PUBLIC PARTICIPATION GIS:
A PROPOSED MODEL FOR COMMUNITY ORGANISATIONS

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ABSTRACT

The concept of Public Participation GIS (PPGIS) arose, in part, as a result of GIS and society research initiatives which were conducted during the 1990s. During that same era, various researchers began to introduce GIS applications within local neighbourhood settings, and document their efforts in peer-reviewed journals. PPGIS proponents viewed the technology as empowering for community groups seeking entry into the public policy decision-making arena, whereas detractors believed PPGIS was marginalising for organisations which lacked the capacity to use such technologies. By the latter half of that decade, the term PPGIS was used to refer to myriad grassroots GIS efforts which heralded from all over the globe, with the noticeable exception of Canada.

An important consideration in this thesis is why there is a paucity of PPGIS initiatives in Canada. In order to further understand the complexity of this issue, I examine a number of frameworks used for conceptualising, implementing, and evaluating PPGIS initiatives, which are derived from research in the United States (US). Several inner-city case studies are presented in order to illustrate various methods undertaken by US researchers implementing community-based PPGIS projects. I then propose a generic model for PPGIS initiatives, which is comprised of three phases, including: (1) capacity assessment for a PPGIS, (2) design of a PPGIS prototype, and (3) sustainable PPGIS.

Research indicates that restricted access to public data, in the Canadian context, may be a primary reason for the relative absence of PPGIS efforts in that nation (c.f. Klinkenberg 2003). Given that most PPGIS initiatives have yet to reach a level of sustainability in the US, it is quite probable that similar efforts in Canada will not succeed beyond a rudimentary level. In such instances in the US, an Internet Map Server (IMS) has frequently been deemed appropriate to suit the geographic information needs of community organisations. An IMS does not, however, represent a fully participatory GIS; rather, in this instance, an external "host" provides the "client" with information, via the Internet. As such, I conclude my research with recommendations for future Canadian PPGIS endeavours, which are based upon the proposed PPGIS model and evidence provided in the thesis.

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1.0 INTRODUCTION

1.1 Introduction

Public Participation GIS (PPGIS) represents a newly emerging field, one which holds much promise for community organisations wanting to engage in GIS-related activities as means toward community empowerment. A PPGIS is envisioned to be a tool for empowering grassroots organisations -- the information and subsequent knowledge derived from a PPGIS enables marginalised groups to enter the public decisionmaking arena, and participate more fully in the development of policies which affect their interests. As such, it is my intent to explore those participatory aspects of a PPGIS which best suit a community organisation.

The field of PPGIS is made up of a broad, interdisciplinary research agenda -- it is comprised of both social and technological aspects of engaging the grassroots in the usage of a GIS. From a practical stance one is concerned with factors surrounding acquisition, implementation, and successful use of the technology (from which numerous technical and organisational studies have evolved). Theoretical research, on the other hand, examines conceptual issues, such as the social impacts of adopting new technologies in order to provide analytical frameworks for understanding the implications of such processes. Social and scientific models may be derived as a result of combining practical applications and theory. PPGIS research can be classified as a hybrid of both approaches -- a mingling of practices which extend across the boundaries of science, social and political geography, planning, and so forth.

1.2 Definition of PPGIS

PPGIS has been defined by various researchers from a number of perspectives. Krygier (2002) defines PPGIS as "an integrative and inclusive process-based set of methods and technologies amenable to public participation, multiple viewpoints, and diverse forms of information" (p. 330). Barndt (1998) provides a similar interpretation of PPGIS:

> . . . [PPGIS is] a term that has been coined to represent the vision of those interested in the socio-political contribution of GIS to communities . . . . The vision includes GIS tools that are easily used and understood by citizens, relevant to public policy issues and available to all sides of public policy debates (p. 105).

Schuurman (2003) describes PPGIS as "a way of extending decision-making processes to include groups that may not otherwise be heard in the context of policy development" (p. 3). As such, a PPGIS may be defined in numerous ways, which tend to be determined by the social, political, and organisational *context* within which the technology is introduced.

Similar to a GIS, a PPGIS is comprised of GIS hardware, software, data, and knowledgeable GIS practitioners. Unlike a GIS, however, a PPGIS project must also accommodate the needs of a community organisation, which frequently lacks the technical skills needed to manipulate, implement, and maintain the technology. PPGIS detractors view the technology as being top-down, difficult to learn, and, subsequently, a marginalising practice for community groups (c.f. Pickles, 1995). PPGIS proponents, however, envision the technology to be empowering for neighbourhood organisations, once such groups have learned to use the PPGIS in a proactive manner.

1.3 Research Objectives

One of the primary objectives of this thesis is to research and identify best PPGIS practices in the United States (US), which could be applied in a Canadian context. Given that the majority of community-based GIS projects have been implemented in the US, it is expected that a careful analysis of several case studies will yield valuable insight into the construction of a sustainable PPGIS model for Canadian citizens. Evidence is gathered in the form of textual analysis of formal texts, peer-reviewed articles, university-community reports, web-based data and GIS sites, and electronic mail communications.

The Cities of Minneapolis and St. Paul, Minnesota, and Milwaukee, Wisconsin, have been selected for this research as many of their neighbourhoods have a rich history of community activism and revitalisation efforts, and because they have demonstrated experience with PPGIS partnerships. As well, the City of East St. Louis, Illinois, has been chosen based on its use of PPGIS as part of a successful community revitalisation initiative: the East St. Louis Action Research Project (ESLARP). Universities situated within, or near, these cities have long engaged in multi-participant collaborative projects in order to empower local neighbourhood groups and to broaden student learning experiences. Other case examples will be included in the thesis in order to illustrate various points, but only in anecdotal format.

It is also my intent to examine the ways in which PPGIS has been introduced to and utilised by community groups. Many questions have come to the fore in the literature, concerning the utility of a PPGIS, and they will be addressed in this study. Such concerns are centred

around whether or not a PPGIS is even appropriate for use by neighbourhood organisations. As one who advocates for a democratic society, I believe it is in the citizens' best interests to have unrestricted access to public data and to gain the skills needed to analyse and understand geographic data in order to make informed decisions, particularly in the policymaking arena. While some would debate the ethical implications of this statement, there are myriad copyright laws, both in Canada and the US, which address issues concerning invasion of privacy and data liability. As such, it is not my intent to engage in deeper philosophical debates; rather, I provide a more pragmatic approach to conceptualising a PPGIS model best suited to grassroots efforts.

Given the complexity of using a PPGIS, most community groups should not be expected to master the technology. Rather, grassroots organisations should focus on learning basic geographical concepts and simple spatial analysis in order to understand the maps created by a PPGIS. As community groups gain knowledge from the use of simple desktop mapping programs, it is expected that some residents will decide to engage in more complex mapping procedures, thereby offsetting some of the initial GIS start-up costs and providing the impetus for more sophisticated technological collaborations. If, and when, a neighbourhood organisation demonstrates the capacity for implementing a sustainable PPGIS, certain steps should be taken to ensure that the project succeeds. As such, this prospect will be discussed in further detail later in the thesis.

1.4 Cross-border Contexts

While difficulties are inherent regarding cross-border comparisons, it is hoped that some generalisations derived from US studies will be applicable in the Canadian context (c.f. Goldberg & Mercer, 1985). Barriers to affordable data access are one of the most significant impediments to PPGIS efforts, particularly in Canada where cost-recovery mechanisms are well entrenched in government practices (c.f. Klinkenberg, 2003). Restrictive privacy and copyright laws in Canada also tend to prohibit equitable distribution of public data. Interestingly enough, PPGIS proponents in the US are beginning to face similar issues, albeit on a much smaller scale. US government retrenchment and devolution of public services over the past twenty years have resulted in the growth of fee-for-service charges by government data providers. Still, when viewed in a comparative light, US citizens have far greater access to data in the public domain than do Canadians.

1.5 Overview and Summary

PPGIS efforts have experienced a relatively short history of slightly more than one decade. None-the-less, there is much to be learned from past and present PPGIS initiatives. In this thesis, it is my intent to contribute to the research by providing a brief history of the subject, as well as evaluate the PPGIS discourse and conceptual frameworks which have been documented by a number of scholars. In light of this knowledge gained, I then provide a generic model for a PPGIS which advocates a partnering venture in which the capacity and needs of a community organisation are considered to be the guiding factor.

In chapter one, I introduce the concept of PPGIS and situate it within the inner-city US context. This is followed by an summary of research objectives for this thesis. A general definition of PPGIS is provided, which will be discussed in greater depth later in the thesis. Concerns regarding a cross-border comparison between the Canadian and the US contexts are raised, and the chapter is then concluded with an summary of the chapters to follow.

In chapter two, I describe precursors to PPGIS, such as the GIS and Society debate, in order to lay the groundwork for the PPGIS research agenda which followed. The literature discussed provides a number of critical viewpoints, within which fundamental PPGIS principles are embedded, including: empowerment, marginalisation, and the notion of public participation.

The above mentioned principles are considered integral to a PPGIS, and, thus, they are carefully unpacked and discussed further in Chapter three. A pivotal Project Varenius conference, conducted by the National Centre for Geographic Information and Analysis (NCGIA) in 1998, marked a turning point in the formalisation of the PPGIS discipline (NCGIA, 1998). Prior to that time, most PPGIS projects were conducted and documented in an *ad hoc* manner. Two related concepts -- community asset mapping, and community mapping -- will also be discussed briefly. The chapter is then concluded with a discussion on the value of a PPGIS to a community group.

In chapter four, I provide a number of PPGIS conceptual frameworks which are derived from the literature. This discussion commences with an overview of fundamental GIS principles

upon which PPGIS may be situated. The conceptual models in the PPGIS literature depart from standard GIS practices, however, in terms of their integration of community requirements and capacity. This chapter is comprehensive in scope, and covers models for conceptualising, implementing, and evaluating a PPGIS.

Three inner-city US case settings are discussed in chapter five. Each context offers its own unique perspective on PPGIS implementation, yet all share a fundamental underlying mandate: community revitalisation and empowerment can be achieved through multi-participant partnerships which engage in the use of a PPGIS. As stated beforehand, these cities include: Milwaukee, Wisconsin, East St. Louis, Illinois, and Minneapolis and St. Paul, Minnesota. The chapter concludes with a critical summary of important findings which are of value to PPGIS implementation strategies.

In chapter six, I propose a PPGIS model which is based upon evidence gathered and discussed in previous chapters. Three phases are identified in the model, including (1) assessment of the capacity for a PPGIS, (2) development and introduction of a PPGIS prototype, and (3) a sustainable PPGIS. My purpose for developing this model is to provide prospective PPGIS initiatives with generic and realistic guidelines for what can be expected when implementing such a project.

Given the paucity of PPGIS endeavours in Canada, only one example of a Canadian university-based PPGIS is discussed in chapter seven. A university-community framework

may prove to be the best prospect for implementing a PPGIS in Canadian communities, for reasons which will be discussed in the chapter.

In chapter eight, I conclude the thesis with a summary of recommendations for further research, particularly with respect to future Canadian PPGIS research endeavours.

