Resource Consumption: Urban waste material recycled and marketed
20. Resource Conservation: % land area kept in natural state

Table 8. Land-Use and Environment Indicators (cont'd).

Morton (1999)
1. Leisure/Recreation: # & Area of parks per 1,000 people 2. Leisure/Recreation: # of Arenas & Recreation facilities per 1,000 people 3. # of restaurants per 1,000 people 4. Access/Mobility: Minimum distance to the closest pharmacy, bank, library, hospital, medical clinic, and convenience store 5. Environment Quality: population density 6. Environment Quality: density of development (total # of private dwelling units per hectare) 7. Environment Quality: % of dwellings constructed within 5 years 8. Environment Quality: % of dwellings constructed within 5 to 25 years 9. Environment Quality: % of dwellings constructed 25 years and more 10. Environment Quality: Average annual daily traffic volumes
Sustainable Community (Hart, 1999)
Recreation 1. Accessibility Indicators • # people using recreation facilities each month • Attendance at Mt. Rainier per mile of trail • Opportunities to participate in art (theatre, etc) • # people served by museums and arts events • Community centres per person • Event/days of bookings at city facilities 2. Cost Indicators • City parks/recreational expenditures per capita • City financial support of arts organizations per capita • Funding amounts and sources for recreation facilities • Major arts expenditures 3. Land Use Indicators • Acres of park lands per person • Recreational trail miles • Public access sites on lakes and rivers • Acres of conservation land intended for public use • # and size of recreational, cultural, and spiritual sites 4. Participation Indicators • Attendance at major arts events or cultural facilities • Public participation in the arts **Resource Use** 5. Energy Indicators (22) 6. Hazardous Material (14) 7. Materials Indicators (4) • Materials: Accumulated depreciation of natural resources • Materials: Materials consumption per capita • Materials: Renewable resources used/total natural resources used • Materials: Resource (material and energy) throughput/ end use output

Table 8. Land-Use and Environment Indicators (cont'd).

Sustainable Community (Hart, 1999)

8. Recycling Indicators (4)
 • % solid waste recycled
 • % recyclable products actually recycled
 • Average post-consumer recycled content of city office paper purchases
 • # people involved in recycling initiative
9. Renewable: The growth rate of timber compared to the rate of harvest
10. Solid Waste Indicators (5)
 • Solid waste generation
 • Space used at landfill sites annually
 • % reduction in land-filled solid waste volumes
 • Highway litter - bags collected per mile
 • Average monthly residential solid waste charge
11. Waste Water Indicators (3)
12. Water Indicators (3)
 • Water use per capita
 • Residential water consumption
 • Gallons of water used daily per person
Environment Indicators
13. Air Indicators (14)
14. Awareness Indicators (5)
 • # environmental education programs for community
 • # environmental education programs at elementary schools
 • Students passing environmental education test
 • # participating in environmental Farm Plan Program
 • % population perceive pollution a priority
15. Biodiversity Indicators (9)
16. Fish Indicators (6)
17. Global Indicators (3)
18. Groundwater Indicators (4)
19. Human Indicators
 • Indoor air quality
 • Noise complaints to local authorities
20. Land Use Indicators
 • Land use patterns
 • Agricultural land loss / total arable land
 • Open land lost to development in square km
 • Total area in significant land-use categories
 • Rate of change of wilderness area
 • # acres of major terrestrial ecosystems
 • Acres of cropland that have been converted to developed land
 • Impervious surfaces
 • Acreage of land used for streets
 • # bio-geographical regions with adequate protected areas
 • Acres under integrated pest management
 • % new residential lots within 1/4 mile of services

Table 8. Land-Use and Environment Indicators (cont'd).

Sustainable Community (Hart, 1999)
• Land area in parks and wildlife refuges • % significant natural areas protected • Forest land acres • Loss of primary forests / total primary forests remaining • # acres of public open space • Area used for organic agriculture / area used for chemical intensive agriculture • Proportion of original agricultural land reserve (ALR) still designated ALR • Trees lost and gained through multi-family development • # trees in urban "forest" • Open space in urban villages • Parks and playgrounds as percent of urban area • Land parcels greater than 80 acres, and greater than 160 acres • Privately owned acres placed under conservation easement • # trees on public property • Area of lands under formal agreement for wildlife habitat • Index of land naturalness • Acres of environmentally sensitive areas • Length of heritage rivers 21. Soil Indicators (4) 22. Surface Water (16) 23. Wetlands Indicators (2)

poisoning form another type of safety indicator. The third type measures the efforts made by local governments towards safety neighbourhoods. For example, some studies use the population per police officer to indicate the availability of the police, and government expenditure on police to measure the economic availability as a result of the government's response to the area.

EDUCATION INDICATORS

The most frequently employed indicators for education are measures of attainment. Percentages of population with different levels of education, such as a university degree, a special training certificate, or a high school diploma, are widely used for this regard. Educational performance is also urged to be a dimension to evaluate education quality. Accessibility and availability of schools is another dimension of the education domain, intending to demonstrate convenience for people to go to schools. Other dimensions considered within this domain include variety of education, advocacy and volunteers, and provision of training programs and teachers.

SOCIAL ENVIRONMENT AND SERVICES INDICATORS

Corresponding to those for physical environment, indicators for this category measure the status and relationships of various social elements. Social environment and social

Table 9. Crime and Safety Indicators.

COMLE Model (CMHC 1996)	City of Toronto (1993) (CMHC 1996)	Morton (1999)	Sustainable Community (Hart, 1999)
1. Economic Availability: Government expenditure on policing 2. Economic Availability: Local government expenditure on fire protection per capita 3. Availability: Population per police officer 4. Availability: Population per fire protection employee 5. Incidence: Violent crime rate per 100,000 people 6. Incidence: # homicide and attempted homicides 7. Incidence: # non-sexual assaults 8. Incidence: # sexual assaults 9. Incidence: # incidents of domestic violence reported to police 10. Incidence: # incidents of child abuse reported to police 11. Incidence: # reports of lesbian and gay bashings reported to gay and lesbian advocacy centres/groups 12. Incidence: # calls to rape crisis centres 13. Incidence: # calls to assaulted women's helpline or centre 14. Incidence: # child abuse reports to Children's Aid Society, Catholic Children's Aid Society, and Jewish Family Services 15. Incidence: # property crime 16. Incidence: Average annual fire losses; dollars per capita	1. Violent crime rate per 100,000 people 2. Number of homicides and attempted homicides 3. Number of non-sexual assaults 4. Number of sexual assaults 5. Number of incidents of domestic violence reported to police 6. Number of incidents of child abuse reported to police 7. Number of reports of lesbian and gay bashing to 519 Church Street 8. Number of calls to Toronto Rape Crisis Centre per year 9. Number of calls to Assaulted Women's Helpline 10. Number of child abuse reports to CAS, CCAS, and JFCS 11. Number of property crime 12. Percentage of people who feel safe walking alone after dark 13. Percentage who decreased park usage because of fear	1. Number of break and enters per 1,000 people 2. Number of assaults per 1,000 people	1. Accidents: Percent traffic injuries to cyclists/pedestrians 2. Accidents: Safety for pedestrians and pedal cyclists 3. Accidents: Deaths from all accidents per 100,000 population 4. Accidents: Traffic accident deaths per capita 5. Crime: Crime victims as percent of population 6. Crime: People feeling safe walking alone at night 7. Crime: Crime rate 8. Crime: Property crimes 9. Crime: Percentage who decreased park use due to fear 10. Crime: Number of Neighbourhood Watch groups 11. Crime: Number of sworn police officers per 1,000 people 12. Juvenile Crime: Juvenile crime rate 13. Services: Average rescue call response time 14. Services: Emergency calls per capita 15. Violence: Number of violent crimes on public transit 16. Violence: Violent crime rate 17. Violence: Domestic assault reported per 100,000 population 18. Violence: Homicide rate per 100,000 19. Violence: Rapes reported per 10,000 population 20. Violence: Calls to Rape Crisis Centre

Table 10. Education Indicators.

COMLE Model (CMHC, 1996)
1. Quality: Student/ teacher ratio (primary level) 2. Quality: Student/ teacher ratio (secondary level) 3. Quality: Expenditure on education by school board 4. Quality: High school drop-out rate 5. Availability: # primary school 6. Availability: # secondary school 7. Availability: # post secondary institutions 8. Accessibility: % applicants admitted to universities 9. Variety: # school boards (public & separate) and private schools 10. Variety: % students in special education 11. Variety: % students in French immersion 12. Attainment: % population 20-34 without high school diploma 13. Attainment: % population 25+ with university degree 14. Attainment: % population 25+ with college certificate 15. Advocacy: % population over 18 participating in local elections for school board representatives
City of Toronto (1993) (CMHC, 1996)
1. Effectiveness: % persons who can be retrained with existing funds 2. Quality: Student/teacher ratio (high school) 3. Quality: Drop-out rate 4. Quality: Literacy rate <level 3 5. Accessibility: % applicants admitted to colleges 6. Accessibility: % applicants admitted to universities 7. Accessibility: Waiting time for adult ESL courses 8. Attainment: % population with a high school diploma
Morton (1999)
1. % of population with less than grade 9 2. % of grades 9 -13 without secondary certificate 3. % of grade 9-13 with secondary certificate 4. % with trade certificate or diploma 5. % with other non-university education 6. % university education without certificate 7. % of university education with certificate
Sustainable Community (Hart, 1999)
1. Adult: Adult education enrolment 2. Adult: % persons retainable with existing funds 3. Adult: % population with high school diploma 4. Adult: % adults with associate's, bachelor's or graduate degree 5. Adult: Waiting time for adult ESL courses 6. Children: # children on subsidized childcare waiting list 7. Children: # child care spaces needed in each age group 8. Children: Nursery education (# children attending pre-school) 9. Literacy: Literacy rate

Table 10. Education Indicators (cont'd).

