The use of spatial and non-spatial analysis for evaluating the need for urban revitalization in Winnipeg

Marcie Snyder, Jino Distasio, Salah Hathout
Department of Geography, University of Winnipeg

Abstract: In recent decades, urban research has explored the causes and responses to urban decline in the North American city, exploring methods and potential solutions to manage decline within the urban environment. This research examines how Geographic Information Systems (GIS) can be used as a tool to monitor and manage urban revitalization strategies. Individual factors contributing to a need for renewal were assessed, using multi-criteria evaluation (MCE) as the method of analysis. Maps were created to establish an index scale by which to measure varying levels of socio-economic need, by census tract, within the study area of Winnipeg, Manitoba. A theoretical framework, which detailed the processes of revitalization and decline in Canadian inner city neighbourhoods, and a classification of Winnipeg neighbourhood designations, was then applied to the results of the GIS analysis in order to bring together quantitative and qualitative data for analyzing urban revitalization. This mixed methods approach was used to diagnose urban areas in need of revitalization. The methodology used in this research can be adapted as census data is updated, and could play an important role in present and future urban revitalization strategies and policymaking decisions.

Key Words: urban revitalization, GIS, Winnipeg
Introduction

In recent decades, urban research has explored the causes of and responses to decline in the North American city, exploring management methods and potential solutions to decline within the urban environment. This study identifies census tracts within the City of Winnipeg that demonstrate a need for revitalization, and does so by prioritizing and weighting variables measuring aspects of the built environment that indicate varying levels of social, economic, and physical need. This assessment uses multi-criteria evaluation (MCE) analysis, which is based on a combination of factors, and is used to establish an index scale as a means by which to measure and assess spatial patterns within the study area.

The objectives of this study are twofold: to examine how Geographic Information Systems (GIS) may be used as a tool to monitor and manage urban revitalization strategies in the City of Winnipeg, using a mixed methods approach that examines spatial and non-spatial criteria; and to analyze varying levels of need for urban revitalization according to census tract using MCE. MCE is a technique that allows a number of revitalization factors to be assessed at once by prioritizing and ranking them, then weighting each factor and combining all factors into an index scale, which can be used to interpret need for urban revitalization.

The City of Winnipeg was selected as the study area for this research as it is a medium-sized, slow growth city, and the use of MCE and a mixed methods approach to analyze areas in need of revitalization are unique to this area. Like many other North American cities, Winnipeg has seen a recent concentration of growth in suburban areas while the inner city experienced depopulation and decline (Leo and Brown 2000), yet relevant literature indicates that relatively little attention has been paid to Winnipeg’s urban context within Canadian urban studies, as the focus has mainly concentrated on major metropolitan centres. Winnipeg, the capital city of Manitoba, consists of a 462 square kilometre area, with a population of 671,274 people dwelling within 165 census tracts (Statistics Canada Census 2001).

Additionally, a review of pertinent literature indicated that MCE modelling has not yet been performed on medium-sized Canadian cities; rather, urban revitalization and GIS researchers have focused their attention on larger, high growth cities such as Chicago (Dai et al. 2001; Thomas 2002; Brown and Perrott 2004). Because urban revitalization is a complex process that involves a broad base of knowledge, methods of evaluation that are unique to an area are of importance when monitoring the resources of a city.
Stewart (1993) indicated that although a range of valuable perspectives on the development of urban revitalization have been offered, there “does not appear to be one particular model that combines all the elements in just the right formula that can be prescribed for all situations” (153). Based on this thought, this research focuses on the advantages of using GIS modelling as one tool to interpret the urban environment with respect to revitalization efforts, and will introduce a model for urban revitalization in targeted areas, which can contribute to future community policy-making decisions and revitalization strategies.

This paper sets out to define the processes and approaches to urban decline and revitalization, focusing on the typologies of the inner city, and using this as a theoretical framework to bring together qualitative and quantitative classifications. Data collection and analysis is described in terms of factor selection and weighting, MCE modelling and mapping, and the results of these final maps as compared to a previous study that the City of Winnipeg undertook in 2000.
Literature Review

Processes of, and approaches to, urban revitalization:

Urban revitalization has emerged as a way of addressing the social, economic, and physical problems of a city. The processes of revitalization involve strategies consisting of multiple components, all concentrated in a particular geographic area experiencing distress (Zielenbach 2000) and can be separated into identifiable processes of change within the context of the city. A “detailed interaction exists between built forms and human activities” (Longley 2003, 116), and therefore social revitalization and reinvestment must be considered along with physical improvements and upgrades (Longley 2003).

Van Criekingen and Decroly (2003) stated that urban revitalization can be divided into individual processes, comprised of four possible stages: 1) gentrification, 2) marginal gentrification, 3) upgrading, and 4) incumbent upgrading. Although the concept of gentrification “only adequately describes the upward movement of very restricted parts of the inner city [whereas] neighbourhood renewal in general more typically comprises marginal gentrification, upgrading, and incumbent upgrading” (2451) it is of value to discuss all four stages, as each can be recognized as a distinct process within the continuum of urban revitalization.