2.0 GIS AND SOCIETY LITERATURE

2.1 Introduction

Prior to 1995, social concerns including public participation in GIS were not considered mainstream in the GIS literature. Rather, the literature was aimed primarily toward the commercial diffusion of the technology including, economic and legal issues (cost-benefit analyses, data acquisition, hardware and software costs), as well as professional implementation strategies.

On occasion, several refereed journals published social aspects of GIS implementation issues, but only a handful of researchers touched on empirical investigations of the potentially disenfranchising effects of GIS and mapping technologies (Harley, 1988, 1990, 1992; Archer & Croswell, 1989; Chrisman, 1987). By the early 1990s, social theorists and GIS proponents began to debate the merits of GIS, the process primarily driven by the former groups (c.f., Taylor, 1990; Edney, 1991; Goodchild, 1991; Openshaw, 1991; Overton, 1991; Pickles, 1991).

For the most part, social research in GIS was primarily focused on corporate organisational implementation issues encountered by GIS managers (c.f., Campbell & Masser, 1991; Campbell, 1991; Crosswell, 1991; Huxhold, 1991, 1995; Budic, 1994; Obermeyer & Pinto, 1994). Institutional concerns began to emerge in the technical literature, which undoubtedly prompted social theorists to speak out.

The notion of public participation GIS (PPGIS) arose in the mid-1990s, in part a result of the broader society and GIS debate. PPGIS will be introduced in the literature review, and then discussed in greater detail in the next chapter. The unique discourse surrounding this newly emerging discipline warrants a thorough review, upon which this thesis is predicated. This chapter is intended to provide a general overview of the GIS and society debate, which emerged in the late 1980s.

2.2 Organisational Issues and GIS

Prior to the late 1980s, "the literature on GIS [was] characterised by both its sparsity and inaccessibility" (Maguire, Goodchild, & Rhind, 1991, p. 5). The relative newness of the discipline, as well as its commercialised, proprietary nature precluded much publication on the research (*Ibid*). In 1988, *The American Cartographer* published a special edition of articles which covered the evolution of GIS and automated cartography since the 1960s.

By the early 1990s, however, there was a marked growth in GIS publications, largely due to "the explosion of interest in GIS . . . [and] the maturity of the discipline" (Maguire *et al.*, 1991, p. 5). Maguire *et al.*'s (1991) *Geographical Information Systems* became the definitive reference text for GIS users and researchers of that decade.[1] Comprised of 56 chapters in all, its two volumes were intended to provide a comprehensive overview of the field. Its subject matter ranged from GIS in history, in institutional and commercial settings, to legal concerns, to a broad selection of GIS applications and management issues located in North America and, to a lesser extent, the United Kingdom (UK).

David Martin's (1991) *Geographic Information Systems and their Socioeconomic Applications* was one of the first books to "explicitly address the role of GIS in socioeconomic applications . . . [albeit] from an understanding of GIS as a spatial analytic and applied science" (Pickles, 1995, p. 14). While severely criticized by Pickles and others for its "unproblematic, naturalised" approach to GIS and lack of ethical and political analyses (1995, pp. 16-17), Martin's text did represent a useful technical foray into new territory:

> . . . [which was] unique in its focus on the socioeconomic applications . . . [thus allowing] the reader to develop a strong position from which to question and judge the validity of contemporary GIS technology and literature (Martin, 1996, preface).

In his chapter on The Technological Setting of GIS (1991), Goodchild presaged social costs surrounding the implementation of GIS:

> In the coming decade the technological problems which plagued earlier generation of GIS products will be far less important than the human ones -- lack of trained staff, the high personnel costs of digitizing, poor planning and management, resistance to technological change within institutions, and so on (p. 53).

By the early to mid-1990s, research began to emerge (and be published) concerning organisational issues and implementation strategies with respect to GIS (c.f., Campbell, 1991; Huxhold, 1991, 1995; Budic, 1994; Obermeyer & Pinto, 1994; Campbell & Masser, 1995). For the most part, the literature was focussed on larger, institutional and planning concerns, such as bureaucratic factors which might inhibit adoption of the new technology, economic justification for the huge cost outlays of purchasing GIS, and GISs and the strategic planning process (Obermeyer & Pinto, 1994). Government, industry, and academia were most able to afford the purchase, implementation, development and maintenance of GIS

[1] Note: a second edition, edited by Longley, Goodchild, Maguire and Rhind, was published in 1999.

technology. Moreover, the expense of data acquisition, manipulation and storage was largely controlled by government agencies and commercial data providers (c.f. Klinkenberg, 2003).

2.3 Social Theoretical Debate

By the early 1990s a new body of work began to emerge, comprised of social critiques of cartography and GIS (c.f. Harley, 1988, 1990, 1992; Openshaw, 1991, 1992; Pickles, 1992; Lake, 1993; Sui, 1994). Within the field of human geography a theoretical shift was in play, which was characterised by social theoretical critiques of positivism and spatial analysis. Brian Harley's writings on social theory and cartography prompted much post-structuralist debate surrounding the power relations embedded in the project of mapping. He associated maps as "part of a wider political sign-system [which] has been largely directed by their associations with elite or powerful groups and individuals" (Harley, 1988 p. 301), and stated that, historically, "maps were used to legitimise the reality of conquest and empire" (*Ibid.*, p. 282).

> Both in the selectivity of their content and in their signs and styles of representation, maps are a way of conceiving, articulating, and structuring the human world which is biased towards, promoted by, and exerts influence upon particular sets of social relations (Harley, 1988, p. 278).

In his article Deconstructing the Map, Harley (1992) argued that the notion of the map is never a value-free "mirror of nature:"

> While the map is never the reality, in such ways it helps to create a different reality. Once embedded in the published text the lines on the map acquire an authority that may be hard to dislodge. Maps are authoritarian images. Without our being aware of it maps can reinforce and legitimate the *status quo* (p. 247).

According to Derek Gregory (1994), Harley's "deconstruction urges us to read between the lines of the map -- 'in the margins of the text' -- and through its tropes to discover the silences and contradictions that challenge the apparent honesty of the image" (Gregory, 1994, p.74). GIS, by extension, is a mapping technology laden with hidden social and political meanings and agendas, and thus cannot provide a completely objective account of the world it is intended to represent.

In his essay Text, Hermeneutics and Propaganda Maps, John Pickles (1992) explored theoretical interpretations of "propaganda" maps. Maps have always been tied in with power relations, war and propaganda. While not all maps are "persuasive" forms of cartography, the hegemonic use of maps can "in unskilled hands . . . easily become a subject of ruthless and stupid propaganda" (Weigert, 1941, p. 530, in Pickles, 1992, p. 208). In his conclusion, Pickles called for a new theory of mapping,

> . . . which incorporates some way of dealing with the possibilities and impact of the 'current upheavals in the forms of communication, the new structures emerging in all the formal practices, and also in the domains of the archive and the treatment of information' (Derrida, 1981, p. 13); specifically we need a means of dealing with the various forms of the 'communication media,' especially, but not confined to, the electronic media (p. 227).

Robert Lake (1993) provided a decidedly grim view of GIS in his article titled Planning and Applied Geography. Given that there was scant literature on the social implications of GIS at that time, he was troubled by

> . . . the likelihood that consideration of these issues will be even further obscured by the popular momentum, technological complexity, and sheer scale of financial investment represented by the ascendancy of GIS. Once that investment is made, the focus is more likely to turn to expanding applications than to reconsidering philosophical foundations (Clark, 1992, in Lake, 1993, p. 405).

In his report on GIS and Urban Studies, Daniel Sui (1994) claimed that "GIS in the early 1990s has a strong positivist/scientific flavor" (Ris, 1991, in Sui, 1994, p. 259). He provided a critical framework for a post-positivist examination of GIS. First, Sui argued that the "ontological inadequacy" of GIS could not adequately represent "socially and culturally constructed space" (Sui, 1994, p. 264). He then claimed that GIS were "epistemologically insufficient" -- by restricting knowledge to Boolean logic, GIS missed out on other, perhaps more enlightening, processes of reasoning (*Ibid.*, p. 265). Third, Sui stated that GIS suffered from "methodological insufficiency" -- GIS were "biased at the very beginning because of the use of secondary data, Boolean logic . . . [and] lack of coherent theory" (*Ibid.*). Last, he claimed that GIS were "ethically inconsistent . . . [in their] inability to comprehend the subjective differences among individuals" (*Ibid.*).

Sui examined the prospect of rectifying the inadequacies described above. It was his belief that some "common ground may exist between GIS enthusiasts and GIS critics" (*Ibid.*, p. 269). Hence, he suggested that "many of the current debates [would] not be necessary if there [was] sufficient dialogue and communication" between the two sides (*Ibid.*). Drawing on Leung (1990) and others' research, Sui (1994) stated that

> . . . fuzzy logic is capable of avoiding the information loss that often arises when crisp Boolean logic is used for retrieving and overlaying geographic information (Hall, Wang and Subaryono 1992; Sui 1992; Wang, Hall, and Subaryono 1990). Fuzzy logic also can accommodate the complex approximation of human thinking and arrive at more realistic conclusions that Boolean logic (p. 270).

With respect to methodological issues, Sui turned to newer applications of GIS such as artificial intelligence (AI) technology and spatial decision support systems. And, for

resolution at the ethical level, he quoted from Chrisman's (1987) article on GIS and social/cultural goals:

> . . . the fundamental organising principles for an information system should not derive solely from pure law of geometry or computing theory, because they must reflect the basic goals of society. GIS should be developed on the primary principle that they will insure a fairer treatment of all those affected by the use of information (equity) (Chrisman, 1987, p. 1367).

Sui concluded his paper by stating that

> . . . tension between GIS enthusiasts and their critics is essential for the development of such a common language and thus will be instrumental for the design of the next generation of GIS. What is urgently needed today is that all the participants in this debate should not just talk but also listen (p. 272).

Evidently, this was a concern shared by a growing number of GIS proponents and social theorists as, by 1995, a special issue of *Cartography and Geographic Information Systems* was published which focussed on Society and GIS. This particular edition documented various papers which were presented a 1993 meeting at the University of Washington's Friday Harbor Laboratories (Poiker, 1995). At the same time, the emergence of John Pickles (1995) seminal text *Ground Truth* dismissed any notion of ignoring critical social implications of GIS in society. This landmark text presented further compelling evidence that the social implications of geographic information systems were seriously overlooked in traditional GIS research (Pickles, 1995).

By the mid-1990s, several research initiatives were in progress (c.f. NCGIA *Initiative 19: GIS and Society*, 1994), yet conference papers were still inconclusive in terms of resolving the GIS and society debate. By 1996, a revolutionary approach to public participation and

GIS, which advocated for an information intermediary, was published in an article titled The Democratization of Data: Bridging the Gap for Community Groups (Sawicki & Craig, 1996). With the advent of the World Wide Web earlier in the decade, information became widely disseminated as various interest groups began to document their research on line. Additionally, the introduction of the Windows interface revolutionised the visual aspects of GIS and automated cartography. As more user-friendly software began to emerge in the market, GIS advocates grew optimistic about the prospects of a new, virtual environment.

2.4 GIS and Society

1995 marked a critical turning point in the GIS and society literature. As noted above, several important bodies of research emerged that would have marked effects on GIS and its practitioners. John Pickles' *Ground Truth: The Social Implications of Geographic Information Systems* (1995), and the emergence of a new *NCGIA* research initiative (*Initiative 19: GIS and Society*) brought forth considerable debate between social theorists and technical advocates.