Sustainable Community (Hart, 1999)
10. Post-secondary: Students entering postsecondary education
11. Post-secondary: Rate of college graduation (five year rate)
12. Post-secondary: Technical school graduates employed in field
13. Post-secondary: Tuition net cost as percent of disposable income
14. Post-secondary: Degrees awarded from county universities and community colleges
15. Post-secondary: High school graduates pursuing advanced training
16. Post-secondary: # pupils completing college entrance requirement
17. Schools: Operating expenditure per student
18. Skills: Numeracy
19. Skills: High school graduates needing remediation in community colleges or univ.
20. Skills: Achievement test scores
21. Skills: % districts with mean test scores equal/above state average
22. Skills: % districts with graduation rate above state average
23. Sustainability: Frequency of sustainable development in K-12 curricula
24. Sustainability: Sustainable development literacy of the public
25. Sustainability: # schools in sustainable school program
26. Teacher: Ethnic diversity of teaching staff
27. Teacher: Student/teacher ratio
28. Teacher: Education level of faculty
29. Teacher: Average teacher salary
30. Training: Employer-sponsored training for front-line employees
31. Training: # residents in job training programs
32. Training: # residents in vocational programs
33. Training: # students in job prep programs
34. Training: % post-secondary graduates finding employment in their field
35. Volunteers: Volunteer involvement in schools
36. Volunteers: # community volunteer programs to support schools
37. Youth: High school graduation rates
38. Youth: Students failing 1st grade
39. Youth: Television and video use by 6th graders
40. Youth: School dropout rate
41. Youth: Schools with 12th grade dropout rate over 10%

services are sometimes dealt separately. They are merged into one domain here because most social services or programs aim to form a better social environment. Most of the referred studies emphasize the elements of family/marriage and low-income/poverty. The FCM Reporting System also measures social pressure by using rates of suicide and business bankruptcies. Social welfare cases and social service programs are suggested in the COMLE model.

Table 11. Social Environment and Social Services Indicators.

FCM (2001) *(Community Stress)*	COMLE Model (1996) (CMHC, 1996) *(Social Welfare)*	Morton (1999) *(Social Environment/Stability)*
1. Percentage of single-parent families 2. Incidence of low income in economic families (%) 3. Teen fertility rate per 1000 women aged 15-19 4. Death rate: All suicides per 100,000 population 5. Business bankruptcies per 1000 establishments 6. Number of 911 crisis calls per year	1. Employment: Average weekly unemployment rate 2. Employment: # welfare cases 3. Availability: Annual expenditure on welfare 4. Availability: # social services agencies per 100,000 population	1. % of single parents 2. Average number of persons per economic households 3. % change in population 1986-1991 4. % legally married and separated 5. % divorce rate 6. % legally married 7. % of low income economic families 8. % persons in low income family units 9. % of low income unattached individuals 10. % of non-movers within one year 11. % of movers within one year of census

Table 12. Community Participation Indicators.

FCM (2001) *(Community Participation)*	Morton (1999) *(Social Opportunity /Participation)*
1. % Voter Turnout : Federal and municipal 2. Charitable donations: Average donation per donor & per tax filler ($) 3. Per capita donations to the United Way ($): Campaign receipts and per capita 4. Weight of collected recyclable goods per resident (kg) 5. % total households receiving daily newspapers	1. % labour force over 15 years and over 2. % population with Canadian citizenship 3. % non-Canadian population 4. % immigrant population who arrived, 1981-1991 5. % immigrant population who arrived, 1961-1980 6. % female participation in labour force 7. % male participation in labour force 8. % population who voted in most recent municipal election

COMMUNITY PARTICIPATION INDICATORS

Communities are socially integrated entities. Measures of people's attitude of and behaviour toward their community intend to objectively determine whether people really enjoy and care about their community. Unfortunately, few studies have given attention to this important quality of life domain. Both the City of Saskatoon Neighbourhood Profiles (6th edition) (Planning and Building Department, 1998) and the FMC report use percentages of voter turnout—federal, provincial, and municipal—to indicate people's political participation. The FMC report also measures how many people are willing to donate (and the amount) to their community.

NEIGHBOURHOOD DATA SOURCES: A REVIEW

Data availability is an important issue in indicator development. Sometimes it becomes a determining factor for the choice, as when ideal indicators are excluded due to data unavailability. Data sources may also have a significant impact on what indicators could be developed because the data to be collected does not always correspond to neighbour-hood boundaries. Based on the earlier review in this report, this section examines data sources pertinent to quality of life and the neighbourhood circumstance. The reviewed data sources mainly involve census data, municipal civic data, health data, and other sources that may help to describe multiple facets of people's daily life in a neighbour-hood.

CENSUS DATA

The population census is the richest and most comprehensive data source that has been extensively used to undertake quality of life studies. Conducted on a five-year cycle, the census captures a wide range of household characteristics encompassing demographic composition, household structure, household income, type of employment, level of education, and shelter costs. It also includes dwelling characteristics, such as construction period, tenure status, and types. There are two sets of census data, 100% and 20% sample data, both of which provide rich sources of population and household information (**Table 13**).

The census data can be applied to generate indicators for several quality of life domains, including housing, employment and income, and education. Compared to other data, the census is most advantageous in terms of its official long-term series that can be used to perform time series studies. It also allows researchers to derive information on demographics and social economic characteristics of households from different censuses, which can be used to monitor the neighbourhood trends and make appropriate decisions. Because urban social geographic change is a gradual process, the census' five-year interval should not be a limitation for neighbourhood indicators. However, if the indicators require more frequently updating (e.g. annually), census data would be inadequate.

MUNICIPAL DATA

The City of Saskatoon collects and maintains a variety of civic data sources that may be used to present quality of life status in neighbourhoods. A primary analysis found that four categories of municipal data might be used to indicate one or more of those identified quality of life domains:

(1) Building and development data: the City Planning and Building Standards Branches keep all residential and commercial housing development records through their building permit process. The data contain important information, such as number of dwelling units, floor space of individual dwellings, and ages of buildings, all of which can be aggregated into the neighbourhood level. The business license program certifies all businesses operating from a fixed address within the city, which includes all home-based businesses and all those operating in designated commercial and industrial areas. The City Planning Branch has also collaborated with Saskatoon Regional Economic Development Authority to periodically carry out Industrial Land Surveys and Commercial Surveys.

(2) Assessment data: The city's Assessment Branch has gathered a great deal of real estate data through home inspections. The branch makes annual appraisals for all residential and commercial properties, showing estimates of market price for the building and lot. Cooperating with the Real Estate Board, the branch has also obtained all real estate transactions in the market by housing type, from which statistics of house price for each neighbourhood can be generated. While home inspection information reflects physical conditions in which people live, the market price statistics are more comprehensive in revealing their overall housing conditions.

(3) Parks and Leisure Services: The Parks Branch maintains all parks around the city. Neighbourhood parks are provided for and accessible to the residents of the neighbourhood where they are located, whereas district parks may serve for several neighbourhoods. Data for park space and accessibility are measures of the potential opportunity and degree to which local residents can enjoy green space. Leisure Services manages various facilities and entertainment programs open to the public. Data about these facilities and programs are useful for indicating the level of possibility that people enjoy the benefit, while registration numbers for those programs may have significance regarding neighbourhood participation and social integration.

(4) Utility data. The city provides water to all neighbourhoods and electricity to most households. Water and electricity consumption is a valuable data source to indicate the material level of people's living.

To sum up, the municipal data are valuable sources of information that include not only land-use but also the distribution of economic activities among the neighbourhoods.

SASKATCHEWAN HEALTH DATA

In many Canadian communities, the health department is the primary resource to explore quality of life indicators, being relatively rich compared to other data sources. Like in other provinces, Saskatchewan Health actively fosters the use of health indicators and maintains the Saskatchewan Health Database (Saskatchewan Health, 2000). The database covers a variety of Saskatchewan Health beneficiaries. This data source includes detailed residence information and is updated via daily visits of patients, an obvious advantage because of its frequent updates. Saskatchewan Health possesses other data, including vital statistics on births and deaths, in which the most significant underlying causes of death are indicated. Through the provincial health department, data on hospital separations by primary causes is also accessible, providing information on cause of illness, hospital discharges by diagnosis, and injury types.

Saskatoon District Health is another major stakeholder for health indicators. Its *2000 Health Status Report* (Saskatoon District Health, 2000) is actually a quality of life study from a health perspective, and includes population analyses, the physical and social environments, as well as detailed investigations on the population's physical conditions. Investigations on population health encompass eight categories—morbidity and mortality; chronic disease; injury prevention; behaviour and health; family health; mental health; infectious diseases; and AIDS/HIV—each of which covers a variety of illness. For example, the morbidity and mortality section documents all-cause mortality, life expectancy, leading causes of death, premature death, hospital separations, and leading causes of hospital separations, while the family health section provides information on reproductive health, teenage birth rates, very low and low birth weight, infant mortality and morbidity, child health, adolescence health, young adults' health (aged 20-44), adult health (aged 45-64), and seniors' health (aged 65+).

These two major data sources have covered almost all dimensions of population health and are valuable for developing quality of life indicators. However, most data included in the health status report are aggregate, without showing spatial distributions of individual indicators. If these data sources were collected in disaggregate format by neighbourhood, they could be used to generate neighbourhood quality of life indicators.

OTHER DATA SOURCES

Quality of life is multiple dimensional and requires diverse data sources to describe. In addition to those discussed above, there are miscellaneous useful sources that can be categorized to other data. Unlike those discussed that usually have one major data provider, this category comprises multiple data sources scattered in different organizations. Currently, the following can be identified that may benefit indicator development:

• Police Information. The city police keep all types of crime records, such as violence and break and enter occurrences, providing a basic data source for crime analysis. The police also have records of major traffic accidents. The emergency call centre receives various calls, including assaults and abuse reported to the police. However, some records such as traffic accidents may be too difficult to be geocoded due to use of non-standardized civic addresses. As a result, manual processing of raw data from the police may be required.