*Gentrification* occurs when a “new middle class” emerge and move into lower income areas with potential for restoration, such as notable architecture or proximity to amenities. Sharp transformations will occur in the neighbourhood, and lower income earners that dwell in the area are often displaced due to rising rents in an area that quickly becomes desirable to the wealthier classes. *Marginal gentrification*, often associated with middle income households, is said to be “richer in cultural capital than in economic capital” (2454) because residents of these neighbourhoods are usually highly educated but tenuously employed. Similar to gentrification, marginal gentrifiers will seek out an urban niche in inner city districts. *Upgrading* occurs in middle income neighbourhoods, where new homeowners make minor repairs to maintain the area’s dwellings, and therefore, this is not directly associated with inner city revitalization. *Incumbent upgrading*, on the other hand, is a renewal process in which long term residents of an area reinvest in their surroundings in order to maintain or improve their own housing conditions. This type of renewal implies little, if any, population change. The process of incumbent upgrading allows a neighbourhood to take pride in their community, thus as housing standards are maintained or improved, social and economic capital may increase as well.
According to Zielenbach (2000), two types of approaches to urban revitalization exist; place-based and individual approaches that may be used to conceptualize and move towards revitalization. **Place-based approaches** view neighbourhood improvement according to geographic location, using methods such as gentrification, incumbent upgrading, and the adaptive redevelopment of existing sites and landuses to describe and define aspects of such renewal, where areas in highest need are targeted for redevelopment. An example of the difficulty with a place-based approach occurs when residents in two different geographic areas are in relatively equal socio-economic need, yet one of these areas may be neglected if it falls outside the designated boundary.

The **individual-based approach** concentrates on improving conditions for local residents in terms of social and economic development and well-being. Here, social development focuses on the “improvement of local institutional capacity” (Zielenbach 2000, 24) whereby strengthening these institutions can serve to develop the skills of individuals. Crime rates can be used as an indicator to assess this type of progress. Program-driven economic development is another type of individual-based approach that focuses on the economic growth of a community by increasing job availability, attracting businesses, and enlisting the assistance of government and non-profit organizations. Employment rates can be used as an indicator to monitor the success of such efforts.

**The inner city:**

It is valuable to have an understanding of the region being investigated, and while “it has been said that all classifications are useful rather than true” (Ley 2000, p. 274), thereby rendering boundaries as somewhat arbitrary, what is termed the inner city must be recognized as an area that has indeed experienced various levels of decline, and has therefore led those concerned with the future of inner cities to look to revitalization efforts. According to Ley (2000), the ring of old neighbourhoods located around the Central Business District (CBD), also known as the inner city, displays considerable diversity, and as the processes of urban decline and revitalization are of interest to this research, a closer examination of the inner city may provide insight in assessing how the urban environment functions as a whole.

Many North American cities have seen a recent concentration of growth in suburban areas, while the inner city experiences decline. In the mid-size city, urban growth is often equated with economic survival, and for this reason, an outward migration has been generated away from the inner city, leaving pockets of the city core lacking in economic capital and
resources (Stewart 1993). Pitkin (2001) contended that urban growth is often considered to be an ideological concept in which investors benefit by promoting the belief that growth provides increased well-being for all residents. Urban sprawl and suburban development draw out those residents and businesses that can afford to do so, leaving the inner city and its surrounding area to decline. For example, newer suburban developments are often accompanied by a plethora of establishments designed to service the consumer needs of an area, including shopping malls, strip development, big box store development, and other retail functions.

Ley (2000) considered inner city areas to be based on “dominant processes of identifiable change” (282) rather than simply on the basis of social characteristics. The inner city is composed of interconnected social, economic, physical, and political elements. By expanding on the work of McLemore, Aass, and Keilhofer (1975), Ley described what causes and forms inner city decline, and this classification facilitated the recognition of similar types of neighbourhoods when examining the GIS-based model created for the study area of Winnipeg, and provided a theoretical framework for analysing the results of the model.

As Table 1 indicates, McLemore et al. (1975) created a typology of change within the Canadian inner city neighbourhood and classified four phases: 1) decline, 2) stability, 3) revitalization, and 4) massive redevelopment.

Districts in decline, demonstrating deterioration of the housing stock and in land costs, often display characteristics such as population loss, poverty, and social problems (Ley 2000). Pitkin (2001) supported this thought by noting that as maintenance costs for older housing increase, investment in the stock often decreases, resulting in disinvestment within the community. Ley (2000) noted that neighbourhoods experiencing stability in population and socio-economic status most often share a sense of community held together by strong social networks. Neighbourhoods experiencing revitalization begin to see some up-filtering, which is essentially the movement of middle class households into lower class districts. Some renovation of housing stock occurs, and an increase in home ownership is evident. This phase of development can benefit a community by increasing pride and ownership; however, it may also result in the displacement of poorer residents. Massive redevelopment usually applies to larger, metropolitan cities, and is characterized by high population growth, resulting in changing household composition due to an increase in densities, and in turn often causes the displacement of low income residents, and prompts changes in existing land uses.
### Table 1: Typology of inner city neighbourhoods.