2.4.1 *Ground Truth*

Ground Truth was comprised of a collection of essays which examined a variety of societal concerns involving GIS and related technologies (Pickles, 1995). In his introductory chapter, Pickles defined GIS as "a set of tools, technologies, approaches, and ideas that are vitally embedded in broader transformations of science, society, and culture." He went on to state that "these contexts are wide-ranging and as yet little studied in the literature surrounding new mapping and analytical technologies" (p. 4). Pickles' call for further research was timely

and reflective of the broader social debates concerning the implications of GIS, which arose during that era. While his language was rather strong, his concerns were, to an extent, valid. He wrote:

> . . . each of us is . . . struggling with the complexity of technologies and practices with which GIS is associated (electronic media, cyberspace, virtual reality, new disciplinary practices) and the contexts within which they have emerged (internationalisation, globalization, commodification of information, market penetration). But this complex of technologies has been poorly defined within a language and framework that weakly reflects its impacts on issues such as individual autonomy, privacy, access, systems of governance, marketing strategies, and military tactics (Pickles, 1995, p. 5).

Pickles, and others, saw GIS as alternatively empowering and disenfranchising. Numerous authors addressed similar concerns in *Ground Truth*, a collection of essays which ranged in scope from ethical inconsistencies embodied by GIS, such as surveillance and privacy (Curry, 1995), to "geodemographics" -- the commodification and control of consumer behaviour by combining GIS and demographic databases for targeting market populations (Goss, 1995).

2.4.2 *NCGIA Initiative 19: GIS and Society*

The Initiative 19 GIS and Society research agenda arose as a result of a workshop held at Friday Harbor, Washington, in 1993. Workshop participants proposed that "issues raised by social theorists in geography (and beyond) should be addressed within the GIS community," a proposal which subsequently emerged under a broader research umbrella within the National Centre for Geographic Information and Analysis (NCGIA 1994). The *Initiative 19: GIS and Society: The Social Implications of How People, Space, and Environment are*

Represented in GIS specialist conference was held within a workshop setting in South Haven, Minnesota, in March 1996.[2]

A Public Participation GIS Workshop (conducted in Orono, Maine, in July 1996) emerged as one outcome of the I-19 conference. Participants attending this meeting presented and discussed various issues concerning "obstacles which accompany present technologies" as well as addressed prospects for making the technology "useful to a wider public" (NCGIA, 1996). The Varenius Research Initiative, which was introduced by the NCGIA in 1997, integrated PPGIS research efforts under the Empowerment, Marginalisation, and PPGIS agenda.

2.5 Public Participation GIS (PPGIS) Research Agenda

By the latter half of the 1990s, a much stronger voice had emerged (and was heard) which advocated for the importance of public participation in GIS applications. Numerous journals and texts were published on the subject, as were myriad articles on the World Wide Web (c.f. *Cartography and GIS 1998; URISA Proceedings Online*). By 1997, a considerable body of work had been published, particularly within the planning literature (c.f. *URISA Proceedings; Journal of the American Planning Association*).

PPGIS was the focus of one Varenius conference, which was held at Santa Barbara, California, in October 1998.[3] By 2002, a text was published which documented much of the 1998 PPGIS conference proceedings (Craig, Harris, & Weiner, 2002). And recently, the

[2] Initiative 19 research papers may be retrieved from http://www.geo.wvu.edu/i19/papers/position.html.

Second Annual PPGIS Conference, sponsored by URISA, was hosted by Portland State University, in Portland, Oregon (URISA, 2003).

Clearly, the newly emerged field of PPGIS has become a noteworthy subcategory of the GIS and society research agenda, and, perhaps, its own formal discipline. In recognition of the unique characteristics of this field, the next chapter will present a more detailed overview of PPGIS, its context(s), discourse, and its prospects for the future.

[3] PPGIS Varenius research papers may be retrieved from http://www.ncgia.ucsb.edu/varenius/ppgis/papers/index.html.

3.0 PUBLIC PARTICIPATION AND GIS

3.1 Introduction

Public participation GIS (PPGIS) is a recent phenomena, having emerged only in the past decade, largely as a reponse to the preceeding Society and GIS debate (c.f. NCGIA Initiative 19, 1995) which characterised the early 1990s. Pivotal research and conference proceedings contributed toward a considerable body of PPGIS research, particularly during the latter half of the 1990s. The NCGIA examined various concepts of PPGIS under the auspices of a formal research agenda: Project Varenius. In October 1998, a specialist meeting was held at the University of Southern California, Santa Barbara, California, to explore issues of "empowerment, marginalisation, and public participation GIS" (NCGIA, 1998).

This chapter introduces the concept of PPGIS and frames it within the broader discourse of the GIS and society research agenda. This is a brief perusal, however, as a comprehensive overview is beyond the scope of this thesis. A discussion of key PPGIS concepts will follow, given their importance in contributing toward a deeper understanding of the subject. The field of PPGIS is still evolving, however; hence the subject matter is open to new interpretations.

3.2 Historical Roots of PPGIS

While I circumscribe my discussion of PPGIS to fit urban community-based GIS frameworks, it is important to note that the scope of this new discipline has been far-reaching. The languages and practices of PPGIS are diverse, and are rooted in a number of

intellectual traditions including "political economy and critical theory, participatory planning and community development, democracy and social justice, anthropology and ethnography, polical ecology, and philosophies of science" (Weiner *et al.*, 2002, p. 6). PPGIS studies have emerged concerning the use of the technology in environmental activism (Sieber, 2002, 2000), in participatory development initiatives (Harris & Weiner, 2002, 1998, 1995; Jordan, 2002), and in efforts to empower indigenous peoples (Bond, 2002; Laituri, 2002).

Of concern to PPGIS advocates are those aspects of the technology which are alternatively empowering and marginalising for grassroots organisations. As was noted in chapter two, PPGIS arose, in part, as a result of such concerns. Once PPGIS researchers began to explore alternative uses of the technology (i.e., viewed from the grassroots' perspective) the potentially disenfranchising social and political implications of the technology began to be addressed. A number of subsequent PPGIS endeavours have since resulted in powerful community partnerships aimed toward ameliorating the negative aspects of local poverty. It is important to note, however, that considerable ground still must be covered by PPGIS researchers, for the conundrum of the technology (as being both empowering and marginalising for community organisations) is far from being resolved.

3.3 Project Varenius: Empowerment, Marginalisation and PPGIS

A specialist meeting on *empowerment, marginalisation, and PPGIS* was hosted by the NCGIA in 1998, which brought together PPGIS proponents from a variety of disciplines, incorporating both local and international perspectives. A diverse array of case studies and conceptualisations of PPGIS were presented at the conference, and, as noted in the previous

chapter, many of the studies have been subsequently published in the text *Community Participation and GIS* (Craig *et al.*, 2002). The meeting was intended to explore the contradictory nature of GIS which "is alternatively seen as a powerful tool for empowering communities or as an invasive technology that advantages some people and organisations while marginalising others" (NCGIA, 1998).

As noted in the previous section, the conference covered a broad range of themes, including PPGIS and inner city revitalisation initiatives, environmental activism and ecological sustainability, development planning methods (e.g., participatory rural appraisal), and indigenous uses of a PPGIS. As this thesis is focused on inner city, community-based GIS efforts in the United States (US), only brief mention of the other themes will be made, except when such material is deemed useful for understanding the broader context of PPGIS. As such, I will next provide a discussion of community development in the US, with a particular emphasis on PPGIS and urban neighbourhood revitalisation strategies.

3.4 Community Development and GIS

The concepts *community* and *neighbourhood* will be used interchangeably in this thesis, and are defined more generally "by [their] physical proximity to others and the sharing of common experiences and perspectives" (Weiner *et al.*, 2002, p. 5). More specifically, I refer to Sawicki and Peterman's (2002) concept of community and/or neighbourhood "to be a spatial as well as a social term: a relatively small, roughly defined area, populated with people who feel themselves to have something in common" (Sawicki & Peterman, 2002, p. 25).

Community groups have been politically active in the US, to varying degrees, for the past forty years at least. Interestingly enough, the field of GIS has emerged along the same timeline. Around the time that grassroots organisations gained popular support in their mobilisation against local, top-down urban planning initiatives (1960s), developments in GIS were gaining momentum. Political rallying for the grassroots and impoverished inner city neighbourhoods were no match for scientific research endeavours. While GIS developments, and technology more generally, continued to evolve within a powerful research arena, social protest movements ultimately fizzled. By the 1980s, neighbourhood organisations began to emerge, largely in response to state fiscal retrenchment strategies (c.f. Castells, 1983, Hasson & Ley, 1994).

Various researchers have claimed that technocentric planning agendas further marginalised already disenfranchised inner city neighbourhoods (c.f. Castells, 1983; Ley, 1983). Community organisations were already suspicious of the scientific claims purported by previous rational community planning strategies. Early studies documenting initial community-based GIS research projects have noted the difficulties in gaining local support in such initiatives (c.f. Myers & Martin, 1994).

Indeed, science remains a powerful discipline today, in spite of the strong social theoretical debates which came to a head in the 1990s. One, perhaps beneficial, outcome of the GIS and society debate is that both positions appear to have gained a more nuanced view of each other. More importantly, a new group of scientific and theoretically-informed grassroots

advocates has since emerged, which, in attempting to bridge the chasm between two polemically opposed disciplines, has begun to engage in participatory strategies aimed toward providing grassroots organisations with the means to acquire and use a PPGIS.

While the concepts of community activism and empowerment are not new, the idea of implementing a GIS at the grassroots level is still a novel concept for some. It may be that the evolution of the technology, from a costly, mainframe environment with a complex language structure, to that of a WIMP (window, icons, menus, pointers) interface, occurred during a time when grassroots organisations were in greatest need of external assistance. Moreover, the digital revolution of the early 1990s has radically transformed the ways in which information and holds great promise for democratising access to public information for all citizens.

Nonetheless, society continues to be plagued by the contradictory nature of access to the technology -- even though a PPGIS may now be financially attainable for many neighbourhood organisations, the knowledge and technical skills required to utilise the technology effectively remain out of reach for the ordinary citizen. Further, access to digital information has been increasingly restricted due to an increasing number of cost-recovery mechanisms, and data liability and privacy laws (c.f. Klinkenberg, 2003).

3.5 PPGIS Discourse

As noted previously, PPGIS is inherently contradictory in scope. Various conceptualisations of PPGIS are found in the literature from the past decade. Research derived from Project

Varenius, and several other NCGIA conference proceedings, has helped broaden the literature as well as the scope and awareness of PPGIS case studies.

PPGIS discourse includes concepts such as *participation*, *access*, *empowerment*, and *marginalisation* within the context of a community-based GIS. Indeed, the definition of PPGIS tends to vary depending on the situation within which it is used. Questions arise surrounding the influences of a GIS on a community group, for example, and how one might gauge the level of citizen participation in such endeavours. Whose interests are best served by implementing a PPGIS? Will a grassroots group benefit from using a GIS, or will it be further marginalised by the technology? These are important concerns, particularly for those neighbourhood organisation with few resources.