• Education Information. The Saskatoon Education Board consists of the Public and Catholic school divisions. Both have data about student enrolment, teacher numbers, school facilities, and programs provided to every school. It should be noted that schools of both divisions each have a corresponding neighbourhood, but students do not necessarily attend those in their neighbourhood.

• Voter Turnout. Data of voters in elections reflects the participation of the residents in political affairs. There are three levels of elections—federal, provincial, and municipal. Voter turnouts for federal and provincial elections can be obtained from Elections Canada and Elections Saskatchewan, and both can be aggregated from polling stations to a neighbourhood level. Municipal elections are separated by municipal wards that do not completely coincide with neighbourhood boundaries, and, as a result, data for a few neighbourhoods need to be re-evaluated.

• Unemployment Data. Human Resource Development Canada (HRDC) and the provincial government have jointly established an organization, Canada-Saskatchewan Career and Employment Services (CSCES), which is responsible for collecting unemployment information. Unemployment data is updated monthly, reflecting the changes in the labour force that seeks to be employed. The HRDC also manages residents' employment insurance claims. To some extent, the unemployment rate and insurance claims reflect the pressures that people receive in the labour market. However, both sets of data may not be collected by neighbourhood.

In addition, some organizations such as Saskatoon Public Libraries (main and all branches) have information on library cardholders. Revenue Canada and the provincial Social Services have annual data on family incomes, tax payments, low-income families, and social welfare applications. All these data sources provide meaningful information about neighbourhoods.

AVAILABILITY OF DATA SOURCES

Table 14 summarizes data availability for this study by matching sources with quality of life domains. On the whole, the above-mentioned data sources covered the most important aspects, but some data may be difficult to collect. Meanwhile, it should be pointed out that these data do not have the same time frame for updates. For example, census data is collected in the population census every five years, voter turnouts approximately every four years, health data annually, and unemployment information every month.

Table 13. Two Sample Census Data Sets.

20% Sample Data (1996 Census)	100% Sample Data (1991 Census)
Table 1: All Persons (Excluding Institutional Residents) by Age, Sex, Marital Status, and Aboriginal Identifier	Table 1: Population by Age and Sex for Saskatoon Neighbourhoods
Table 2: All Persons (Excluding Institutional Residents) by Mother Tongue, Age, and Aboriginal Identifier	Table 1A: Population by Age and Sex showing Marital Status for Saskatoon Neighbourhoods
Table 3: All Persons (Excluding Institutional Residents) by Ethnic Origin and Age	Table 2: Population by Sex, Ethnic Origin with Single and Multiple Response showing Age for Saskatoon Neighbourhoods
Table 4: Private Households by Household Size, Low Income Status of Primary Household Maintainer (PHM), Household Type and Aboriginal Identity of PHM Showing Mean Number of Persons, Household Income Groupings and Mean and Median Income	Table 3: Private Households by Household Type and Household Income with Average and Median Household Income Showing Household Size for Saskatoon Neighbourhoods
Table 5: Population in Private Households by Age, Sex, Structural Type, and Aboriginal Identifier	Table 4: Private Occupied Dwellings by Structural Type of Dwelling and Period of Construction Showing Tenure and Owners/ Renters Major Payments for Saskatoon Neighbourhoods
Table 6: Population Age 15+ in Private Household by Age, Sex, Highest Level of Schooling, and Aboriginal Identifier	Table 5: Population in Private Households by Age and Sex Showing Structural Type of Dwelling for Saskatoon Neighbourhoods
Table 7: Population 15 years and over with employment income by Aboriginal Identifier and Occupation (1991 2-digit Standard Occupational Classification) showing 1995 Employment Income, 1996 Census	Table 6: Economic Families in Private Households by Economic Family Type, Age of Primary Household Maintainer, and Economic Family Size Showing Economic Family Income for Saskatoon Neighbourhoods
Table 8: Private Non-Farm, Non-Reserve Dwellings by Structural Type, Period of Construction, Condition of Dwelling and Tenure Showing Major Payments, and Mean Payments.	Table 7: Population by Mother Tongue Showing Age for Saskatoon Neighbourhoods

Source: Compiled from Census Data Profiles (Statistics Canada, 1991, 1996a).

Quality of life indicators should use the most recent data possible, and average the data if availability fluctuates. Another issue regarding data is that some sources may be hard to disaggregate to the neighbourhood level, or the statistics' boundaries do not match the existing neighbourhoods. Therefore, it is necessary to examine each data source in detail before using it as indicator data.

Table 14. Summary of Data Availability.

QOL Domains/Indicators	Major Data Source
Housing	Census, Municipal (City Planning, Building Standard, and Assessment)
Health	Saskatchewan Health, Saskatoon Health District
Employment and Income	Census, Human Resource Development Canada
Crime and Safety	Police
Education	Census, School Board (Public and Catholic)
Land-use and Environment	Municipal (City Planning, Leisure Services, Parks)
Social Environment and Services	Census, Health, Social Services
Community Participation	Elections (federal/provincial/municipal), community associations

NEIGHBOURHOOD QOL INDICATORS AND DATABASE

Based on reviews of the indicators and data, this section first examines the criteria for indicator development, and then proposes a suite of suggested indicators for each quality of life domain. Issues related to building a neighbourhood quality of life indicator database are also discussed.

DEVELOPMENT OF NEIGHBOURHOOD QUALITY OF LIFE INDICATORS

The development and use of neighbourhood indicators represents an effective means of providing data needed for policy-making and urban planning. An indicator is something that gives an idea of the presence, absence, nature, quantity, or degree of something else. For example, an economic indicator is one or a group of statistical values that, taken together, give an indication of an economy's health. In other words, it is a statistic used in an attempt to determine the state of general (especially future) economic activity.

However, not all things being measured are indicators, and, in reality, some are simply facts. To determine whether measured information is worthy of having an indicator, criteria need to be developed for examining indicator validity. Such criteria for quality of life indicators often include validity, availability and timeliness, stability and reliability, comprehensibility, responsiveness, policy relevance, and being representative (Hart Environmental Data, 1998: 55; Saskatchewan Health, 2000:5; Redefining Progress

and Earth Day Network, 2002:14). In this study, a neighbourhood indicator should be judged against four criteria:

• Validity and Relevancy: This criterion requires the indicator to specify the status of people's life from a specific perspective, and the issues to be measured must be directly related to quality of life. An indicator should be able to highlight certain socio-economic or environmental concerns existing in a neighbourhood. In addition to its strong policy implications, an indicator is supposed to be capable of quickly responding to a change in the neighbourhood. Essentially, it is expected to help the local neighbourhood make a difference through public policies or other actions.

• Reliability and Understandability: The indicator needs to be relatively consistent, measuring things in the same way over time, and can thus be reliably used to monitor changes. Moreover, indicators should be constructed so as to be straightforward for the general public to understand their relevance to quality of life. It would be better to construct the indicator as a rate, relationship, or linkage where possible.

• Accessibility and Availability: It is necessary to establish reliable data collecting channels so that indicators can be generated systematically and consistently for a certain period (e.g. five years for census data). Devising an indicator that is derived from occasional data (such as survey data) should be avoided.

• Spatial Responsiveness: A neighbourhood's spatial property requires an indicator to be spatially sensitive. It must be able to specify the conditions and concerns within neighbourhood boundaries and reveal variations over space.

Neighbourhood indicators are measures of local trends that include all three dimensions of what it takes to build a healthy neighbourhood—economic, environment, and social (Redefining Progress, 1997: 1). Unlike its social and urban indicator precursors, neighbourhood indicators are developed to inspect data in smaller geographic areas within a metropolis. Meanwhile, neighbourhood quality of life indicators have strong implications for policy formulation. Varied policies are often designated for implementation in different neighbourhoods to improve the overall quality of life in a city. Therefore, indicator development needs to integrate the social and spatial properties and reflect the complexity and spatial variation of a neighbourhood. As indicators are more effective when used in groups, the number of indicators is also significant. There is no standard for how many indicators ought to be generated, but the number should be kept as small as possible without reducing their representative effects.

SUGGESTED NEIGHBOURHOOD QUALITY OF LIFE INDICATORS

Indicators are a means for monitoring specific aspects of quality of life status. Therefore, indicator choice should aim to answer precisely questions people usually ask. For example, housing indicators usually respond to whether housing is available in a neighbourhood and whether people can afford their homes. Given the general criteria for

indicator selection, neighbourhood quality of life indicators are identified on the basis of domain definitions and indicator review. Specifically, indicators are chosen under the following situations:

- If it has been used in the neighbourhood profiles (e.g. ethnic diversity, average family income);

- If it has been widely used in other studies and is possible to be generated with current data sources (e.g. low income incidence, social assistance);

- If it is an indispensable component (e.g. total mortality rate, crime rate); and

- If it has been identified in studies as an significant indicator for Saskatoon neighbourhoods (e.g. percentage of Aboriginal population, percentage of lone parent families).

It should be pointed out that there is no "best" quality of life indicator suite, for the selection process is rather subjective in terms of the researcher's decision. It is preferable to develop a suite of such indicators with the participation of diverse stakeholders making compromises and satisfying various groups.

Table 15. Suggested Neighbourhood Quality of Life Indicators.

Indicators	Description	Data Source
Demographic Profile		
1. Age-Sex Structure of Population	Population pyramid	Census
2. Ethnic Diversity	Sum of the concentration indexes of all ethnic groups and mother tongues	Census
3. % Population Change	Percent of change in population over the past 5 years: total, youth, and seniors	Census
Housing Indicators		
1. Ownership of Homes (%)	Percent of homes owned to all homes (# of homes owned / total # of homes in a neighbourhood * 100%)	Census
2. Affordability of Housing	A ratio of the median household income to the average price of housing of a neighbourhood	Census and assessment
3. Owner's Shelter Cost Measure	The average home owner's payments as a percentage of the median household income.	Census and assessment

Table 15. Suggested Neighbourhood Quality of Life Indicators (cont'd).