<table>
<thead>
<tr>
<th></th>
<th>Decline</th>
<th>Stability</th>
<th>Revitalization</th>
<th>Massive Redevelopment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Population</td>
<td>Continuing loss of population</td>
<td>No significant losses or gains</td>
<td>Little change</td>
<td>Gain in population</td>
</tr>
<tr>
<td>Socio-economic status</td>
<td>Decreasing</td>
<td>Stable</td>
<td>Increasing</td>
<td>Increasing</td>
</tr>
<tr>
<td>Family status</td>
<td>Increasing proportion of non-family units &amp; elderly</td>
<td>Maintenance of population mix</td>
<td>Maintenance of population mix</td>
<td>Loss of families, gain of singles</td>
</tr>
<tr>
<td>Ethnicity</td>
<td>Varies: can be an influx of deprived ethnic group or breaking down of traditional community</td>
<td>Sometimes strong ethnic community</td>
<td>Sometimes loss of ethnic groups</td>
<td>Seldom important</td>
</tr>
<tr>
<td>Community organizations</td>
<td>Poorly organized, unstable unstable</td>
<td>Varies</td>
<td>Increasing well organized</td>
<td>Usually unorganized</td>
</tr>
<tr>
<td>Physical conditions</td>
<td>Worsening</td>
<td>Stable</td>
<td>Improving</td>
<td>Improved housing, possible environment problems</td>
</tr>
<tr>
<td>Housing/land costs</td>
<td>Increasing much less than metro average</td>
<td>Increasing at same rate as metro average</td>
<td>Increasing more rapidly than metro average</td>
<td>Increasing more rapidly than metro average</td>
</tr>
<tr>
<td>Tenure</td>
<td>Increasing tenancy</td>
<td>Varies, but often high ownership</td>
<td>Little change</td>
<td>Tenancy</td>
</tr>
<tr>
<td>Non-residential functions</td>
<td>Loss of commercial-industrial functions with no replacement</td>
<td>Maintaining a mix of functions</td>
<td>Maintaining a mix of functions</td>
<td>Losing some commercial functions, but gaining others</td>
</tr>
<tr>
<td>Pressure for redevelopment</td>
<td>Low</td>
<td>Low</td>
<td>Strong, but controlled</td>
<td>High</td>
</tr>
</tbody>
</table>


## Methodology

### Geography of analysis:

Cities can be broken down into census tracts, census tracts into neighbourhoods, and neighbourhoods into communities; each will have various agendas. Although investigating the City of Winnipeg at the census tract level may seem broad and generalized when compared to neighbourhood or community areas, generalizations can be made at any level of analysis. As Elwood and Leitner (2003) revealed, even the term community can be problematic, implying uniformity in the identities and
interests of neighbourhood residents, which is often not the case. Therefore, although analysis at the census tract level covers a larger area than the neighbourhood or community level, suggesting a certain degree of generalization when examining the dynamic socio-economic and physical conditions of a city region, it should be noted that even at the community level, which would appear to be a relatively specialized level of intervention, simplifications can still potentially be made.

The definition of a census tract is an area that is small and relatively stable, usually has a population of 2,500-8,000 individuals, and is located in large urban centres that have a core population of 50,000 or more (Statistics Canada 2001). A community is often considered to be a sociological concept that generates a feeling of belonging and a common recognition of shared interests. The term neighbourhood tends to fall somewhere between census tract and community. Neighbourhoods are defined by physical boundaries similar to that of a census tract, but can also share the fuzzy boundaries of a community, as a neighbourhood often generates a positive or negative feeling limited only by perceptual borders (Schneider 2004).

**Modelling the urban environment:**

According to Longley (2002), Thomas (2002), and Brown and Perrott (2004), the use of MCE and GIS can provide valuable methods for urban revitalization strategies; MCE handles decision situations where the data being analyzed has both qualitative and quantitative characteristics.

Harris and Weiner (1998), Sheppard (1995), and Elwood and Leitner (2003) have described how GIS can be used not only for the revitalization of communities, but by communities as well. Harris and Weiner (1998) noted that GIS can serve to empower a community, allowing them the ability to obtain and develop alternative information and knowledge in relation to their surroundings. This information can then be used to improve their quality of life by increasing their communicating and negotiating power within the realm of urban politics.

As discussed above, the process of urban revitalization and rehabilitation involves both people and place, and statistical analysis and qualitative insight allow multiple perspectives of dynamic features to be considered. A mixed method approach offers “a strategy of inquiry that allows the researcher to converge qualitative and quantitative methods, with the result being a comprehensive analysis of the research problem” (Creswell 2003, 12). Distasio (2004) highlighted the importance of a mixed method approach to the study of urban development and emphasized that, “authors studying urban phenomena tend to… [make] use of multiple
theories and perspectives to study urban processes such as neighborhood change, revitalization, gentrification, and population turnaround” (98).

The research of Moodly and Hathout (2000) demonstrated how GIS modelling can incorporate elements of qualitative and quantitative data in an effort to enhance the interpretation of an urban area. Their research used GIS to assess satisfaction and quality of life in an urban environment, where aspects of satisfaction with life were based on the representation of services derived from household survey information, and quality of life was based on the availability of services derived from calculated baseline indicators. An objective index of the quality of life was calculated and the information could then be effectively visualized and analyzed at a district level.

Modelling the urban environment can therefore allow one to generalize or simplify a complex issue in order to bring forward flexible answers and provide potential solutions and problem solving techniques to urban revitalization initiatives. GIS allows its users to engage in descriptive representation of the physical environments in which symbolic interactions take place, thus improving and promoting wider public understanding of generalized spatial systems. By duplicating the urban environment in the form of a GIS model, it is possible to gain new visual information about the human processes and patterns that make up the city (Longley 2004).

**Data collection and processing:**

GIS and MCE are used as tools to monitor and manage urban revitalization strategies in the City of Winnipeg, and this section outlines the use of a mixed methods approach that examines spatial and non-spatial criteria in order to analyze varying levels of need for urban revitalization according to census tract. Revitalization factors were assessed by prioritization and ranking, then each factor was weighted to generate an index scale which was used to interpret patterns of need for urban revitalization. MCE is an important means of analysis in spatial decision support systems, as it allows weighted values to be assigned to spatial layers, and the sum of these values produces a final map, thereby allowing a research problem to be analyzed and weighted according to component factors (Carter 1991). It should be noted that the results of the MCE analysis are heavily dependent on the specified values.