3.5.1 Defining PPGIS

As noted in the introductory chapter of this thesis, there are various ways in which to define a PPGIS. For the purposes of this research, a PPGIS is intended to be an inclusive and participatory vision of a community-based GIS. In other words, not only should a PPGIS engage full community participation in it efforts, but, as well, it should incorporate alternative ways of knowing and understanding the community. It is possible for one to conceptually map a community's social capital (e.g., capacity for social and economic development) as well as capture a neighbourhood's physical geography in a visual display (i.e., by means of a map).[4] The means with which one actually captures community data, translates, and then transforms and displays such data, are the decisive factor in determining whether or not one is using a PPGIS. For the purposes of this thesis, a PPGIS is comprised

of community data in digital format which are stored, analysed, and displayed by means of a Geographic Information System, and, ideally, the PPGIS is situated within a community organisation.

Clearly, the definition of a PPGIS may be tailored to suit the particular discipline within which it is situated. In order to understand the broader PPGIS term, however, it is necessary to unpack the terminology encompassed within the acronym. How may we define concepts such as public participation and access, and empowerment and marginalisation within a community-based GIS framework? The following discussion is intended to address such concerns.

3.5.2 Access and Participation

The ability to *access* geographic information and *participate* in using a GIS have become key concerns for many. From a scientific perspective, the notion of *access* may range from concerns about modeling the shift from access to physical space to that of virtual space, as well as access to, ownership of, and control over digital data (Onsrud & Craglia, 2003). Community-based advocates are more likely to be concerned with difficulties in gaining access to and using a GIS, not to mention the implications and impacts of adopting the technology.

At the rudimentary level, *access* is determined by a community's "ability to obtain data, hardware, and software" (Elwood & Leitner, 1998, p. 78). This concept becomes much more complex, however, when viewed from a participatory community research perspective.

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[4] See the discussion on community asset mapping, later in this chapter.

Grassroots organisations are often unaware of the potential uses of a GIS, and further constrained by a lack of knowledge on how to use the resource effectively. Moreover, barriers to equitable data access, including complex data coding practices and fee-for-service charges, tend to discriminate against those lacking technical skills and financial resources.

The notion of *public participation* is related to the concept of *access* in PPGIS, and will be discussed at length in the next sections of this chapter.

3.5.3 Public Participation

Public participation in western civilisation presumes the notion of democracy, in which citizens have the right to participate in decisionmaking about their political, economic, and social well-being. Based on that premise, it follows that a public participation GIS should also permit unrestricted access and participation in all aspects of the acquistion and implementation of the technology. As has already been noted, this simply does not hold true for all citizens. GIS has, for many, been inaccessible or at the very least difficult to understand and use (c.f. Pickles, 1995; Harris & Weiner, 2002, 2000, 1998, 1995). A number of GIS proponents have argued for the need for *information intermediaries*, interpretors if you will, to translate the complexity of the technology for the lay public (c.f., Sawicki & Craig, 1996; Barndt & Craig, 1994). Others are more sceptical of the term PPGIS, claiming that the techology is inherently top-down and ill-suited to grassroots endeavours (c.f., Harris & Weiner, 2002, 2000, 1998, 1995).

Citizen Participation Ladder

Carver (2003) and Weiner *et al.* (2002) describe a citizen participation ladder as a means with which to conceptually measure public participation in policy decisionmaking. In **Figure 1** the six rungs of the ladder are shown, in which, at the bottom rung (public right to know), citizens have no opportunity to participate. The participation ladder extends along a continuum, in which, at the top rung, citizens have full control over the decisionmaking process. Traditionally, public participation tends to be limited to the first few rungs. A PPGIS is envisioned to help community organisations climb the participation ladder by providing such organisations with scientifically-grounded knowledge. This type of knowledge can provide local groups with useful information which, in turn, can empower them to participate in decisionmaking which affects their interests.

Figure 1: Citizen Participation Ladder

Public Participation in Final Decision
Public Participation in Assessing Risks and Recommending Solutions
Public Participation in Defining Interests, Actors, and Determining Agenda
Public Right to Object
Informing the Public
Public Right to Know

Source: Weiner *et al.*, 2002, p. 6; adapted from Weidemann & Femers, 1993.

3.5.4 Empowerment and Marginalisation

As noted previously, empowerment and marginalisation are conflicting tendencies often found in a PPGIS. In the following hypothetical example, I provide a typical conundrum faced by many community groups when they attempt to use a PPGIS. A community organisation which engages in PPGIS activities may, for example, achieve a certain level of prestige, as a result of the power gained from becoming a knowledgeable participant in the public policy arena. Concomitantly, however, the organisation may face significant challenges in implementing and using a PPGIS, thereby diminishing the value of any achievements previously gained. Moreover, the introduction of a new technology can be a politically divisive factor for neighbourhood groups which lack consensus in the adoption of a PPGIS (c.f. Ghose & Elwood, forthcoming; Elwood, 2002). Given that the technology can be seen as both empowering and marginalising at the same time, a close evalution of these concepts is warranted.

Carver (2003) defines *empowerment* as

> . . . the process by which stakeholders identify and shape their lives and the society in which they live through access to knowledge, political processes and financial, social and natural resources (*Ibid.*, 2003, p. 62).

Many neighbourhood residents are severely constrained by their circumstances and, consequently, are *marginalised* in terms of accessing such resources. Limited knowledge of potentially democratising practices (such as PPGIS) and socio-economic barriers, tend to prevent such citizens from participating in the political arena.

Harris and Weiner's (2002, 1999, 1998, 1995) research on GIS and local knowledge in post-apartheid South Africa is particularly instructive for grassroots GIS efforts. The insights derived, albeit from a development research perspective, are applicable in many community settings. Integral to their research is the notion of *community-integrated GIS* (CiGIS), which emphasises "three broad conceptual principles: popular community participation; local, social and spatial differentiation; and regional political ecology" (Harris & Weiner, 2002, p. 248).

The authors note some of the caveats in the process of community participation:

> Community meetings are held, local input is gathered, reports are produced, and top-down planning is maintained. In this context, participation helps to legitimize decisions that are not necessarily 'popular' within impacted communities (*Ibid.*).

Hence, they advocate for *popular participation*, a process which integrates the knowledge and opinions of everyday life, and which has some impact on the kinds of technologies implemented. The important point to be made here is that communities are empowered considerably when they direct the course of their own technological development, irrespective of external powers (e.g., governments) and interests.

Social, spatial, and ethnic differentiation are also relevant concepts for PPGIS advocates. US inner city neighbourhoods, for example, tend to be comprised of diverse populations which include ethnic minorities, immigrants, and marginalised sectors of society. Local understanding of what constitutes a community, knowledge of that place, and the capacity to communicate such information varies from one citizen to the next. Diverse viewpoints and

local knowledge, when evaluated qualitatively, can be difficult, if not impossible, to capture by quantitative methods.

Of concern to all are the negative implications of differential access to the technology and technical expertise; hence, the inclusion of the term marginalisation factors in strongly in the PPGIS discourse. Indeed, some PPGIS proponents have concluded that the technology is not necessarily empowering for grassroots organisations. As noted above, Harris and Weiner (2002) and others are exploring alternative PPGIS methodologies, such as CiGIS and new participatory visualisation strategies (c.f. Shiffer, 1998, 1995; Krygier, 1996). While my intent has been to identify the utility of a PPGIS, and to examine the implications of grassroots usage of the technology, one point remains clear -- community access to and usage of a PPGIS must be facilitated in such a way as to tailor the GIS to *empower* the community through its usage of such a technology.

The phrase *community asset mapping* has been linked with PPGIS and, more generally, with community mapping. A brief overview of these concepts is provided below, as they tend to be referred to more frequently than the term PPGIS, in the Canadian context.

3.6 Community Asset Mapping

The concept of *community asset mapping* was popularised by Kretzmann and McKnight (1993). These Northwestern University professors have advocated for a community-asset based revitalisation strategy based upon local capacity for change. In this process, an inventory of all community assets is mapped (figuratively), and then used as a means to

mobilise community re-development and improvement strategies. By focusing on community assets, rather than deficits, Kretzman and McKnight believe that a community organisation becomes empowered by participating in the process of realising its own potential.

Assets are categorised as both social and institutional and include individual capacity, social networks, local service agencies, formal public institutions, and so forth. Hence, the fabric of the community becomes *internally focused* and *relationship-driven*, in order to ameliorate the negative consequences of poverty. The process of community asset mapping is envisioned to empower residents to the extent that they are able to direct their own course of community re-development.

3.7 Community Mapping

Community mapping is described as a process in which maps are used as a means with which to engage participants in expressing a variety of viewpoints. This interpretation views maps as powerful tools for advocating change, as well as providing local residents with a greater understanding and appreciation of their neighbourhood (Common Ground, 2003). While community mapping is considered a participatory mapping process, it can not be considered a PPGIS in the truest sense. The following discussion will compare the two concepts and identify some of their key differences.

Community mapping has often been referred to as mapping in the physical sense (literally) or else conceptually (figuratively). The former definition may be more appropriate when

discussing a GIS, given that the technology is, for the most part, tangible and reliant upon human manipulation in order to function (a trait also shared with formal cartographic practice).[5]

While the terms community mapping and GIS have been used interchangeably (mistakenly so), they are quite different from one another when viewed from a research perspective. GIS has traditionally been operated by technical experts and scientists, usually in positions of power and authority. Community mapping, on the other hand, tends to be directed by people at the grassroots level who, more often than not, have little, if any, cartographic experience. Confusion may also arise when attempting to distinguish between that which is produced by digital means (e.g., an analytical hardcopy map) and that which is represented by local knowledge (e.g., oral histories). A brief perusal of Aberley's (1993) research will shed some light on what is being said.

Aberley (1993) provided a thoughtful text of essays in which he discussed the prospects of bioregional mapping for local empowerment. By creating their own maps and images, communites could re-connect with their locality and, subsequently, become empowered by the knowledge gained during the process. When using this technique, local residents would gain the means with which to challenge external interpretations and representations of their home spaces, and subsequently redirect their own development strategies. While this is an admirable, perhaps even romanticised notion of empowerment, there are flaws in this line of thinking.

[5] Yet, without a conceptual foundation there would not be a theoretical understanding of GIS. This is a subject best left for further discussion elsewhere.

Aberley has, unfortunately, situated his ideas within the boundaries of the historically marginalising cartographic project (c.f. Harley, 1992, 1990, 1988). In other words, he has continued to support the historically-disempowering rhetoric of the map, albeit from an alternative perspective. He suggested that, in order to create one's own bioregional map, "you need to find a base map which shows a land area sufficient to 'frame' the bioregion you will define" (Aberley, 1993, p. 75). Aberley then followed with a discussion of simple cartographic techniques intended to direct communities in mapping their regions from a bioregional mapmaker's perspective. The argument to be made here is that Aberley was advocating for traditional cartographic practices which have, historically, marginalised many existing disenfranchised populations. As such, this is a discussion which is best left for another venue.

In light of the benefits of community mapping, however, a PPGIS is also premised on the combination of community-based perceptions and needs, and local empowerment through participatory ventures. Indeed, there is great promise for PPGIS proponents and enthusiastic members of community organisations who decide to meet at the table, and join together to share their respective knowledge, capacity, and vision for a collaborative community-based PPGIS. The final section of this chapter is devoted to an overview of the prospective advantages to a community by adopting a PPGIS.