Housing Indicators		
4. Tenant's Shelter Cost Measure	Renters' shelter costs as a percentage of the average rent costs to the median household income.	Census and assessment
5. Average Price of Housing	Average market price of a single family dwelling ($)	Assessment
6. Vacancy Rate (%)	Percent of vacant homes (%)	City Planning
7. Housing Age	Average years of all houses in a neighbourhood	Building Standards / Assessment
8. Condition of Housing	Percent of substandard units in total occupied private dwellings (%)	Assessment data
9. Adequacy: Overcrowding	Average floor space per person (average floor area sq. m/ average household size persons)	City Planning / Building Standards
Employment and Income Indicators		
1. Employment Structure	Sum of the concentration indexes of all employment categories in the standard industrial classification	Census
2. Employment Rate (%)	% employment of population of age 15 and over	Census and HRDC data
3. % Self-employed	% self-employed to the total employed labour force	Census
4. Unemployment Rate (%)	Unemployment rate (%): Total, female, youth, minority and Aboriginal	Census and HRDC data
5. Family Income Distribution	A Gini Coefficient of household income distribution according income level groups	Census
6. Household Income Equity	Percent of household incomes in minority, Aboriginal families to the average household income	Census and Statistics Canada
7. Tax Contributions per Capita	Tax contributions per capita in a neighbourhood	Revenue Canada and Statistics Canada
Health Indicators		
1. Total Mortality Rate	Number of death per 1000 population per annum	Saskatchewan Health

Table 15. Suggested Neighbourhood Quality of Life Indicators (cont'd).

Health Indicators		
2. Infant Mortality Rate	Infant mortality rate per 1,000 live birth	Saskatchewan Health
3. % Of Low Birth Weight	% single birth less than 2,500 grams to total single birth	Saskatchewan Health
4. Hospital Discharges Rate	Hospital discharge rate: Crude rate per 1,000 population	Saskatchewan Health
5. Number of Clinic Visits	Average number of a person goes to see doctors per annum	Saskatchewan Health
6. % Disable Population	% of population who are identified with disability	Census and Saskatchewan Health
7. Outflow of Illness or Disability	% hours lost due to illness or disability to total actual hours worked at all jobs	HRDC data and Statistics Canada
Crime and Safety Indicators		
1. Crime Rate of Young Offenders	Young offender charged per 1,000 population	Police
2. Crime Rates of Violence	Crimes of violence per 1,000 population by type	Police
3. Property Crime Rate	Property crime per 1,000 population	Police
4. Rate of Injury and Poisoning	Hospital discharges rate per 1,000 population due to injury and Poisoning	Police
5. Number of Assault Incidence	Number of incidence of assaults reported to the police per 1,000 population	Police
6. Number of Child Abuse Incidence	Number of incidence of child abuse reported to police per 1,000 population	Police
7. Incidence of Fire	Number of incidence of fire	Police and fire protection
8. Number of Traffic Accidents	Number of traffic accidents occurred in a neighbourhood	Police
Land-Use and Environment Indicators		
1. Land-Use: Parks and Open Space	% of land for parks and open space in a neighbourhood	Planning
2. Land-Use: Commercial Use	% of commercial land-use in a neighbourhood	Planning

Table 15. Suggested Neighbourhood Quality of Life Indicators (cont'd).

Land-Use and Environment Indicators		
3. Environment Quality: Population Density	Number of population per square kilometre	Planning
4. Environment Quality: Density of Development	% of gross building area in a neighbourhood (or number of dwelling units per hectare)	Planning
5. Proximity/Access: Recreation and Services	Average floor space (sq.m) per 1000 residents	Commercial survey and business licence data
6. Proximity/Access: Use of Parks /Open Space	% of households within a distance of 1km from a neighbourhood park	Planning
Education Indicators		
1. Population without High School Diploma	% of population over 20 without high school diploma	Census
2. Population with University Degree	% of population 25+ with university degree	Census
3. Population with College Certificate	% of population 25+ with college certificate	Census
4. High-School Dropout Rate (%)	High-school dropout rate (%)	School Board
Social Environment and Services Indicators		
1. % of Lone Parent Families	% of lone parent families in all economic families	Census
2. Incidence of Low Income (%)	% of low income families in all economic families	Census and Social Services data
3. Teen Fertility Rate	Teen fertility rate per 1,000 women aged 15 to 19	Saskatchewan Health
4. % of Families with Kids	% of families with kids to in all economic families	Census
5. Household Size	Average number of persons per economic household	Census and Social Services data
6. % of Households Receiving Social Assistance	% of households that receive social assistance and welfare	Social Services and Census data
Community Participation Indicators		
1. % of Population of Volunteers	% of population of volunteers	Community association
2. % of Population Being Members of Community Associations and Alliance	% of population being members of community associations and alliance	Community association

Table 15. Suggested Neighbourhood Quality of Life Indicators (cont'd).

Community Participation Indicators		
3. % Voter Turnout—Federal, Provincial and Municipal	% voter participating in the federal, provincial, and municipal elections to all qualified voters	Elections Canada Elections Saskatchewan City Clerk's Office
4. Charitable Donations	Donations—Average donation per tax-filer ($)	Revenue Canada
5. Newspapers Distribution	% total household receiving (subscribing) daily newspapers	Star Phoenix
6. Public Library Use	% of residents with a public library card	Saskatoon Public Library

Neighbourhood QOL Indicator Database

Over the past decade, building a database has become a necessary part of QOL indicator projects. In particular, many indicator reporting systems that need to periodically update information require supportive databases. A database is a shared collection of logically related data managed by a software system called a database management system (DBMS). A database is designed to meet an application's information needs, providing controlled access to the data and laying the application base.

Development of a neighbourhood QOL indicator database includes database modeling, design, and implementation. The main purposes of data modeling are to assist understanding the data and facilitate communication in development. A database design begins with application requirements proposed by the end-user or project sponsor, including application environment, data maintenance, and user interface. After the requirements are specified, a design to include conceptual, logical, and physical data models is provided as an abstraction and definition of the database. The data models progressively transform the requirements into application implementation.

Given its aim to provide information, a neighbourhood QOL indicator database should be developed with an internet or intranet application to serve public or corporate users. Such an application, known as an information system, usually includes three tires in its architecture: a presentation tire, a business/application tire and a data (database) tier. When a user searches for information through a web browser, the request is conveyed to a web server, which passes it on to the database through the application or code (often at an application server). When the database management system finds a solution, the result is sent back to the user, reversing the request path.

There are some issues that need to be carefully considered when building a neighbourhood QOL indicator database. First, most data come from other organizations and multiple sources. For example, health data usually comes from the health district and provincial health, and housing data from the housing authority or municipality. Therefore, the database design should consider the format and structure of the original sources so that data transformation and generation is not arduous. Second, QOL indicators are multi-dimensional, including at least area, criterion, and time. The database design should consider how to store multi-dimensional data and facilitate indicator data queries. Appropriate database technology that can help to effectively represent the data, such as data warehousing, should also be considered. Finally, because building a QOL indicator database is a long-term effort, maintenance and regular updating is key to making the development process successful. A user-friendly interface is usually required and always helpful. Above all, knowledge of the data sources and database design is essential to creating a high quality neighbourhood QOL indicator database.

Saskatoon Neighbourhoods: Housing Indicators and Neighbourhood Types

This section consists of two case studies. The first examines the feasibility of suggested housing indicators and the second looks at the types and changes of Saskatoon neighbourhoods.

Quality of Life Revealed by Housing Indicators

Housing is a crucial aspect of quality of life. Being the single largest ongoing expense for most families and often influencing personal and family decisions, housing is a foundation to a strong and vibrant community. Many municipal governments attempt to achieve for every person in the community access to safe, appropriate, and affordable housing. To ensure a wide variety of housing, city planners usually provide different residential zoning designations to meet people's varied needs. Indicator use can help city planners address housing concerns and also monitor its effect on overall quality of life in the city. Therefore, this sub-section tests the feasibility of a number of suggested housing indicators and examine their distribution in Saskatoon neighbourhoods.

Ownership of homes

The ownership of homes indicator is devised as a percentage of homes owned to all homes in a neighbourhood. It answers the question, what proportion of households in a neighbourhood own their homes?