Seven key factors associated with a need for urban revitalization were derived from 13 variables, as is shown in Table 2. The selected data was derived from Statistics Canada’s 2001 census (Statistics Canada 2001), and the City of Winnipeg’s Neighbourhood Designation Report (City of
These variables were selected based on consultation with key informants in the field of urban revitalization and pertinent literature on urban decline and revitalization, namely the theoretical framework provided by Ley (2000) and the work of Brown and Perrott (2004). Factors are derived from one or more variables. For example, housing is an aggregate of 4 related variables; namely, cost, rental rate, condition, and age. Each layer in the GIS analysis evaluated a key factor relating to need for urban revitalization.

It should be noted that in the case of the crime factor, data were only available at the neighbourhood level; therefore, the census tract layer was overlaid with the neighbourhood characterization area (NCA) layer, using the intersect function of ArcGIS, in order to measure the total proportion of neighbourhood area that fell within each of Winnipeg’s 165 census tracts. For example, it was found that approximately 30 percent of the total Burrows-Central neighbourhood, 50 percent of the total Dufferin neighbourhood, and 10 percent of the total Weston Shops neighbourhood fell within one given census area.

Table 2: Factors indicating need for urban revitalization.

<table>
<thead>
<tr>
<th>FACTORS</th>
<th>VARIABLES</th>
<th>SOURCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Income</td>
<td>1- average household income</td>
<td>Statistics Canada (2001 Census)</td>
</tr>
<tr>
<td></td>
<td>2- low income as percentage of households</td>
<td></td>
</tr>
<tr>
<td>2. Unemployment</td>
<td>3- unemployed population 15 years of age and over</td>
<td>Statistics Canada (2001 Census)</td>
</tr>
<tr>
<td>3. Housing (based on total number of private dwellings)</td>
<td>4- rental rate 5- age of dwelling (built before 1946) 6- average value of house 7- condition of dwelling (in terms of need for repairs)</td>
<td>Statistics Canada (2001 Census)</td>
</tr>
<tr>
<td>4. Mobility</td>
<td>8- 1 year population mobility 9- 5 year population mobility</td>
<td>Statistics Canada (2001 Census)</td>
</tr>
<tr>
<td>5. Education</td>
<td>10- population age 20-85+ with less than grade 9 education 11- population age 20-85+ with university diploma</td>
<td>Statistics Canada (2001 Census)</td>
</tr>
</tbody>
</table>
Factor Analysis:

Analysis of each standardized and reclassified socio-economic, housing, mobility, education, crime, and population factor as per census tract was examined, an example of which is illustrated in Figure 2.

Criteria evaluation needed for urban revitalization for the entire city shows variations for each factor between census tracts as follows:

Socio-economic factors. Average household income was represented as per total number of households by census tract. The average annual household income earned in Canada’s major metropolitan centres in 2001 was $30,000, with Winnipeg being below this average at $24,000 (Carter et al. 2005). Households falling below the average income are noticeably clustered within the core area, with very little exception. Household incomes were assessed at under $35,000, with the result being a significant concentration within the inner city area.

Unemployment was represented by unemployed persons 15 years of age and over, as compared to the total population age 15-64 years of age,
per census tract. Overall, the City of Winnipeg had an average unemployment rate of 4.6 percent in 2001, and once again, above average unemployment rates are found radiating out from the city centre. However, it may be noted that unemployment is a citywide trend, and higher rates may also be found in the northwest and southeast regions of the study area. Although the average maximum unemployment rate was 12.37 percent, and unemployment levels are low within the study area, it should be noted that the availability of low paying jobs may be equated with poverty in certain areas.

**Housing factors.** Four criteria were considered under this category. Bourne and Lorius (2000) noted that, housing is a significant aspect of urban revitalization strategies and presents “issues of poverty, marginalization, and economic well-being [that] are invariably tied to housing conditions and costs” (40). Physical, social, and economic welfare must also be considered to provide an effective approach to housing. The Neighbourhood Designation Report by the City of Winnipeg (2000) contends that housing revitalization strategies must integrate economic and structural change to improve the quality of life for community residents, while building on neighbourhood stability.

As older housing stock requires a greater degree of regular maintenance, the proportion of houses built prior to 1946 are an important element to consider, and Winnipeg is well above the Canadian metropolitan centre average of 14 percent (Carter et al. 2005). It was found that older dwellings are distributed throughout both the poorest (core area east) and the wealthiest (south) areas of the city. However, a high need for repair does not necessarily correspond with an older housing stock. When examining the study area, only the census tracts containing the Chalmers and Elmwood neighbourhoods, on the east side of the Red River (the major river running through the study area), are consistent with a great need for repair and a comparatively moderate percentage (between 20 and 40 percent) of pre-World War II dwellings. Affordable housing can contribute to a greater quality of life, as households have more disposable income available to cover additional living costs. In many census tracts throughout the study area, average household income is relative to average house value, where census tracts with an income ranging between $20-35,000 have homes worth approximately $50,000 in the same area, a cost that falls well below the average Winnipeg house value of $104,331 (Statistics Canada 2001). According to the Canada Mortgage and Housing Corporation (1998), households earning an income between $25-35,000 can afford homes available at a maximum price of $60-96,000. Based on these observations alone, it would seem that affordable housing is available in inner city areas with lower incomes. This being said, many of these
dwellings are in need of major repairs, and therefore may be an expensive investment for low-income families.