3.8 Value of a PPGIS

In an era of government fiscal cutbacks, neighbourhood organisations in the US have had to seek alternative resources in order to survive, and have subsequently begun to engage in strategic partnerships as a means toward community revitalisation efforts. Community-based PPGIS initiatives are viewed as a means for mobilising local empowerment. In the following discussion, I look at the various ways in which a PPGIS is considered valuable to a community organisation.

Weiner *et al.* (2002) provide a list of several of the positive traits of a PPGIS:

- GIS can assist groups in climbing the participation ladder
- better information leads to more appropriate responses
- GIS lends credibility to an organisation's analyses and requests

As noted earlier in the chapter, the public participation ladder provides a conceptual framework for measuring the level of participation in the public policy decisionmaking process. A PPGIS can enable community groups to climb the participation ladder, by providing such organisations with knowledge which can assist such groups in making changes in public policy. A community group possessing such knowledge can gain credibility, particularly in the eyes of external funding agencies. A PPGIS can also provide more accurate spatial analysis of local concerns (e.g., crime locations, or vacant housing), thereby providing the community organisation with better information so that an appropriate course of action may be taken.

Elwood and Leitner (1998) also consider PPGIS valuable to a community organisation for a number of reasons. Neighbourhood organisations that are engaged in revitalisation strategies have considerable need for various geographic data and analyses. Examples of common data needs include: socioeconomic data, housing and property values, urban infrastructure of their neighbourhood (e.g., traffic arteries, sidewalks), and local business information. Such data are useful for GIS applications, and are designed to be used as community planning and program evaluation tools. Demographic profiles derived from these data are particularly useful for targeting areas in greatest need of funding.

A PPGIS has the potential for storing an inventory of neighbourhood information, for tracking progress of local development, as well as the capacity for monitoring community conditions. Locality-specific neighbourhood problems (such as vacant housing, crime, and environmental hazards) can be more readily identified using a GIS and then mitigated by subsequent changes to urban policy. The rhetoric of the power of the map figures strongly in this argument -- the visual persuasiveness of the image is believed by many neighbourhood residents to be highly influential in the public policymaking arena. Several organisers, in one study, are quoted as having said:

> 'GIS would show [neighbourhood issues and problems] in a form that people can understand. In today's flashy media world, you need something flashy.' Another organiser stated: 'I could use this [map] to explain things to my board [of directors] or to residents. A map can show them things much more clearly than I can tell them about it' (*Ibid.*, p. 84).

Perhaps one of the greatest values of a PPGIS is that which is *perceived* to be useful to a community organisation.

The next chapter delves into PPGIS conceptual frameworks currently in practice in the US. These frameworks provide prospective models for implementing and evaluating a community-based GIS. While a significant number of case studies have been presented in the literature, the diversity of such research is context-bound. There are few (if any) standardised models available for a sustainable PPGIS. As such, in chapter four, I lay out the conceptual groundwork for introducing a prototype PPGIS community-based model for inner city organisations.

4.0 PPGIS CONCEPTUAL FRAMEWORKS

4.1 Introduction

In this chapter, I will present several of the more important PPGIS conceptual frameworks which have been discussed in the literature. Given that the concept of a PPGIS has, for the most part, been derived from the larger discipline of GIS, it is valuable to reflect upon organisational frameworks of a GIS, as well as the related institutional concerns. As such, in this chapter I commence with a brief overview of Sieber's (2000) framework of standard GIS organisational requirements, and Budic's (1996) research on institutional issues surrounding the implementation of a GIS.

Various models for providing a PPGIS to community organisations have now come to the fore in the literature. My purpose for presenting such research is to establish a foundation upon which a prototype PPGIS may be designed, in light of the case studies presented later in the thesis. Hence, in the remaining portion of this chapter, I provide an overview of conceptual frameworks for understanding a PPGIS and for implementing a community-based PPGIS. I conclude the chapter with a discussion of methods with which to evaluate the efficacy and utility of a community-based PPGIS.

4.2 GIS from an Institutional Perspective

As noted previously, a PPGIS stems from the larger discipline of GIS. Numerous studies have been conducted on institutional issues surrounding a GIS; hence, a brief perusal of this subject matter is deemed an appropriate introduction to the chapter. I commence this section

with an overview of standard GIS organisational requirements, and then follow with a discussion of some the more important institutional concerns which can arise when attempting to implement a GIS (and, by association, a PPGIS).

4.2.1 Organisational Requirements

Sieber (2000) presents seven standard requirements which comprise a successful institutional GIS model. These criteria are taken from the literature and tend to constitute the more sustainable professional GIS projects in practice today (Crosswell, 1991; Huxhold, 1991; Azad, 1993; Onsrud & Pinto, 1993; Budic, 1994):

- evaluation of GIS user needs
- long-term upper management commitment to the GIS project
- sufficient allocation of resources
- adequate staffing
- timely and sufficient training
- a *GIS champion*, who will shepherd the project from acquisition to use
- organisational communication or diffusion to smooth the transition to full utilisation (Sieber, 2000, p. 16)

The above list will be re-visited later in the thesis, at which time a model for PPGIS will be proposed. My purpose for including such criteria at this point is instructive, and is intended to set the stage for the discussion which follows -- institutional issues and GIS.

4.2.2 Institutional Issues

Numerous studies have been conducted concerning the conceptualisation and implementation of a GIS, particularly from a technical perpective (c.f. Lo & Yeung, 2002). Of greater

relevance to PPGIS, however, are those studies which emphasise the importance of institutional concerns surrounding the technology. Budic's (1994) research is particularly instructive in this area, and will be referred to in an overview of the more significant institutional barriers to implementing a GIS. While the technical issues are also of considerable importance to a successful GIS, these will not be identified until later in the thesis (at which time a proposed model for PPGIS will be introduced).

In 1991, Budic (1994) conducted a survey of local governments in four southeastern US states in order to determine the effectiveness of GIS in local government planning agencies. Using a survey instrument (questionnaire) based on a Likert five-point scale[6] "the subjects were asked to assess overall changes in operational and decision-making effectiveness" (Budic, 1994, p. 249). Budic selected seven factors which influenced the effectiveness of GIS:

- political support
- staff support
- experience with GIS
- system sharing
- database comprehensiveness
- number of GIS applications
- types of tasks performed with GIS

The results of the survey are extensive and are not fully covered in this discussion. Rather, it is useful to focus on the more important findings in Budic's research. In general, all seven of the GIS implementation factors listed above were seen to have an impact on the effectiveness

[6] The scale ranged from "significantly worse" to "no change" to "significantly better."

of a GIS. Budic's examination of *institutional* issues tie in strongly with a significant body of research addressing the "dependency between the successful use of GIS technology and a number of personal, organisational, and institutional factors" (Budic, 1994, pp. 246-7). I include the details of one footnote taken from Budic's paper, to further emphasise this point:

> It is also recognized that technological factors have less importance than some others in determining the implementation outcomes of organizational information systems. Technological determinism, that is, arguing that the technology is the sole 'driver' of organizational computing (Glaser et al., 1983), has been criticized (King and Kraemer 1986). In fact, the technology itself presents less of a barrier to adoption of GIS than other factors do (Dueker 1987; Chorley 1988; Campbell and Masser 1991; Campbell 1993; Budic 1993a). This is not to say, however, that the role of technology is negligible or absent (Budic 1994, p. 258).

My purpose for including Budic's essay was to introduce some of the organisational issues which may be encountered when implementing a GIS within more formally structured organizations, such as a government agency. If formal institutions encounter a certain degree of difficulty in implementing a GIS, it follows that a community organisation would likely present even greater resistance to employing a GIS, based on the following premise. Given that most community groups tend to lack sufficient organisational resources and the infrastructure needed in order to implement a GIS, the relative *absence* of a supportive social and political climate can also contribute to an organisation's failure when attempting to adopt a new technology.

Reasons for community resistance to a GIS may include lack of community consensus in terms of embracing a new technology, lack of technical experience, and little (or no) staff support needed to maintain the system. Additionally, scarcity of funding tends to be an

inhibiting factor for many neighbourhood redevelopment initiatives. These types of institutional concerns are explored further in the following discussion.

4.3 Conceptualising PPGIS from a Community Perspective

Many questions come to mind when attempting to conceptualise community usage of a PPGIS. The following is a list of some of the concerns which will be addressed in the remainder of this chapter:

- *why* and *how* would a community group use a PPGIS?
- *what* methods are used to introduce a neighbourhood PPGIS?
- *how* may community groups gain access to a PPGIS?
- are some partnership strategies better than others?
- *which* practices are of the greatest benefit to community groups?

An institution's resource base and its organisational framework tend to be the key differentiating factors when distinguishing between a GIS and a PPGIS. Whereas a more formalised institution (such as a government agency) may have the resources to more fully integrate a GIS, a community group may face significant challenges in its attempts to utilise a GIS. The initial set-up costs of implementing a GIS (and a PPGIS), as well as the knowledge and expertise required to operate such a system, tend to be out of reach for most neighbourhood organisations. Moreover, neighbourhood groups tend not to be as formal in structure as larger, corporate organisations.

Indeed, the term Public Participation GIS (PPGIS) is somewhat of an oxymoron. Given the complexity of establishing and operating a standard GIS, one would expect this technology to be beyond the reach of the average citizen (which, often, is the case). Yet, there is a growing

cadre of researchers who are advocating community-assisted GIS partnerships in order to democratise information technology more generally, by providing participatory partnership opportunities for community groups (i.e., PPGIS). In the following discussion, I will provide a conceptual framework for assessing the utility of a PPGIS from a community perspective.

4.3.1 Utility of a PPGIS

As noted in the previous chapter, Craig and Elwood (1998) have provided a useful discussion in their article titled How and why community groups use maps and geographic information. Basing their research on three inner city neighbourhoods in Minneapolis, Minnesota, the authors provided a framework for community usage of geographic information and maps. The types of information deemed useful for a community group were categorised by purpose, including *administrative*, *strategic*, *tactical*, and *organisational*.

In **Table 1**, a practical framework is provided for understanding the utility of a PPGIS, with respect to community needs and activities. The four rudimentary functions of a PPGIS, as identified above, are intended to fit community organisation's own goals. Examples which are intended to illustrate each function are also shown in the table. From an *administrative* perspective, a neighbourhood group would use maps and geographic information to support community action to rally against the negative impacts of poverty and unequitable bank loan policies, for example. *Organisational* functions, as another example, would also be reliant on the use of maps and data, particularly when a community organisation seeks external funding and support.

The following point, stated in the conclusion of their article, is particularly instructive:

> Maps and geographic information can be used by community groups to improve administrative efficiency and effectiveness, to identify key strategic issues facing the community and useful ways of addressing them, to transform plans into tactical actions, and to organize members of the community (Craig & Elwood, 1998, p. 103).