*Ownership of homes = # of homes owned / Total # of homes in a neighbourhood * 100%*

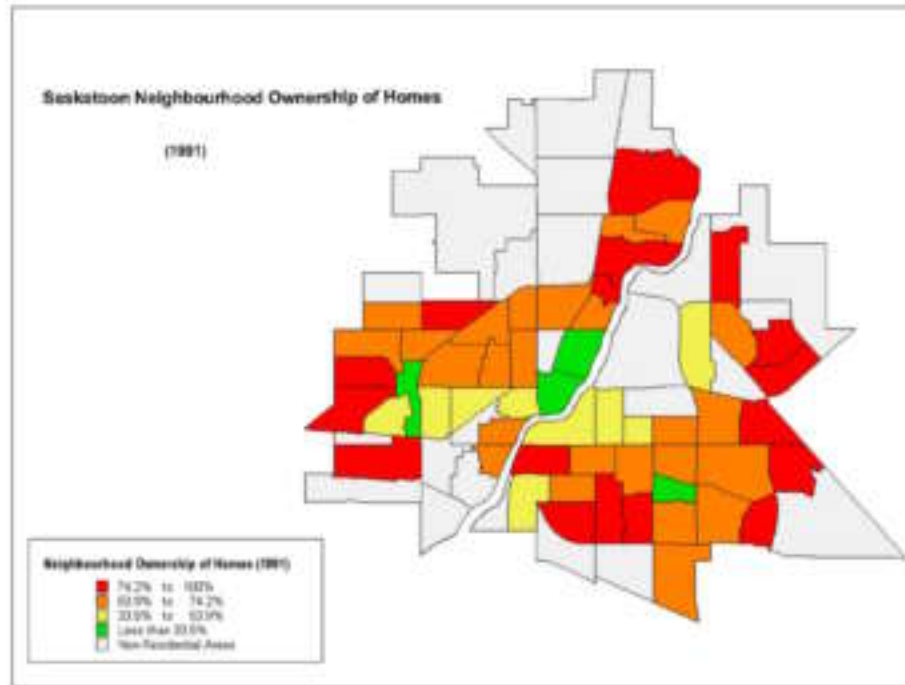**Figure 3. Saskatoon Neighbourhood Ownership of Homes (1991).**

Figure 4. Saskatoon Neighbourhood Ownership of Homes (1996).
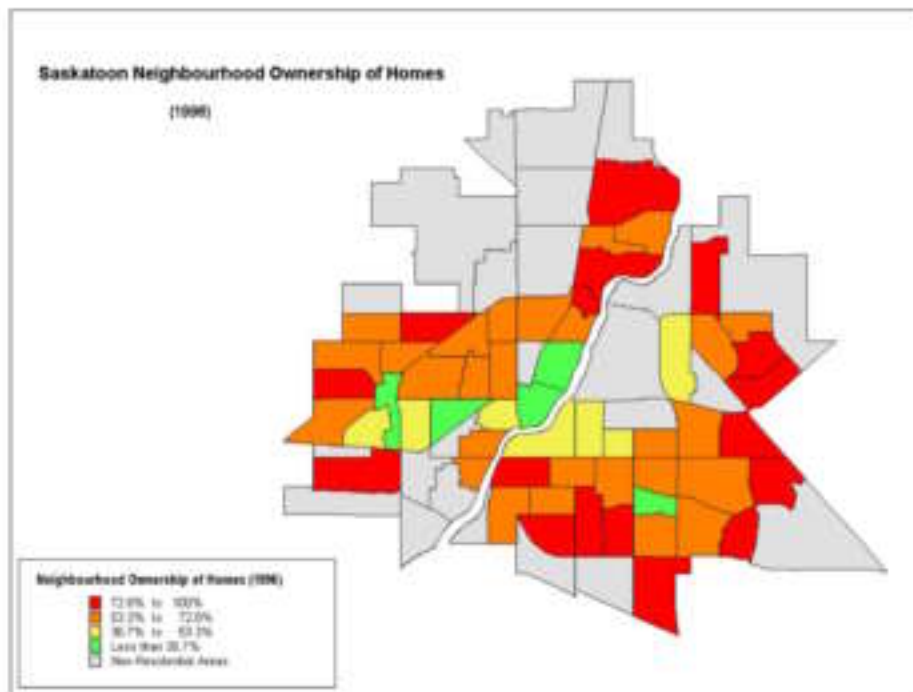
Figure 5. Neighbourhood Home Ownership and Household Income.

Using household data from the 1991 and 1996 censuses, home ownership by neighbour-hood for both census years was computed. When MapInfo's natural break method—a simple cluster analysis—was applied, all neighbourhoods were then classified into four groups according to their home ownerships. In 1991, the neighbourhoods with the lowest home ownership were found in the downtown area (CBD), City Park, and Confederation and Nutana Suburban Centres. Pleasant Hill was also classified in this group in 1996. In contrast, the highest ownerships in both census years were found in peripherally-located neighbourhoods, such as Briarwood, Arbor Creek, Erindale, Silverspring, and Montgomery Place, most of which were developed over the past two decades.

Neighbourhood home ownership is influenced by many factors, including personal preference, age, and family size, but it is perhaps most importantly determined by financial ability or income. Taking Saskatoon's residential neighbourhoods as a sample, **Figure 5** shows the relationship between home ownerships and median household incomes. Even though fluctuations exist for both 1991 and 1996 data, it is clear that a positive relation-ship, as revealed by the cubic polynomial trend line, exists between home ownerships and household incomes.

Affordability of housing

Neighbourhood housing affordability is measured by comparing household income to shelter cost. This comparison may be done in two ways, resulting in two different mea-sures. The first measure of housing affordability is formulated as a ratio of the median household income to the average price of housing, which reflects households' ability in a particular neighbourhood as a whole to purchase a house. To a certain extent, it

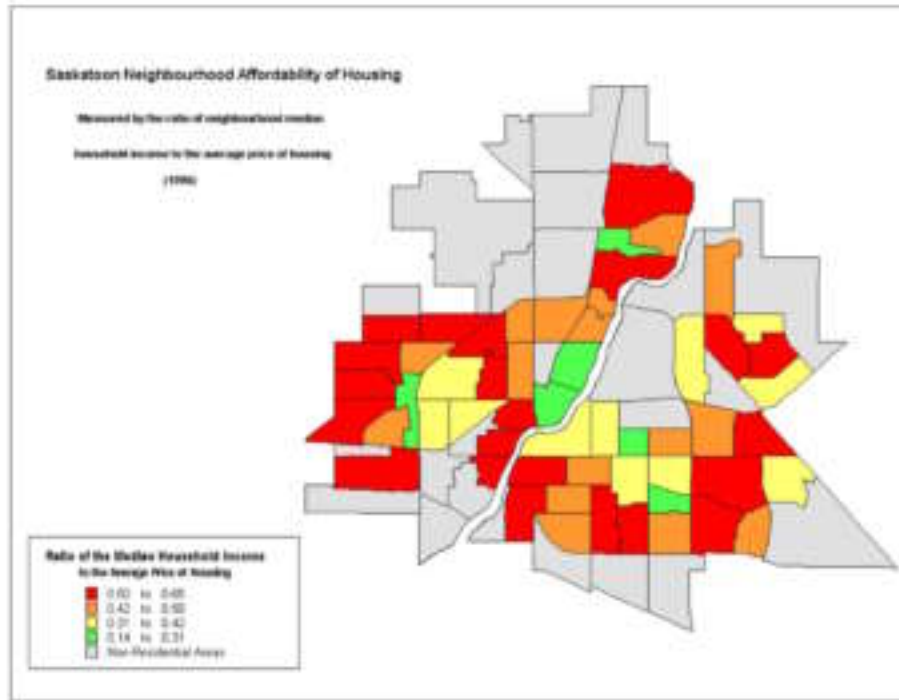**Figure 6. Saskatoon Neighbourhood Affordability of Housing (1996).**

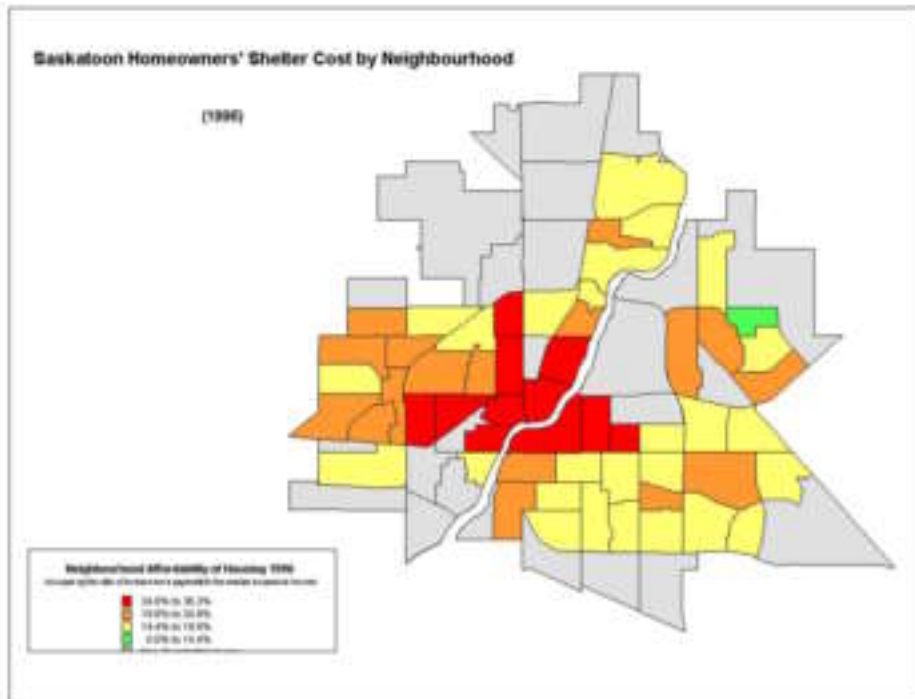**Figure 7. Homeowners Shelter Cost among Neighbourhoods (1996).**