High rental rates coupled with population turnover are found concentrated in the inner city area. Greater than 80 percent of the population dwelling in the core area are renters, and 60 to 80 percent of renters are located along the edge of this area.

**Mobility factors.** Movers over a one-year and a five-year period were analyzed. High mobility areas are often associated with population transience and high rental areas. A concentration of movers can be seen in the inner city over a one-year period, with a maximum of 35 percent of the population relocating. Over a five-year period, higher rates of mobility can be seen more evenly distributed throughout the study area, with the focal point being in the southern sector of the city. It should be noted that over a five-year period these rates double, with a maximum of 72 percent of the population moving over this time period. When this data is reclassified, concentrations of high mobility are emphasized within the core area of the city, as well as in the south-central area. High levels were noted in close proximity to the city’s University of Manitoba, where a large proportion of the student population is found.

**Education factors.** Population over 20 years of age, with less than a Grade 9 education, as well as population with a university diploma, as compared to the total population age 20-85+ years of age, were calculated per census tract. It was found that 15-25 percent of the population that have less than a grade 9 education are located in the northwest side of the city, whereas 35-50 percent of the population with a university education dwell in the south-west side of the city. Maps produced by the GIS model illustrated that the city as a whole has followed this pattern, noting that the entire north side of the city has a low percentage of population with a university education, suggesting a predominantly blue-collar population. According to Brown and Perrott (2004), improving education is a factor that can contribute to urban revitalization, as many areas in the inner city experience a poor quality of education, and lack of education can lead to a lack of job opportunity, perpetuating a cycle of decline.

**Crime factors.** The conditions leading to crime1 are important, as it was found that the highest crime rates cut right through the centre of the

---

1 Crime rate was based on crimes committed against person and property include homicides, attempted murder, sexual offences and assaults, assaults, abductions, and robbery, and crimes against property included break and enters, theft, possession of stolen goods, motor vehicle theft, fraud, residential arson, and mischief. Commercial buildings, such as shopping malls, were not included in this data (City of Winnipeg Neighbourhood Designation Report 2000).
city. As Bourne (2000) expressed, depopulation and decline in the inner city can create “a polarized society…producing feelings of alienation and isolation, and often higher levels of antisocial behaviour” (42). A high percentage of misdemeanours can also be found in the sparsely populated industrial areas of the city, such as in the St. James Industrial and St. Boniface Industrial Park areas. Crime rates were determined according to number of crimes per census tract divided by total population per census tract. The City of Winnipeg’s Neighbourhood Designation Report (2000) provided total crime rates per neighbourhood, but in order to contrast areas and break crime down into comparable levels, a percentage was calculated to illustrate the number of crimes per person, per census tract.

**Population density factors.** Population density is a factor that would rather benefit from analysis over time, as it may then highlight growing or declining areas within a city. High population density does not necessarily equate itself with a need for revitalization in slower growth cities such as Winnipeg. Although pockets of high density can be seen in the core area of the city, population distribution is fairly consistent throughout the rest of the urban area, with 800 to 2,500 people per square kilometre on average.

**Multi-criteria evaluation:**

MCE has benefited this study in that it has allowed key factors to be prioritized, and allowed multiple variables to be assessed in the form of a single map. Thirteen variables grouped as 7 factors were selected according to their significance when considering the need for urban revitalization (City of Winnipeg Neighbourhood Designation Report 2000; Statistics Canada 2001; Brown and Perrott 2004). Each of these variables was then ranked according to hierarchical order, based on assigned numeric values derived from relevant literature and a qualitative assessment made by two experts in the field of urban geography. These results were then synthesized to determine priorities to be assigned to each variable (Dai et al. 2001) based on literature relevant to the topic of urban revitalization as well as the subjective judgement of two senior urban researchers at The Institute of Urban Studies, University of Winnipeg. Each researcher was given a survey that listed factors pertinent to the need for renewable urban development (City of Winnipeg Neighbourhood Designation Report 2000; Statistics Canada 2001; Brown and Perrott 2004); the researchers were informed that these factors would be used to create an index scale for urban revitalization in order to quantitatively measure physical and socio-economic variations within the City of Winnipeg. They were then asked to prioritize each variable by ranking it in order of importance, thereby combining qualitative assessment with qualitative values. This assessment was given primary consideration when applying MCE to the study area.
Table 3 shows the final factor ranking according to the level of importance together with their variable components. Each factor was calculated based on a percentage from the total components of variables and was given a percentage rating according to importance, so that when weighting variables for MCE, not all are given equal consideration. For example, when examining the income-based factor, it was determined, based on relevant literature and the interviews with urban experts, that average household income had a more significant influence on distressed urban areas than the percentage of low income households, where average household income is 1.5 times more significant than the percentage of low income households.

Table 3: Factor rankings.