Table 1. Utility of a PPGIS

Function	Goal	Examples
Administrative	Use information and maps to support community actions	• Property records showing complaints • Map of distribution of loans • Map of areas in need of assistance
Strategic	Assess neighbourhood capacity & resources	• Demographic analyses of community • Map of crime locations • Map of locations of local programs
Tactical	Guide community action	• Map of drug arrests • Map of airport noise patterns • Compare maps which misrepresent the community
Organisational	Recruit new members	• Use maps to identify local problems in door-to-door campaigns
	Facilitate local meetings	• Include local knowledge on maps
	Seek external assistance	• Use maps & data for government funding applications • Use maps to show local problems to the media / municipal government

Source: Craig & Elwood, 1998.

4.4 Conceptualising Implementation Frameworks for a PPGIS

The literature concerning conceptualisation of PPGIS implementation frameworks has had a relatively brief history. Indeed, the notion of PPGIS only appeared in the 1990s; therefore, conceptual models of PPGIS are an even more recent phenomenon. Noteworthy journals, including *Cartography and GIS*, the *Journal of the American Planning Association*, and the

URISA Journal, had begun to publish articles concerning frameworks for implementing a PPGIS by the mid-1990s (c.f. Craig & Elwood, 1998; Elwood & Leitner, 1998; Leitner *et al.*, 2002, 2000, 1998). Once the Varenius Project PPGIS specialist meeting was held in 1998, however, a flurry of research began to emerge which documented a considerable number of models for conceptualising and implementing a PPGIS.

I commence this discussion with a detailed review of one of the earlier frameworks for conceptualising the implementation of a PPGIS, by means of an information intermediary (data provider). Craig (1994) introduced the concept and discussed the importance of an *information intermediary* for community groups at the landmark Initiative 19 Conference (NCGIA, 1994). I then follow with a review of Sawicki and Craig's (1996) article on the democratisation of data for community groups, in which the authors describe the notion of a *data provider*.

4.5 Data Providers, Information Intermediaries, and PPGIS

The notion of a PPGIS data provider was put forth by Craig (1994) at the NCGIA Initiative 19 Conference. Subsequent research has helped elucidate the importance of the role of the data provider/information intermediary. Sawicki and Peterman (2002) provided a classification of intermediaries to include:

- government agencies
- non-government organisations
- universities
- non-profit organisations
- community learning centres

Hence, the intermediary/provider may be considered to be a group of organisations, a single organisation, or, on occasion, an individual. In the following section, I consider the terms information intermediary and data provider to be interchangeable, as research has demonstrated that they are intended to fulfill similar roles. While the two terms have appeared separately in the PPGIS literature, they have since evolved into one concept.

4.5.1 Data Providers

To determine the extent to which US data providers were using GIS, Craig (1994) conducted a seminar at a URISA conference, "where eleven premier data providers discussed their successes and frustrations" (NCGIA, 1994). He presented his findings at the 1994 NCGIA Initiative 19 Conference, and has since provided a considerable body of research concerning community- and neighbourhood-based GIS. Craig's writings are particularly instructive in terms of providing a preliminary framework for conceptualising a data provider.

In his position paper Community groups need equal footing, Craig (1994) argued for the importance of providing information to empower community groups in the US. He stated:

> Information can provide that power, and information can be derived from data and GIS technology. The problem is that community groups don't have access to any of these resources. Information providers have sprung up as middle-men [sic] across the country . . . (Craig, 1994).

Upon conducting a survey of 31 cities, Craig observed that the US decennial Census[7] provided only health and crime data on a regular basis. He noted that:

> . . . most population, housing, and economic data were never summarised and distributed for subcity levels between census years -- despite the fact that most of the raw data for such summaries exists as part of normal municipal operations (*Ibid.*).

[7] Craig's survey was based on 1990 US Census data.

Moreover, as a cost-saving measure, the US Census Bureau began to publish data and reports in machine-readable format only, thereby limiting access for all data users. Additionally, the use of such data further required increased levels of expertise, further marginalizing many community groups not possessing such capabilities.

In the one-day gathering at the 1994 URISA conference, Craig met with eleven data providers in order to understand some of the obstacles encountered by these pioneers. The following list cites their frustrations:

- lack of information providers
- lack of interest in data on the part of community groups
- difficulties in acquiring useful data from other organisations
- knowing how to best use the results of the analysis

While various suggestions and strategies were presented in order to alleviate these concerns, the data intermediaries were aware that PPGIS efforts still remained at the formative stages. As stated by Craig, "each frustration identified at this session is a potential area for new development and research" (*Ibid.*). Recommendations and lessons learned would follow in the latter half of the 1990s.

4.5.2 Information Intermediaries

In their ground breaking article titled The democratisation of data: bridging the gap for community groups, Sawicki and Craig (1996) provided a seminal discussion in which they

examined the potential role for *information intermediaries* in the provisioning of data and technical services for inner city, resource poor community-based organisations. Their discussion explored the value of such efforts and how they were achieved, as well as the challenges to be faced by information intermediaries. They concluded the paper by stating that

> . . . many of the perplexities described above would be solved if community organisations knew more about what this technology has to offer and how other groups around the country are using it successfully (*Ibid.*, p. 519).

The authors suggested that there are numerous methods of and venues for conveying the utility of a GIS to a grassroots organisation, including

- the media (Internet, television, radio, telephone, flyers)
- community (or neighbourhood) events, schools, and churches
- local advertising (street posters, billboards, flyers)
- government reports

Informing a community organisation of the potential of a PPGIS does not, however, transfer knowledge of the processes of implementing and operating the technology. Hence, the concept of an information intermediary was introduced as means with which to facilitate the transfer of knowledge from technical specialists to members of a community organisation. Sawicki and Craig provided a list of recommendations to assist information intermediaries with the challenges they face:

- engage all project participants in a "meaningful dialogue centred on data, information, policy, and action"
- identify data that address specific community issues, and place issues into a broader policy agenda
- explore ways to get around difficulties in acquiring data and information

- seek measures for sustainability (e.g., funding)
- evaluate "the effectiveness of the provider organizations"
- invite university students trained in GIS to help fill the role of information provider (Sawicki & Craig, 1996, pp. 518-519)

As such, an information intermediary plays an integral role in determining whether or not a community organisation decides to adopt a PPGIS. Moreover, the successful outcome of such a venture may be predicated on the facilitative capacity of the information intermediary.

4.7 Conceptual Frameworks for PPGIS Implementation

In this section, I review more recent research provided by several scholars concerning conceptual frameworks for implementing a PPGIS. Schmitt (1997) proposed a timely conceptual model which advocated for a *scholar-advocate* approach to PPGIS implementation. It is interesting to note that numerous subsequent PPGIS conceptual models have also based on university-community alliances. I conclude this discussion with an overview of Leitner *et al.*'s (2002) comprehensive framework of six models of PPGIS provision.

4.7.1 Scholar-Advocate Model

One of the first university-community GIS conceptual frameworks was introduced by Schmitt (1997), a researcher at Rutgers University. Schmitt utilised a *scholar-advocate* GIS model to assist a Camden, New Jersey, organisation of churches in their housing improvement campaign. University faculty and students provided the much-needed knowledge and technical skills for assisting the community organisation in achieving its

goals. While a handful of university-community GIS efforts had already taken place earlier in the decade (c.f. Barndt & Craig, 1994; Martin & Huxhold, 1994), Schmitt was one of the first scholars to provide a conceptual framework for understanding community-university GIS projects.

The *scholar-advocate* model was envisioned by Schmitt to be the middle ground between two more extreme *public access* and *participatory GIS* models. The *public access* model was intended either to provide citizens with hard copy data and maps of their communities (usually supplied by a city planning department) or else online access to GIS data and information. While viewed by many as a democratised approach for accessing public data, this model is not without limitations. In addition to cost-recovery fees often charged by public agencies for documents, the notion of public access GIS was not intended to educate the user about GIS or integrate GIS within the community organisation. Rather, in the case of an online GIS/Internet Map Server, for example, data and maps are standardised and simplified within a web interface in order for the public to learn more about their city and local communities. Such a filtered view is anything but transparent; those public agencies which are fearful of scrutiny (e.g., city planning and police departments) are able to continue to withhold data all the while claiming they are participating in a public access GIS.

The *participatory GIS model* places the technology within the community. While this would initially appear to fulfill a community-based ideal of self-empowerment, such organisations are frequently overwhelmed by the complexity of operating a GIS.[8] Issues such as poorly designed maps and lack of standardised data and symbology tend to confuse, if not mislead,

the original intent of a GIS-generated map (c.f. Monmonier, 1993). Without the necessary technical expertise, neighbourhood groups are unable to use a GIS efficiently in tandem with their own organisational goals. Indeed, the goals of a community group may even be superceded by the demands of maintaining a GIS, which is certainly not in the best interests of the community.

Hence, the scholar-advocate model was deemed a more pragmatic approach (at that time), in which academics, university students, community leaders and residents would collaborate in order to determine the utility and suitability of a GIS for that local organisation. While the neighbourhood group would remain in charge of the project, the university was intended to provide much-needed technical capacity for GIS operations and analyses. The technology would be adapted to the community's needs, instead of the reverse, thus ensuring that the organisation retained its original social and political mandates.

Several other advantages of the scholar-advocate model included: university coverage of the expense of provisioning, implementing, and using community GIS technology, as well as the prestige gained by a neighbourhood group when embracing GIS as part of their revitalisation strategies. A university-supported community GIS could gain legitimacy in the eyes of local institutions, thereby paving the way toward future multi-participant projects and funding.

While Schmitt provided one of the first conceptual models of a PPGIS, Leitner *et al.* (2002) have since provided a more complete review of models for a PPGIS. Additionally, various other researchers have also documented their efforts and concerns regarding implementation

[8] See the Metcalfe Park Study in chapter 5.

and evaluation strategies for PPGIS projects, which will be discussed in the following section.

4.7.2 Models for PPGIS Availability

Leitner *et al.* (2002, 2000) conceptualised six frameworks of PPGIS availability. Their research was based upon urban community-based GIS projects in Minnesota and Wisconsin.[9] The models include:

- Community-based (in-house) GIS
- University-community partnerships
- GIS facilities (universities/libraries)
- Map Rooms
- Internet Map Servers
- Neighbourhood GIS centre

Each model of PPGIS availability will be discussed in turn, in order to determine both the positive and negative aspects of such frameworks. This discussion is not intended to be fully inclusive of the authors' works; rather, it is a summary of key points which will be referred back to when categorising several PPGIS case studies which follow in the next chapter.

Community-based (in-house) GIS

To date, there are very few (if any) community-based in-house GIS projects in existence. This mode of GIS provision physically places a GIS in the neighbourhood, and has great potential for democratising community implementation and usage of a GIS. The reputed advantages of this type of framework include: tailoring of the GIS to suit local needs, direct

neighbourhood access to a GIS and, consequently, flexible and immediate response to community issues. Neighbourhood monitoring of (and perhaps control over) local concerns, and the prospect for community-based technological employment are also prospective advantages.

The disadvantages, however, have contributed to the paucity in numbers of such endeavours. Lack of funding, technical capacity, and a high turnover rate in staff are a significant deterrent to community-based GIS efforts. Moreover, neighbourhood access to public data tends to rely on political connections and the willingness of public agencies to share such information. While a community-based GIS is not usually liable for public data, it is important to note that a neighbourhood organisation can be held responsible for community-generated data (Leitner *et al.*, 2002, p. 42).