Figure 8. Renters' Shelter Cost Among Saskatoon Neighbourhoods (1996).
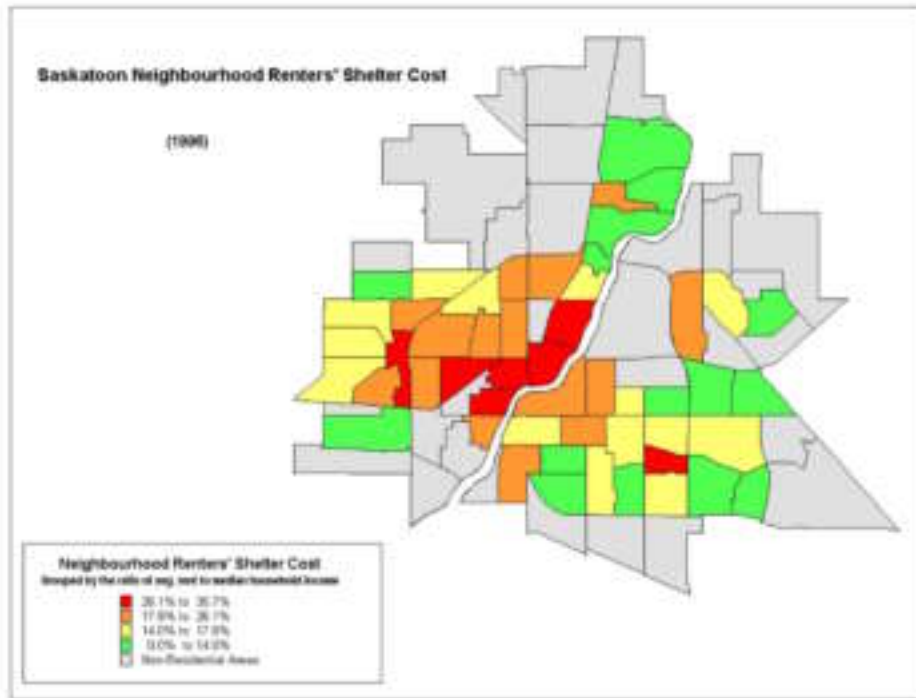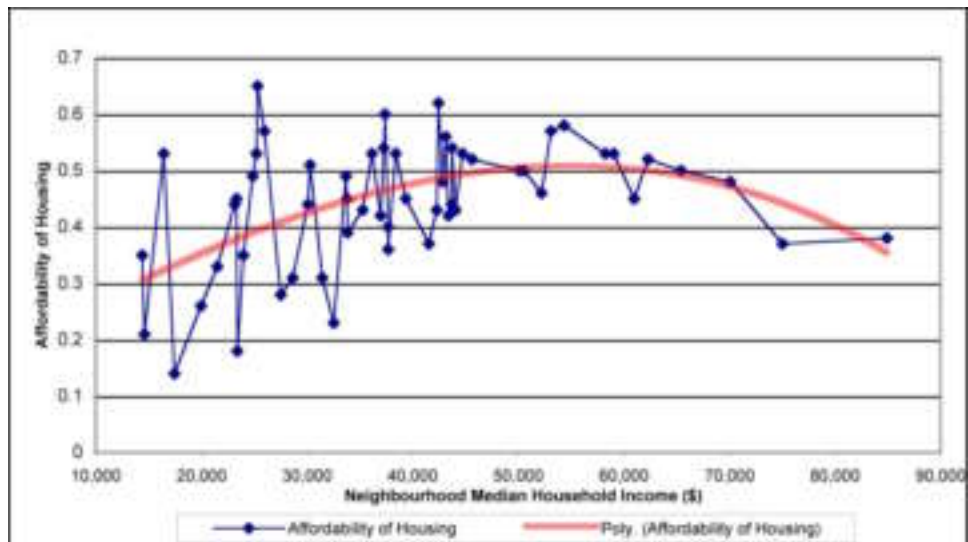

Figure 9. Neighbourhood Affordability of Housing and Household Income.

measures the matching degree of a neighbourhood's household income and housing market price.

Affordability of Housing = Neighbourhood Median Household Income / Average Price of Housing

The second measure is constructed as the proportion of the average shelter cost to its median household income of a neighbourhood, which indicates the average ability of households in a neighbourhood to bear maintenance costs for their current shelters. To a degree, this indicator reveals a neighbourhood's average household expenditure pattern in terms of shelter cost. However, there are two types of shelter cost statistics—average owner's major payments for those who own their home, and average rent for those who rent. The homeowners' shelter cost is measured by the average homeowners' payments as a percentage of the median household income, and the renters' shelter costs as a percentage of the average rent costs to the median household income.

Homeowners' Shelter Cost = Average Homeowners' Payments / Median Household Income *100%

Renters' Shelter Cost = Average Rent Costs / Median Household Income *100%

Both indicators attempt to compare a neighbourhood's average shelter costs and household income to measure the average ability of homeowners and tenants in a neighbourhood to maintain their homes. While housing costs remains the largest portion in the expenditure for most families, these indicators measure the degree to which incomes match housing expenses. Statistics Canada considers 30% to be the maximum affordable expenditure on shelter (defined by the "Low Income Cut-Off"), but both indicators help identify those neighbourhoods that are "substantially worst off than the average." Renters' shelter cost is also comparable to the rental affordability indicator developed by the FCM Quality of Life Reporting System.

Housing affordability of Saskatoon residential neighbourhoods

Average neighbourhood housing prices were calculated using data collected by the Assessment Branch. Along with household incomes and shelter costs from the census data, all three indicators are analyzed and mapped. Housing affordability in Saskatoon neighbourhoods demonstrates a fairly complicated distribution. The highest affordability appears in neither the highest income neighbourhoods nor those of the lowest. Controlled by two variables—household income and housing price—neighbourhoods with secondarily high incomes statistically bear the highest affordability. However, this bell-shaped distribution is unbalanced—the top income neighbourhoods still demonstrate a comparatively higher affordability than those of the least incomes. It should be

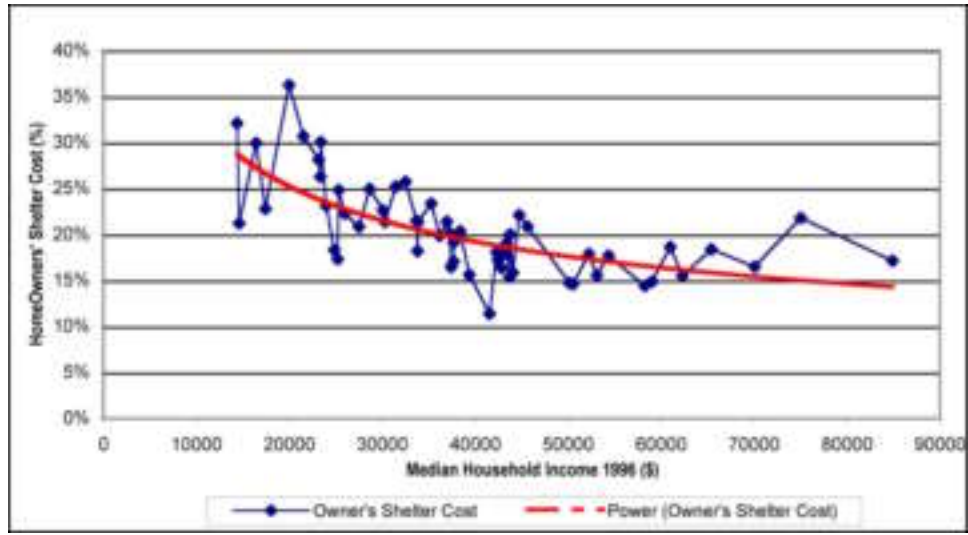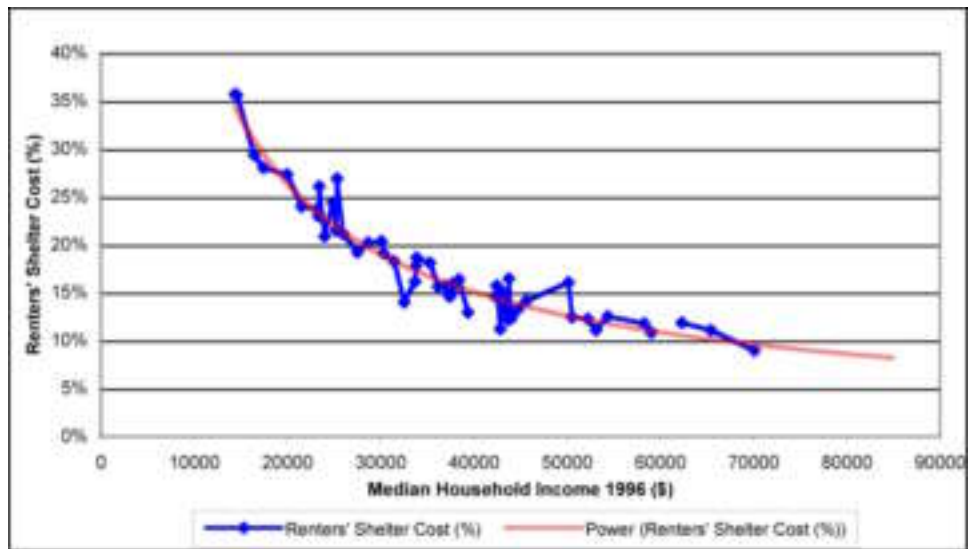**Figure 10. Household Income and Homeowners' Shelter Costs.**

Figure 11. Household Income and Renters' Shelter Cost.

noted that significant fluctuations between these two factors imply a rather complicated relationship. In view of that, the affordability of housing indicator can be understood as a measure of the matching degree of household income and housing price in a neighbourhood.

Figures 10 and 11 demonstrate a pattern where both homeowners' and renters' shelter costs decline overall with the growth of household income, while the relationship with the renter's shelter cost shows less variation. Both graphs show that all neighbourhoods with shelter costs greater than 30% of household income fall into the lowest income group. With respect to the spatial pattern of these two indicators, the highest relative shelter costs appear in the core neighbourhoods. The significant difference is that the lowest homeowners' shelter cost neighbourhoods distribute continuously around the CBD, while those with the highest renters' shelter cost include the CBD and its four neighbours, as well as the Confederation and Nutana Suburban Centres.

TYPES AND CHANGE IN SASKATOON RESIDENTIAL NEIGHBOURHOODS

An important objective of quality of life research is to initiate and implement appropriate policies to different neighbourhoods. In practice, different policies are initiated to correspond to specific concerns of a certain group of neighbourhoods. Therefore, identifying policy-oriented neighbourhood groups forms a major task in a quality of life study. Using variables that indicate socio-economic characteristics, a cluster analysis method can effectively reveal and classify groups of neighbourhoods with common concerns. This sub-section attempts to apply this approach to Saskatoon residential neighbourhoods, examining the types and spatial patterns of neighbourhood clusters in 1991 and 1996 and their changing trend.