<table>
<thead>
<tr>
<th>FACTOR</th>
<th>RANK</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average household income (60%)</td>
<td>1</td>
</tr>
<tr>
<td>Percentage of low income households (40%)</td>
<td>1</td>
</tr>
<tr>
<td>Unemployment (100%)</td>
<td>2</td>
</tr>
<tr>
<td>Proportion of rented dwellings (20%)</td>
<td>3</td>
</tr>
<tr>
<td>Age of dwelling (20%)</td>
<td></td>
</tr>
<tr>
<td>House condition (i.e. in need of major repairs) (35%)</td>
<td></td>
</tr>
<tr>
<td>Average house value (25%)</td>
<td></td>
</tr>
<tr>
<td>5 year population mobility (70%)</td>
<td>4</td>
</tr>
<tr>
<td>1 year population mobility (30%)</td>
<td></td>
</tr>
<tr>
<td>Less than grade 9 education (pop. &gt; 20 years of age) by highest level of schooling (60%)</td>
<td>5</td>
</tr>
<tr>
<td>University degree/diploma (pop. &gt; 20 years of age) by highest level of schooling (40%)</td>
<td></td>
</tr>
<tr>
<td>Annual crime rate (100%)</td>
<td>6</td>
</tr>
<tr>
<td>Population density (100%)</td>
<td>7</td>
</tr>
</tbody>
</table>


The data for each factor was then reclassified into 5 user defined classes (as shown in Figure 2) based on the average of each factor under consideration, plus and minus two standard deviations from the mean, in order to reveal spatial patterns and groupings within the study area, a method derived from the work of Brown and Perrott (2004).

A pairwise matrix was designed that weighted each factor against another, where pairs of factors were individually compared. As an example, variable one (income) is twice as important as variable 3 (housing), and a value is determined. It is a criteria score that then assigns a relative value between 0.9 and 9 to the intersecting cell, where a value of 9 is the highest given weight, and a value of 0.9 is the lowest given weight. Table 4 indicates
the pairwise matrix together with the weight for each factor used to create the index for urban revitalization.

Pairwise matrix data was used to calculate the eigenvector of weights for each factor. This procedure generated an acceptable consistency ratio (a value between 0.00 and 1.00), and the weighted values could then be input into a MCE model, using weighted linear combination, which is defined as being composed of the sums and differences of elements in a field of real numbers (Dai et al. 2001).

MCE serves as a weighted overlay function that aims “to investigate a number of possibilities in the light of multiple criteria and conflicting objectives” (Voogd 1983, 21). This provides the framework for processing derived weight values, and handles decision situations where the data possess both qualitative and quantitative characteristics (Carter 1991). Therefore, in the case of this project, MCE was selected as the method of measurement.

MCE can take into account all 13 factors in one map, creating an index scale that indicates a need for revitalization (Figure 3); in other words, all factors under consideration can be brought together and weighted by MCE in order to create a map based on ranked variables.

**Index scale:**

The establishment of an index scale, as described in the previous section, designates census tracts with very high need for urban revitalization ranging to those with very low need in the study area of Winnipeg. The index scale was reclassified into four computer generated, equal class interval categories to reflect census tracts with very low need for revitalization, those with moderate need, and those with an urgent (high or very high) need for urban revitalization.

**Table 4: Pairwise comparison matrix.**

<table>
<thead>
<tr>
<th>Variable</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.1943</td>
</tr>
<tr>
<td>2</td>
<td>.7</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.1590</td>
</tr>
<tr>
<td>3</td>
<td>.6</td>
<td>.7</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.1355</td>
</tr>
<tr>
<td>4</td>
<td>.5</td>
<td>.6</td>
<td>.7</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td>0.1177</td>
</tr>
<tr>
<td>5</td>
<td>.4</td>
<td>.5</td>
<td>.6</td>
<td>.7</td>
<td>1</td>
<td></td>
<td></td>
<td>0.1030</td>
</tr>
<tr>
<td>6</td>
<td>.3</td>
<td>.4</td>
<td>.5</td>
<td>.6</td>
<td>.7</td>
<td>1</td>
<td></td>
<td>0.0901</td>
</tr>
<tr>
<td>7</td>
<td>.2</td>
<td>.3</td>
<td>.4</td>
<td>.5</td>
<td>.6</td>
<td>.7</td>
<td>1</td>
<td>0.0781</td>
</tr>
</tbody>
</table>

Consistency Ratio: 0.00

To further conceptualize the four categories of need for revitalization, based on the MCE index scale, the four indicators were measured against the neighbourhood designation categories derived from the City of Winnipeg’s Neighbourhood Designation Report (2000) for comparative levels of need.

MCE areas indexed as high need are fairly consistent with those deemed as Major Improvement areas by the City of Winnipeg. However, the present study’s model indicates that the areas of highest need are growing and spilling beyond the boundaries originally determined by the city. As well, rather than showing a homogeneous area, the MCE model reveals a diversity of need in the core area, with certain neighbourhoods demonstrating a more urgent need for revitalization initiatives.

When examining the results of this study, it appears that a high need for housing revitalization exists in pockets throughout the city, as well as in the core area. The maps created using MCE are comparatively consistent with the major improvement and rehabilitation areas; although the model

Figure 3: All 13 variables.
shows additional high need areas in the central east and west regions of the study area.

Table 5 illustrates the results when comparing the City of Winnipeg’s Neighbourhood Designation categories to the urban revitalization index scale generated by the MCE model.

Table 5: Winnipeg housing policy classifications as compared to index scale rating.