Community-University Partnership

A community-university partnership tends to be a far more common approach to providing GIS to local organisations in the US. Frequently, a university GIS department is asked to assist a community group in using GIS to further the neighbourhood's own planning initiatives. The advantages of this type of strategy lie in the provisioning of technical knowledge and expertise, more affordable GIS facilities and access to digital data. Many urban GIS university courses have community-based learning requirements, which can be fulfilled by partnerships between students and neighbourhood groups. Community-based faculty research projects are also included within this framework. GIS data are provided and

[9] These locations will be discussed in further detail in the next chapter.

maintained by the university, thereby freeing the neighbourhood organisation of data liability.

Factors which may limit successful community-university partnerships include: student and faculty timetables, differing research goals, lack of a longer term commitment to the GIS project, and limited university capacity to serve the needs of all communities. Hence, participants should be flexible given the potential for diverse viewpoints, wants, needs, and so forth.

GIS Facilities (universities/libraries)

Typically, a community representative would have to travel to a university or a public library in order to access GIS-generated products. The facility, in turn, would conduct spatial analyses and produce hard copy maps as required by the neighbourhood organisation. Several benefits of this type of arrangement include: cost reductions for community use of a GIS, and the prospect of the university as being a longer term resource for technical assistance.

While this mode of community GIS does provide community groups with the expertise and technology for conducting geospatial analyses, direct interaction with the technology is limited for community organisations. Additionally, the involvement of various stakeholders, particularly those that control funding, tends to complicate the overall process. Moreover, there are myriad complex legal issues surrounding the ownership and use of data generated in this framework.

Map Rooms

Map rooms are usually operated by local government offices and agencies. While quite similar to GIS facilities, in that a map room is intended to provide public GIS data (either in mapped or tabular format), this method of provisioning GIS does differ in several respects. First, the map room usually operates within a fee-for-service framework, which may be a limiting factor for more impoverished community groups. Second, there is little expertise offered to a neighbourhood organisation concerning the products they purchase. Indeed, access to GIS-generated information may be also be limited by an agency's data policies and mandates. The potential for misinformation (or worse, misuse) increases when the data and maps are generated by non-GIS users.

Internet Map Servers (IMS)

Envisioned by many to be the way of the future, an Internet Map Server (IMS) provides the user with direct access to geospatial data via the Internet. For the most part, maps and some data sets (digital and/or analogue) are pre-defined by the host server and then made available to the client for limited interaction (e.g., point-and-click queries) by means of a web-based interface. The host site usually provides a disclaimer, in order to prevent data liability should the IMS be used inappropriately.

It is important to keep in mind, however, that an IMS is designed and maintained by stakeholders who usually operate outside of a community's locale. Thus, information provided to the client (by means of an IMS) is filtered in terms of content and availability by

the host server. Moreover, an IMS should not be mistaken for a fully operational PPGIS -- an IMS is neither fully functional as a GIS nor fully participatory from the perspective of a community organisation.

Neighbourhood GIS Centre

One other mode of provisioning a community with GIS is found under the rubric of a neighbourhood GIS centre. This is a rarity amongst community-based GIS projects, but one which may prove to be of great value to neighbourhood groups. A neighbourhood GIS centre is a collaborative effort in which "neighbourhoods pool their expertise and resources to provide a central facility that all affiliated community organisations can use" (*Ibid.*, p. 45). Such efforts are considered part of a proactive community development strategy: by rallying community groups together in terms of a shared agenda, neighbourhood GIS centres can enable community groups to express a stronger voice in the public decisionmaking arena.

A neighbourhood GIS centre allows community members (under professional guidance) to update their own GIS database, analyse their own data, and present their case from a scientific perspective (a significant factor when these groups meet with city planning officials, for example). There are, however, some difficulties in translating this concept from theory to practice. A centralised neighbourhood GIS means that most community members would have to travel to the facility in order to use its technology. Continuity of external funding, technical capacity and maintenance are key concerns when planning and implementing a sustainable community GIS. Moreover, the propect of neighbourhood conflicts increases with the number of organisations that participate in such a venture.

Differing priorities and political agendas could further reduce the effectiveness of this type of effort. Finally, a neighbourhood GIS centre "faces complex legal and ethical issues . . . [concerning] the accuracy and reliability of databases and software acquired from external stakeholders" (*Ibid.*, p. 46).

Each of the models discussed above are prospective frameworks for providing a PPGIS to a community organisation. In providing a community group with access to a PPGIS, each model is viewed as a participatory initiative. Hence, Leitner *et al.*'s schematic is demonstrative of PPGIS conceptual frameworks. One question remains, however: how might one evaluate the outcome of implementing a PPGIS? In response to this concern, I conclude this chapter with an overview of conceptual models for evaluating a PPGIS.

4.8 Conceptual Models for Evaluating a PPGIS

This chapter would not be complete without some discussion of the measures currently proposed for evaluating the efficacy and utility of a PPGIS. When designing any type of PPGIS model, one should consider the impacts and implications of the technology in practice. As such, this section of the chapter sets the stage for a latter chapter of the thesis -- a proposed model for PPGIS. While frameworks for PPGIS assessment are still in the early stages, various academics and practitioners are engaging in such evaluative processes.

I commence this section with Sieber's (2002) discussion of five community PPGIS requirements, which are derived from her research on the implementation and use of PPGIS by environmental organisations in the US. As noted previously, grassroots organisations

tend not to operate in a formalised manner; yet, there are fundamental concerns for all when it comes to the introduction and implementation of a new technology.

Leitner *et al.* (2002) discuss several important considerations surrounding the appropriateness of a PPGIS, which provides an entry point for formulating evaluative conceptual frameworks for the technology. This section concludes with Barndt's proposed criteria for evaluating a PPGIS, which are situated within three broad contexts: PPGIS data and technology, PPGIS management, and community development principles.

4.8.1 PPGIS from a Grassroots Perspective

In a recent publication, Sieber (2002) noted that the successful implementation of a GIS by a non-profit group was based on its innovativeness in securing resources. In most instances, the fiscal costs of acquiring the necessary technology as well as the technical expertise needed for operating a GIS extended beyond the scope of most community organisations. Therefore, a community group's capacity to improvise upon existing resources by seeking new sources of funding, technology, and assistance, was vital in terms of its ability to implement a PPGIS.

Table 2. Grassroots PPGIS Requirements

Resource	Source
Software donations	Software development corporation
Hardware, software, data, and expertise	Universities
PPGIS volunteers / students	Universities / community members
PPGIS *hyper-champion*	University professor / community member / philanthropist
Informal connections rather than formal policies	University / community / external funding sources / politicians

Source: Sieber, 2002, p. 161.

As noted in **Table 2**, key resources may be found through alternative service providers, such as universities and philanthropic organisations. Software corporations, such as ESRI, have mandated generous donations to nonprofit groups engaging in GIS efforts. Perhaps most important is the presence of a GIS champion, a tireless individual who advocates for the positive remains involved in the process for the longer term. Given that most community organisations lack such resources, PPGIS efforts are also heavily reliant upon volunteers who are committed to such initiatives.

4.8.2 PPGIS Model Requirements

Leitner *et al.* (2002) emphasised two major PPGIS concerns:

- the need for a flexible model which is responsive to a community organisation
- the inherent difficulties of implementing and maintaining a PPGIS

The importance of PPGIS model flexibility and responsiveness can not be over-emphasised. Given that community organisations are highly heterogeneous and comprised of diverse populations and politics, the introduction of a new technology must, at the outset, be determined to be appropriate for the community's, often unique, requirements. If this is indeed the case, the PPGIS model should be responsive to the organisation's capacity and needs and be flexible enough to adapt to (and, at times, be restructured) in order to best suit the neighbourhood organisation. While much easier said than done, these aspirations are the hallmark of a PPGIS.

A second concern raised by Leitner *et al.* (2002), addresses the difficulties of implementing and maintaining a PPGIS. This category may be broken down in terms of financial costs,

technological, and management issues surrounding a PPGIS. As noted earlier in the thesis, management (organisational) issues have been known to supercede all other concerns when implementing a GIS. A community organisation lacking the social capital, or at least the necessary support networks to tackle a PPGIS, may ultimately fail in its attempts to adopt the technology.

4.8.3 An Evaluative Framework for PPGIS

In his paper titled A model for evaluating public participation GIS, Barndt (2002) framed his methods for PPGIS evaluation within three broad contexts, including:

- the value of PPGIS information
- successful PPGIS project management
- PPGIS and community development principles

Barndt further identified a check list of criteria and questions that should be addressed when evaluating a PPGIS. Of particular interest is his emphasis on community development principles and the ways in which a PPGIS may be of benefit to a community organisation. The concepts, characteristics, and associated attributes related to each rubric, have been listed in **Tables 3** to **5**. While the tables are, for the most part, self-explanatory, I provide a brief discussion of each.

The Value of PPGIS Information

In **Table 3** are Barndt's interpretations of key characteristics of the value of PPGIS information. The characteristics shown in this table are primarily data-related. Notions of *appropriate* and *accurate* information, for example, are intended to determine whether or not

the data gathered are useful for the community organisation, as well as their potential for misuse. The immediate availability of *timely* information can enhance group decisionmaking and policy development. *Insightful* and *synergistic* data can help demystify stigmatised community groups, and can also lead to collaborative data sharing initiatives. Further, Barndt viewed the combining of *qualitative* and *quantitative* data as an integral component of PPGIS information.

Table 3. The Value of PPGIS Information

Characteristic	Attributes
Appropriate information	• do the data match community objectives? • are the data accurate? Biased? • who has access to the data?
Action-oriented	• will the data support community decisionmaking? • are the data detailed enough for the community to use effectively? • are the data easily translated into knowledge?
Timely	• can the data be adapted to a community's schedule? • can the PPGIS participants adapt to scheduling changes in the provision of data and information? • are community priorities altered by GIS providers external to the organisation?
Accurate	• how accurate are the PPGIS results? • can local knowledge assist in cleaning up errors in the database? (e.g., due to Census aggregation of local data, or errors in data collection and analysis)
Insightful	• can community groups help demystify incorrect perceptions of their neighbourhoods? • will local knowledge reveal new information?
Timely	• can neighbourhood comparisons be generated by a PPGIS? • what are the historical patterns of community geographies at varying scales?
Synergistic	• what are the advantages of gathering information from several sources? • will data sharing help ameliorate inter-related problems? (e.g., information clearing houses / central data repositories)
Qualitative and quantitative	• how can we combine different sources of knowledge?

Source: Barndt, 2002, pp. 347-350.

Successful PPGIS Project Management

Barndt has proposed that a PPGIS project's level of success be measured in terms of four principal characteristics, which are shown in **Table 4**. One important consideration is that of project *sustainability*: aside from funding and project volunteers, Barndt identified several other considerations which are important to a sustainable PPGIS, which are discussed as follows. *Efficient* methods for *replicated* procedures (e.g., templates) go far in terms of preserving a community organisation's resources. By bringing the technology to the community group, and ensuring that citizens are actively involved in the process, Barndt envisioned that the PPGIS would become *integral* to that organisation. A final characteristic of PPGIS project management concerns the *complexity of the system*: how might a PPGIS be modified in order to be more approachable without compromising its technical capacity for complex GIS analyses?