Methodology

Significant spatial variations of social, economic, and demographic statistics exist among Saskatoon neighbourhoods. Having examined a great number of variables/indicators among the neighbourhoods in experimental studies conducted in the Planning Research and Information Resource Centre at the City of Saskatoon, Bill Holden identified five socio-economic indicators that have the most significant impacts on neighbourhood quality of life: (1) percent of Aboriginal population; (2) median household income; (3) percent of lone parent family households; (4) percent of homes owned; and (5) percent of employment of population fifteen years and older (Holden, 2001).

Selected neighbourhood demographic data from the 1991 and 1996 censuses were analysed using a software application, SPSS 10.0. These variables were standardized and the scores submitted to the K-Means Cluster routine. After a three-cluster solution was specified for each data set, classifications of all residential neighbourhoods were made and summary statistics for each group's component neighbourhoods obtained. The sample neighbourhoods were also mapped according to their group memberships.

To enhance the initial cluster analysis, five more socio-economic variables/indicators were added to the database: (1) percent of family households with kids; (2) percent of married population; (3) percent of seniors; (4) percent of single-person households; and (5) average household size.

The data and results of cluster analyses

Table 16 presents statistical summaries for the five variables. The statistics show that during 1991 and 1996 the mean of four out of five variables increased, while the percentage of employment of those 15 years and older decreased slightly. The maximums of these variables all increased significantly, but the minimums had only minor changes. As a result, variations of the five variables among neighbourhoods became much bigger, as revealed by changes in the data's range and standard deviation.

A cluster analysis was applied to 52 and 56 neighbourhoods for the 1991 and 1996 data sets, respectively. Each analysis generated three distinct neighbourhood clusters, distinguished by their social economic characteristics as revealed by aggregate variable values (**Tables 17-20**). The three clusters for both census years were then mapped with the software package MapInfo Pro 6.0 (**Figures 12 and 13**).

The 1991 pattern of neighbourhood clusters

Middle-class families

With 32 neighbourhoods, this group represented the highest household income areas in the city. It had the highest rate of employment and home ownership. The percentages of both lone parent families and Aboriginal residents were very low. The additional data of this group also revealed it to be dominated by family-oriented neighbourhoods, with both the highest percentage of married population and lowest percentage of single-person households. These are all characteristics of middle class families.

Moderate-income families

With higher percentages of Aboriginal population and lone parent families than the city's averages, this group had mean values of median household income, home ownership, and employment rates. It is therefore categorized as moderate-income families.

Seniors and singles

With only five identified neighbourhoods, this group had the lowest averages of all five variables. Additional data also show that this group had an extremely low percentage of family households with kids, which was less than half the city's average, but a very high rate of single-person households, which was more than double the city average. With 44% of its population identified as seniors, which was 3.3 times the city's average, its average household size of less than two persons indicated that they were neighbourhoods dominated by seniors and singles.

Table 16. Statistical Summaries for the Five Adopted Variables, 1991 and 1996.

| Summary of the 1991 Data (52 neighbourhoods)					
Statistics of the 1991 Data	Percent of Aboriginal Population (%)	Median Household Income ($)	Percent of Lone Parent Families (%)	Percent of Homes Owned (%)	Percent of Employment of Population 15 & Over (%)
Mean	7.87	35828.9	10.10	61.17	68.60
Range	29.06	48135	24.00	87.29	72.50
Minimum	.99	13662	.00	10.97	16.45
Maximum	30.05	61797	24.00	98.26	88.95
Std. Deviation	7.13	12056.3	4.69	20.18	13.25
Summary of the 1996 Data (56 neighbourhoods)					
Statistics of the 1996 Data	Percent of Aboriginal Population (%)	Median Household Income ($)	Percent of Lone Parent Families (%)	Percent of Homes Owned (%)	Percent of Employment of Population 15 & Over (%)
Mean	8.2	38954	10.5	62.7	67.9
Range	44.37	70522	37.7	90.9	85.6
Minimum	0.0	14390	0.0	9.1	11.5
Maximum	44.4	84912	37.7	100.0	97.1
Std. Deviation	9.64	15531	6.42	21.47	15.66

Table 17. Aggregate Data of the Three Neighbourhood Clusters (1991).

Variables/ Neighbourhood Clusters	Percent of Aboriginal Population (%)	Median Household Income ($)	Percent of Lone Parent Families (%)	Percent of Owned Single Family Dwellings (%)	Percent of Employment of Population 15 &Over (%)	Number of Cases
Moderate Income Families	16.68	25102.00	14.93	52.13	63.13	15
Middle Class Families	4.32	42799.84	8.61	69.92	75.20	32
Singles and Seniors	4.20	23395.80	5.17	32.31	42.76	5
All Neighbourhoods	7.74	35968.98	10.12	61.16	68.54	52

Table 18. Aggregate Additional Data of the Three Neighbourhood Clusters (1991).

Variables/ Neighbourhood Clusters	Percent of Family Households with Kids (%)	Percent of Married Population (%)	Percent of Seniors (65&Over) (%)	Percent of Single-Person Households (%)	Average Household Size (Persons)
Moderate Income Families	66.19	33.29	11.67	28.89	2.49347
Middle Class Families	64.30	44.14	9.31	20.81	2.75756
Singles and Seniors	29.38	35.64	43.96	55.76	1.83480
Total Neighbourhoods	61.49	40.19	13.32	26.50	2.59265

Figure 12. Types of Saskatoon Residential Neighbourhoods (1991).
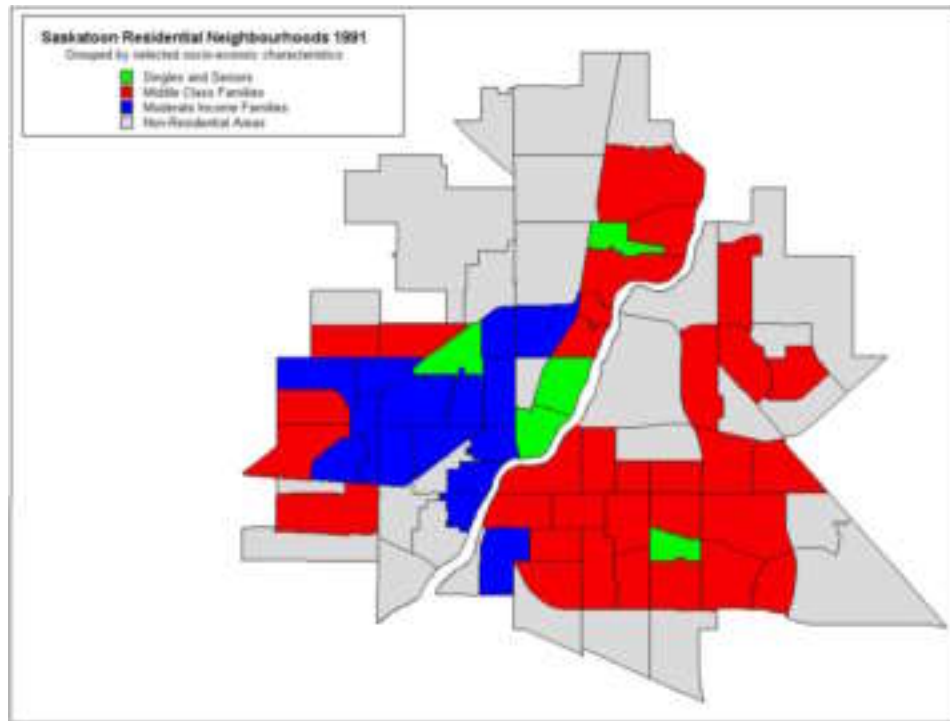
The 1996 pattern of neighbourhood clusters

The clusters of neighbourhoods in 1996 further distinguish themselves by their socio-economic characteristics. The results clearly show neighbourhood groups with high to low socio-economic status.

Middle-class families

Like the 1991 clusters, this group included the highest median income neighbourhoods in the city. While it continued to have the highest rates of employment and home ownership, rates of lone parent families and percentage of Aboriginal population in these neighbourhoods remained very low.

Lower-income families

Replacing the 1991 neighbourhoods of moderate-income families, this group had the lowest household income, lowest rate of home ownership, lowest rate of employment, highest percentage of Aboriginal population, and highest rate of lone parent households. Clearly, this group was characterized by lower income families, indicating that it was the most disadvantaged set of neighbourhoods in the city.

Mixed household neighbourhoods

With moderate incomes, these twenty neighbourhoods all had their aggregate means of the five variables in between the above two groups. Indeed, they represented a diverse middle ground in the socio-economic and demographic structure of Saskatoon's neighbourhoods.

Table 19. Aggregate Data of the Three Neighbourhood Clusters (1996).

Variables/ Neighbourhood Clusters	Percent of Aboriginal Population (%)	Median Household Income ($)	Percent of Lone Parent Families (%)	Percent of Owned Single Family Dwellings (%)	Percent of Employment of Population 15&Over (%)	Number of Cases
Lower Income Families	25.95	22970.33	19.92	43.39	58.61	9
Middle Class Families	4.32	51067.74	9.41	77.60	77.90	27
Mixed Households	5.49	29792.20	7.79	51.28	58.80	20
Total Neighbourhoods	8.21	38953.68	10.52	62.70	67.98	56

Table 20. Aggregate Additional Data of the Three Neighbourhood Clusters (1996).