<table>
<thead>
<tr>
<th>Neighbourhood Designation</th>
<th>Identifiable Characteristics</th>
<th>Index Scale</th>
<th>Identifiable Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Major Improvement Area</td>
<td>Older area experiencing significant decline, renewal is required</td>
<td>Very High Need</td>
<td>Older area of inner city, in major decline, and in very high need of social, economic, and housing revitalization</td>
</tr>
<tr>
<td>Rehabilitation Area</td>
<td>Decline is beginning to impact overall stability of the area, some intervention is required</td>
<td>High Need</td>
<td>Decline found in inner city area, and spilling into outlying regions; area is in need of renewal intervention, as it is experiencing high levels of factors associated with poverty and decline</td>
</tr>
<tr>
<td>Conservation Area</td>
<td>Area that is stable, but requires monitoring as it may be showing initial signs of decline</td>
<td>Moderate Need</td>
<td>Area that is stable; somewhat transient area with moderate income, showing potential decline</td>
</tr>
<tr>
<td>Emerging Area</td>
<td>Area where new development is being considered</td>
<td>Low Need</td>
<td>Outer ring of city, little to no need for revitalization; stable socio-economic and physical area</td>
</tr>
</tbody>
</table>


A theoretical framework:
Through the investigation described in Table 5, one finds that the theoretical framework of the subjective characterization of the processes of inner city change, and the results of MCE, act as a bridge to link together the elements of urban revitalization. Ley (2000) stated that a considerable amount of diversity exists between and within inner city neighbourhoods, and although they are often seen as homogeneous, this is a broad generalization. Therefore, by combining elements of a descriptive framework such as provided by Ley (2000) (Table 1) with the results of MCE analysis, the necessary detail can be added to determine whether this diversity is recognizable at the census tract level. Each process of change identified by McLemore et al. (1975), and as furthered in the work of Ley (2000), will be reviewed in the context of the results of the MCE analysis, as well as the context of the recognizable processes of inner city change.
The classification of the inner city, as set out by Ley (2000), uses this framework to identify characteristics of the study area, and guides interpretation of the GIS model.

Firstly, it is clear that districts in decline are evident within Winnipeg’s inner city. These districts are associated with high tenancy rates, house values below the metropolitan average, and a high population turnover (Ley 2000). When analyzing the 7 most important factors contributing to a need for revitalization in Figure 4, the ring of inner city neighbourhoods radiating out from the downtown area are shown to be in highest need. In general, the figure still shows the inner city area to be in high need, but most specifically the census tract containing the neighbourhood of Point Douglas South, one of Winnipeg’s oldest neighbourhoods, is identified as being in highest need. These areas overlap with the Major Improvement Area, as designated by the City of Winnipeg.

Districts experiencing stability demonstrate higher home ownership and better-maintained houses that have a value similar to that of the metropolitan average (Ley 2000). Average house values can be seen in

Figure 4: 7 highest ranking criteria/factors.
census tracts to the west of the inner city, as well as in areas that circle the core area and run along the city’s rivers, as do the city’s Rehabilitation Areas.

Revitalization regions are often located in “proximity to existing elite area[s]” (Ley 2000, 288); as well, they may be located near a university. Populations found in these areas are often better educated, and therefore will generally have somewhat higher than average income levels. Census tracts containing the neighbourhoods of Wolseley and Lord Roberts fall into this category based on the above-mentioned criteria; these neighbourhoods are also considered to be Rehabilitation Areas according to the City of Winnipeg (see Table 5).

As previously discussed, massive re-development areas are most often situated in larger, high growth metropolitan areas. Such development has not yet been observed in Winnipeg; however, the “bull-dozing,” slum clearing based initiatives that are typified by this type of development were practiced in Winnipeg during the 1960s and 1970s, where portions of the downtown and core area experienced this process of change (McFayden and Gunn 2004). Today many of these inner city areas are found to be in very high need for revitalization, as this “bull-dozing” approach to urban renewal demolished both housing stock and commercial services that have not since been rebuilt.

Imposing the typology of Ley (2000) after McLemore et al. (1975) over the core region of the study area has allowed for an enhanced examination and interpretation. In many cases, “both a statistical and perceptual overview obscure important internal diversity between districts” (Ley 2000, 292), and so continued analysis and involvement is required when investigating the changing geography of the city.

Isolating variables:

As can be seen in Figure 5, factors indicating a need for housing revitalization were isolated. This allowed a more specific type of need for revitalization to be examined, and it was revealed that a very high need for housing restoration exists in several distinct pockets located in the vicinity of the city centre, in neighbourhoods such as Inkster, St. John’s, Weston, and Luxton. As well, a high need for housing revitalization can be found scattered throughout the study area. It must be noted that the census tract containing the airport and the St. James Industrial Area, located on the west side of the city, is defined as a very high need district; this may be due to the fact that a very low population of 280 persons dwells here, and there is a high proportion of low cost, rental housing.
Socio-economic variables affecting the need for urban revitalization were then segregated by grouping all factors not associated with housing, and in doing so it was found that areas demonstrating both very high and high need for socio-economic improvement are concentrated in the core district of the study area. Several neighbourhoods are shown to be in very high need of urban revitalization initiatives. Neighbourhoods most affected by very high need for socio-economic revitalization include North and South Point Douglas, Centennial, and West Alexander. It is important to note that high need areas do extend beyond these neighbourhoods, and pockets of need can be found in areas of St. Boniface and St. James, for example.

The ranked housing and socio-economic factors were isolated in order to reveal patterns and trends in the study area that might otherwise be overlooked (Figures 5 and 6). By isolating and overlaying selected variables in the form of an MCE model, patterns of need that might not otherwise readily emerge can be established. This model worked well in conjunction with the work of Ley (2000) and the City of Winnipeg’s Neighbourhood
Designation Report (2000), as it allowed census tract areas to be grouped according to need, thereby corresponding with the four categories of need for revitalization as described in the typology of inner city neighbourhoods and the study area itself.