Cluster of Neighborhoods	Percent of Family Households with Kids (%)	Percent of Married Population (%)	Percent of Seniors (65 & Over) (%)	Percent of Single-Person Households (%)	Average Household Size (Person)
Lower Income Families	73.11	25.56	9.22	29.89	2.54
Middle Class Families	67.04	44.37	8.30	15.78	2.90
Mixed House-holds	45.45	39.85	28.10	40.00	2.01
Total	60.30	39.73	15.52	26.70	2.52

Figure 13. Types of Saskatoon Residential Neighbourhoods (1996).
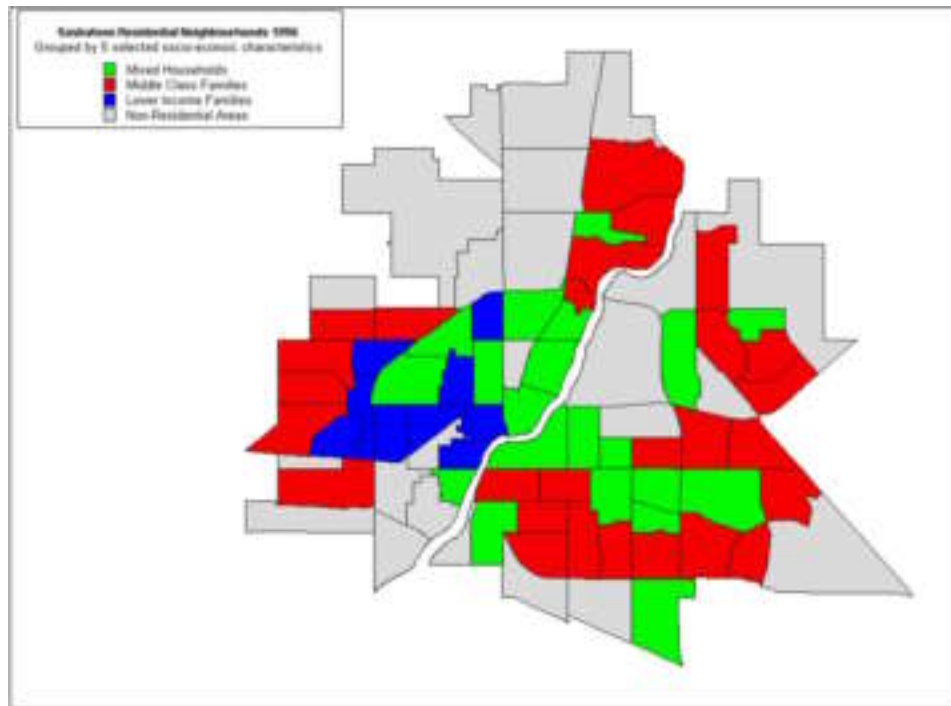
Change in the clusters of neighbourhoods, 1991-1996

The neighbourhood clusters in **Figure 12** show a very interesting spatial pattern. Except for the Exhibition area, all other moderate-income households continuously spread out on the west side of the South Saskatchewan River. Almost all neighbourhoods east of

the river, together with northern and far-western located neighbourhoods, were classified as middle-class families. Singles and seniors were concentrated downtown and in three isolated areas—the Lawson Heights Suburban Centre, Nutana Suburban Centre, and Hudson Bay Park. In 1996, most far-western and northern located neighbourhoods retained their status of middle class families. Neighbourhoods east of the river, however, split into periphery-located middle class families and interior-located mixed households.

Comparing the 1991 and 1996 patterns, two major trends can be observed. First, a process of spatial differentiation took place in Saskatoon's residential neighbourhoods. While the number of middle class neighbourhoods shrunk slightly, the socio-economic characteristics of the cluster grew to be more typical in terms of its higher income level, higher employment rate, and higher home ownership, combined with lower rates of lone parent families. Differences among moderate-income neighbourhoods also became apparent and a lower income group developed from the former moderate-income families. This new group had lower incomes and was identified as the most disadvantaged. Its median household income was only 59% of the city average and its home ownership nearly twenty percentage points lower than the average. Over one quarter of its population was Aboriginal, which was more than three times the city average. Second, as a result of the differentiation, a group of mixed households emerged. This group had a diverse family make-up, including all five former singles and seniors' neighbourhoods, eight of the former middle class families, and five of the former moderate-income families. It appears to have been between the middle class and lower-income families as a holding area, while socio-economic differentiation led to a process of spatial polarization among Saskatoon neighbourhoods. City planners and policy makers should be aware of those upgrading or downgrading socio-economic characteristics in different areas of the city. Public policy and planning can play a significant role in building healthier relationships among neighbourhoods.

SUMMARY AND DISCUSSION

Quality of life is often regarded as a subjective issue determined by individuals' perceptions. However, it can be measured using objective indicators that measure the environment in which people live, experience, and perceive. In this sense, quality of life is regarded as equivalent to liveability. While a neighbourhood possesses both social and spatial properties, neighbourhood quality of life actually measures the liveability of neighbourhoods within a city.

Based on the literature review, this study identified eight quality of life domains and several dimensions in each of them. Considering data availability and applicability for the small-scale spatial units, a suite of indicators was suggested for Saskatoon neighbourhoods.

A few housing indicators were examined with the 1991 and 1996 census data for their feasibility. Moreover, five other indicators were applied to a cluster analysis to identify types of Saskatoon neighborhoods. The case study revealed that the city experienced spatial polarization during the early 1990s, resulting in peripherally-located middle class families and disadvantageous inner city lower income group.

This study suggests that neighbourhood quality of life indicators are a means to measure and monitor specific attributes as well as neighbourhoods' overall liveability, which can help achieve the goal of building a healthy community. Use of such indicators also allows the making of comparisons among neighbourhoods to identify their comparative advantages and potential problems.

INDICATOR SPATIAL VARIATION AND SIGNIFICANCE

The general criteria for judging what are good quality of life indicators have been presented. However, whether an indicator should be included into the suggested list actually depends on its significance for Saskatoon neighbourhoods. This is an issue regarding universal versus specific relevance—some generally important indicators may or may not be important for Saskatoon. For example, ownership of vehicles is often used for measuring the material level of living. It would not be a meaningful indicator if a trivial difference existed among the neighbourhoods. In other words, if a candidate indicator doesn't sensitively show spatial variations among neighbourhoods, it will not make a significant contribution to differentiate their levels of quality of life, and therefore should not be devised as a neighbourhood indicator. Similarly, an indicator should be omitted if it is largely dependent on (or closely correlated to) another indicator. Therefore, all candidate indicators should be re-examined against the real data before making the final decision.

INDICATOR REPRESENTATION AND COMPARISON

Ideal indicators should give people a direct sense of their relative status. However, not all indicators are so obvious for people to make a quick judgment, and some require further comparison and interpretations. In this case, indicators should be re-examined and devised in an alternative way.

Likewise, comparison among different indicators is also difficult because of incomparable measuring units. A solution to this problem is to transform indicators into relative values. Given the number of available methods for data transformation, different methods may result in variations in the final evaluation. For example, cluster analysis, which is often applied to identify neighbourhood groups, includes three major procedures, each of which can be accomplished with a variety of methods. Methods for data transformation may include standardization, centralization, and normalization. Those for measuring distance between samples include Euclidian-distance, Minkowski-distance, and similar coefficient. Those for clustering samples include nearest-neighbour,

farthest-neighbour, and Ward (square sum of dispersion) methods. While a variety of methods are available for each procedure, it is common to have different clustering results when different combinations of those methods are used in the process. Caution must be exercised when making a multi-dimensional comparison.

COMBINING SUBJECTIVE AND OBJECTIVE MEASURES

Quality of life can have both subjective and objective measures. Given that neither measure is perfect, it would be ideal to combine measures. On the one hand, objective indicators can overcome the subjective measures' shortcomings, namely that they are poorly comparable and inevitably formed out of one's experiences. On the other hand, all indicators do not equally contribute to overall quality of life, varying particularly with different types of stakeholders. They should therefore be given unequal importance when representing the interests of different groups of people. To synthesize varied opinions using comparable data, subjective and objective measures should be combined.

A common solution to combining subjective and objective measures is to construct a weighted quality of life index, giving each objective indicator a subjective valued weight. In order to determine indicator weights that involve multiple levels of criteria, the Analytical Hierarchy Process (AHP) is strongly recommended. Developed by Thomas Saaty, AHP provides a proven, effective means of dealing with complex decision making and can assist with identifying and weighting selection criteria, analyzing the data collected for the criteria, and expediting the decision-making process. AHP helps capture both subjective and objective evaluation measures, providing a useful mechanism for checking the consistency of the evaluation measures and suggested alternatives, thus reducing bias in decision-making.

Applying the AHP method to the neighbourhood quality of life study consists of three major steps. The work starts with establishing a decision-making tree. In this study, a general goal of a high quality of life is on top of the hierarchy. Underneath, the hierarchy comprises a number of quality of life domains, each of which are further divided into indicators. Given each criterion with a local/immediate priority, the next step involves assigning a relative weight to each element by a number of experts. Each criterion (a domain or indicator) beneath a given parent in each tier of the model is assigned a relative value, and its global priority shows its relative importance within the overall model. Finally, after the criteria are weighted and information collected, they are put into the model. Scoring is on a relative basis, comparing one indicator to another. Scores are then synthesized through the hierarchy, yielding a composite score for each indicator at every tier, as well as an overall score. While the AHP model has a consistency checking mechanism, an apparent advantage is ensuring that the survey only includes those of high-quality, logically reliable subjective data.

Toward a Neighbourhood QOL Indicator System

Quality of life indicators have become useful tools to monitor urban development trends. A number of Canadian municipalities have endeavoured to create practical and meaningful indicators. For example, the City of Winnipeg contracted with the International Institute for Sustainable Development to develop a suite of quality of life indicators (IISD, 2000). It should be noted that development of quality of life indicators is a huge project requiring enormous effort. Unlike a one-time project, it necessitates long-term monitoring and observation after the initial indicator selection is complete. For this reason, it is imperative to develop a neighbourhood quality of life indicator system, particularly regarding involvement and information access by the public. The system will help realize the original objective of the project that citizens, political leaders, businessmen, and community groups, by observing the indicators, can monitor the growth of communities and make better decisions.

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