**Discussion and Conclusion**

The urban landscape is a dynamic structure, made up of social, economic, physical, and political components, all of which interconnect with one another. In a complex environment such as the urban area, it is vital that research strategies and methods of urban revitalization be part of a continuous, sustainable process; a process that can benefit from the use of various tools for analysis. GIS and MCE were used as tools to monitor urban revitalization strategies in the City of Winnipeg, using a mixed methods approach that examined spatial and non-spatial criteria and analyzed varying levels of need for urban revitalization according to

*Figure 6: Isolated socio-economic indicators.*
census tract. Areas displaying common characteristics were highlighted in the form of a single map. MCE is a technique that allowed a number of revitalization factors to be simultaneously assessed by prioritizing and ranking them using a mixed methods approach that joined qualitative and quantitative analysis. These factors were then weighted and combined to create an index scale which was used to interpret varying levels of need for urban revitalization. The use of MCE and a mixed methods approach contributes to the existing literature and research base, as the method described and used to define areas in need of revitalization in this study is unique to medium-sized Canadian cities. GIS and MCE research examining the subject of urban revitalization has predominantly focused its attention on larger, high growth metropolitan areas in this context.

A theoretical framework was established in order to define and diagnose urban areas emerging or increasing in need for revitalization, and was used to illustrate spatial and non-spatial patterns and trends within the study area of Winnipeg when examining the generated series of maps. This approach also allowed the use of both quantitative and qualitative techniques of analysis. A theoretical framework that characterizes the processes of inner city change, joined with GIS and MCE analysis, can be used to effectively assess the need for urban revitalization in a medium-sized Canadian city.

Various factors benefit from more specific consideration when determining revitalization policies, and the MCE model allowed for factors contributing to a need for housing revitalization, as well as those indicating a need for socio-economic revitalization, to be isolated and examined separately, offering a distinct perspective to the study area while supporting existing classifications. This process allowed for clusters of specific high need to be highlighted in areas that may otherwise have been overlooked by creating an index scale that illustrates the existing and emerging divisions of census tracts within the study area that are in highest need for physical and/or socio-economic revitalization.

GIS, in combination with MCE, can benefit community and government policy and decision-making strategies as it offers a holistic view of the city, allowing quantitative statistics to be mapped in conjunction with the qualitative expertise of researchers and planners in the area of urban revitalization. This method of analysis may offer an increased understanding of a slow growth urban environment, and serve to bring together various elements as part of problem solving strategies. This model can adapt to new data, and can be modified as census information changes, making it an important tool for assessing the present and future development of the urban environment.
As a recommendation for further study, it would be useful to consult with a larger, more diverse panel of key experts on the subject of urban revitalization, as the results of MCE rely heavily on the weights assigned by key informants. It would be valuable to survey those that share a vested interest in the successful development of the Winnipeg area, such as researchers, government officials, city planners, and community members. Additional factors that contribute to a need for urban revitalization could be considered in future, such as those associated with education, schooling, and family type.

References

BROWN, A.R. and PERROTT, K.J. 2004 ‘Using GIS to evaluate urban renewal strategies of the city of Chicago’ University of Guelph
BUNTING, T. 1986 ‘Reinvestment in older, inner-city housing’ Canada Mortgage and Housing Corporation Publication
CARMON, N. ‘Neighbourhood revitalization and community development’ International Encyclopedia of the Social and Behavioural Sciences, 10494-10499
CARTER, S. 1991 ‘Site search and multi-criteria evaluation’ Planning Outlook 34, 27-36
——. 2005 ‘Canada’s 25 major metropolitan centres: a comparison’ Research Highlights No. 6, 1-12
CITY OF WINNIPEG. 2001 ‘Description of geographies used to produce census profiles’ unpublished web page available online: <http://www.winnipeg.ca/census/2001/includes/Geographies.stm>
COMMUNITY SERVICES DEPARTMENT. 2000 Neighbourhood Designation Report (City of Winnipeg: City of Winnipeg)
DISTASIO, J. 2004 Reacting to Actions: Exploring How Residents Evaluate Their Neighbourhoods (University of Manitoba: Department of Geography)

DOEL, M. 2001 ‘Qualified quantitative geography’ Environment and Planning D: Society and Space 19, 555-572


HARRIS, T. and WEINER D. 1998 ‘Empowerment, marginalization, and “community integrated” GIS’ Cartography and Geographic Information Systems 25(2), 67-76


LONGLEY, P.A. 2002 ‘Geographical Information Systems: will developments in urban remote sensing and GIS lead to ‘better’ urban geography?’ Progress in Human Geography 26(2), 231-239


MCFAYDEN, L. and GUNN, J. June, 2004 Policy Responses to Neighbourhood Decline in Winnipeg (Institute of Urban Studies: Summer Institute Information Session)


MURPHY, P. and PUDERER, H. March 2002 ‘Census metropolitan areas and census agglomerations with census tracts for the 2001 Census’ Geography Division Statistics Canada, Catalogue No. 92F0138MIE


PITKIN, B. 2001 ‘Theories of neighbourhood change: implications for community development policy and practice’ UCLA Advanced Policy Institute
POON, J.P.H. 2003 ‘Quantitative methods: producing quantitative methods narratives’ *Progress in Human Geography* 27(6), 753-762

SCHNEIDER, J. 2004 ‘The role of social capital in building healthy communities’ *Policy Paper produced for the Annie E. Casey Foundation*

STATISTICS CANADA. 2001. ‘Census Data’ webpage available online: <http://ceps.statcan.ca/english/profil/Search/PlaceSearch1.cfm?SEARCH=BEGINS&LANG=E&Province=46&PlaceName=winnipeg>

STEWART, D.G. 1993 ‘A critique of the Winnipeg Core Area Initiative: a case study in urban revitalization’ *Canadian Journal of Urban Research* 2(2), 150-161