Table 4. PPGIS Project Management

Characteristic	Attributes
Sustainability	• project support? • capacity for the project to expand / grow?
Replicability / efficiency	• reduce duplication of efforts
Integral	• pool all resources
System complexity	• how may the technology be simplified without compromising the complexity of GIS analyses?

Source: Barndt, 2002, pp. 350-352.

PPGIS and Community Development Principles

As noted in **Table 5**, Barndt has identified six PPGIS and community development principles for evaluating the efficacy of a PPGIS. The first principle of PPGIS and community

development was intended to fully *integrate* the components of a working Community Information System (or PPGIS) within a community group. Characteristics of this principle are listed in the table, and are considered a vital components of the overall process.

Access to data and information characterises the second principle -- the costs of acquiring, processing, and maintaining data tend to remain out of reach for most neighbourhood organisations. Creative and collaborative approaches to gaining access to and sharing of data must be further explored.

Table 5. PPGIS and Community Development Principles

Principle	Characteristics
Integrate the components of a working CIS	• accurate database systems • clearinghouse operation • technical resource provider • community research analysts • community project participants • financial support
Rights of information access	• what are the barriers to data access?
Community priorities and capacity building	• community control of the PPGIS? • local empowerment
Value of co-production	• joint PPGIS partnerships
Increase capacity of community group to use the technology	• role of the information intermediary • transfer of the technology and educating the users of PPGIS • centralise the technology
Integrate PPGIS into a broader community development process	• design the PPGIS to fit the community's goals and objectives

Source: Barndt, 2002, pp. 353-356.

Community priorities and community capacity building are the key focus of the third PPGIS and community development principle. Geographic data, information, and analyses must be oriented toward empowering grassroots organisations. The process of assisting a community

group in PPGIS projects may "extend to empowering staff of [such] organisations to conduct much of the analysis work themselves" (Barndt, 2002, p. 354).

Co-production (or multi-participant partnerships) marks Barndt's fourth principle of PPGIS and community development. Joint community-based projects draw upon all available resources, including those of the community group, which, subsequently, tends to benefit all participants.

The fifth principle emphasises *increasing the capacity of the community groups to use the technology*. Barndt emphasises the importance of the role of the GIS/information intermediary for several reasons, which are described as follows. Of primary concern, when implementing a PPGIS, is the need for technical expertise. According to Barndt, many community groups would better expend their energies by focusing on organisational concerns, and leaving much of the technical concerns to a GIS intermediary. An intermediary also serves the purpose of educating the community-based GIS users to use the technology. Barndt also recommends that the centralisation of the data and technology (e.g., a clearinghouse) would provide a more efficient and cohesive PPGIS infrastructure.

The *integration of a PPGIS into the broader community development process* marks Barndt's sixth principle of PPGIS and community development. Barndt noted that the community development process is of primary importance; therefore, a PPGIS should be modeled to best fit community capacity, wants, and needs.

In this chapter, I have presented frameworks for conceptualisation, implementation, and evaluation of a PPGIS, which are deemed most appropriate for urban community-based ventures. In the next chapter, I provide several case studies in order to illustrate the various strategies undertaken thus far by PPGIS proponents in the US.

5.0 CASE STUDIES

5.1 Introduction

According to Yin (1994), "the distinctive need for case studies arises out of the desire to understand complex social phenomena" (p. 3). A review of several US inner city settings is deemed appropriate for further understanding neighbourhood usage of a PPGIS. Indeed, the implications of a PPGIS have yet to be fully realised, given the short history of such projects. As such, I discuss PPGIS initiatives that have been conducted in three urban settings which have been extensively documented by researchers since the early 1990s.

As noted in previous chapters, a community-based GIS is inherently complex as it is comprised of myriad, often conflicting, social and political agendas. Due to research constraints, the stories told are derived from a research perspective, not that of the grassroots. While a more inclusive picture would have enriched the quality of this research, concerted attempts have been made to gather evidence from a variety of sources. It is expected that the value of the information derived will outweigh any potential bias.

In this thesis, I have relied upon a synthesis of textual evidence to further understand and explain the efficacy of PPGIS for neighbourhood organisations in the US. This strategy is intended to derive generalisations from PPGIS efforts in order to propose and construct a prototype PPGIS for the Canadian context. As noted previously, there are caveats implicit in cross-border comparisons and assumptions (Goldberg & Mercer, 1985). With this thought in

mind, the model proposed in the chapter which follows, is intended to be generic, highly flexible, and sensitive to local context.

Ideally, this research would have been structured around Canadian PPGIS studies. Unfortunately, there is a paucity of PPGIS ventures in this nation primarily due to restrictive data regulations, among other reasons (c.f. Klinkenberg, 2003). As such, the case settings selected for this thesis are situated in the US, a nation which provides the next-best resource base for understanding the prospects for and implications of community-based PPGIS initiatives.

The three case settings were chosen based on the longevity of their PPGIS ventures, and for their high level of commitment to community participatory strategies. Two locations (Milwaukee, Wisconsin, and the Twin Cities, Minnesota) are focused on community development with a strong PPGIS flavour, whereas the third site (East St. Louis, Illinois) is geared toward participatory neighbourhood action research with less of an emphasis on PPGIS.

One of the first documented community-based PPGIS projects was introduced in Milwaukee's Metcalfe Park Neighbourhood; hence, this initiative is considered a pioneer in the field of PPGIS. The City of East St. Louis, Illinois, once lacking even the most rudimentary elements needed for community redevelopment, has benefited tremendously as a result of university-generated participatory action research strategies and federal government funding. The Cities of Minneapolis and St. Paul, Minnesota, have now progressed to a stage

where city-wide neighbourhood PPGIS partnering strategies are underway, which are directed by a consortium of many different stakeholders.

In the following sections, I present each PPGIS case study as a separate entity. I commence each study with a discussion of its local context and PPGIS project stakeholders. A detailed overview of one exemplary initiative then follows, and each study is concluded with a critical summary of project successes and lessons learned.

5.2 Milwaukee, Wisconsin: *Lessons Learned*

5.2.1 Introduction

The University of Wisconsin, Milwaukee (UWM) has played a vital role in the implementation of community-based GIS projects in the US. Since the late 1980s, two key researchers, in particular, have played an integral part in the growth of PPGIS initiatives in the Twin Cities. Bill Huxhold, a professor with the School of Architecture and Urban Planning at UWM, and Michael Barndt, retired from UWM and now a director at the Nonprofit Centre of Milwaukee, are pioneers in community-based GIS initiatives (UWM, CUIR, 2003; UWM, SARUP, 2003). In collaboration with other researchers, neighbourhood organisations, and government agencies, Huxhold and Barndt helped set the stage for viable university-community PPGIS partnerships.

5.2.2 Context

By the mid-20th century, Milwaukee, like so many other US cities, experienced severe blight due to economic restructuring and de-industrialisation. Its inner city neighbourhoods

were particularly hard hit as a result of disinvestment and population decline, leaving its resource poor residents struggling to survive. One response was the emergence of neighbourhood coalitions in order to mitigate local problems by politically engaging in neighbourhood planning and revitalisation strategies. As such, many Milwaukee community groups are now viable organisations with the political will to participate in the public participation arena.

5.2.3 Stakeholders

The City of Milwaukee has long advocated public participation in its planning efforts. In response to the devolution of federal funding to the local and state levels, Milwaukee has emphasized the role of citizen involvement in public-private partnerships. Indeed, by the early 1990s, the city's planning department and Mayor's office strongly supported civic engagement in neighbourhood revitalization initiatives and advocated the use of GIS in such strategies (Ghose & Huxhold, 2001). Such collaborative technological efforts are instructive, given their decade-long history and their continued growth.

The Neighbourhood Strategic Planning (NSP) Areas of Milwaukee were designed through a public participatory process which emphasised a bottom up approach to neighbourhood revitalisation (City of Milwaukee, 2003). Community residents were included at the formative stages of the NSP process, in collaboration with the Community Block Grant Association (CBGA)[10] and the Neighbourhood Data Centre Program of the Milwaukee Nonprofit Centre. Neighbourhood boundaries were identified by their residents and then

[10] The Community Block Grant Association is sponsored by the US Department of Housing and Urban Development (HUD).

incorporated into 17 strategic planning areas in 1996. The project continues to date, as community residents continue to participate in strategic funding proposals for the CBGA. Such strategies are dependent upon accurate data and geospatial analyses (often provided by the Data Centre) in order to target those neighbourhoods in greatest need of assistance.

The Neighbourhood Data Centre (formerly known as MAUD) has provided technical assistance including mapping, training, and policy information, to nonprofit organizations since 1992. Funded by the CBGA, the Data Centre has become a vital repository for up-to-date local and public-domain data (UWM, CUIR, 2003) The centre is not fully sustainable, however, due to staff turnover and limitations on staff time (Ghose & Huxhold, 2001). In addition to the Data Centre, the University of Wisconsin-Milwaukee (UWM) has also emerged as a key stakeholder.

A key mandate of the UWM is "strong research and service involvement to the community" (Ghose & Huxhold, 2001, p. 201). As such, UWM faculty and students have long participated in collaborative community revitalisation efforts which frequently include the City's planning department. The City provides digital parcel and tax data for free to the UWM in exchange for university provided hardware, software, and technical expertise. Such cooperative efforts have gone far in terms of facilitating public engagement in the uses of PPGIS.

Two forms of community-university partnerships have begun to emerge in Milwaukee, which emphase either a short-term or long-term project approach to PPGIS implementation.

The former focuses on meeting short-term PPGIS requirements, often relying on Census or local administrative data, which are analysed by external service providers. The latter is aimed toward establishing a longer term sustainable community GIS, in which few (if any) have succeeded in their efforts.

5.2.4 Metcalfe Park Study

Metcalfe Park is a "mixed residential and industrial neighbourhood" located in the inner city of Milwaukee (Myers & Martin, 1994). With a poverty rate of 54 per cent,[11] this neighbourhood is predominantly comprised of African American, single parent families living in rented duplexes. The City of Milwaukee and the US Department of Housing and Urban Development (HUD) were instrumental in funding housing revitalisation programs, in which Metcalfe Park participated. The Metcalfe Park Residents Association (MPRA) was established in response to the many inner city problems experienced by its residents.

> The MPRA consists of a board of directors and sub-committees on housing, crime, and sanitation. This board appoints residents to the Development Advisory Groups of the Center City Initiative program [a redevelopment project]. Therefore, the residents participating in this project have an organisational structure already in place and have been working on the urban problems for quite some time. The majority of this resident group are *homeowners* with little or no experience with computers (Myers & Martin, 1994).[12]

One of the *earliest documented* community-based PPGIS studies was conducted by the UWM in 1993, in the Metcalfe Park neighbourhood. UWM graduate students provided technical support and GIS training for the MPRA, as part of an applied urban planning

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[11] Knox (1994) defines "the poverty level for a nonfarm family of four [as] just under $13,000 in 1990."
[12] The term *homeowners* is deliberately emphasised to point out the fact that this group does not necessarily represent the majority of Metcalfe Park's residents who reside in *rental* properties. This may have been one of the underlying causes of UMN's failure to maintain a community-based GIS over the longer term.

course. It was expected that such efforts would provide the residents with "basic [technical] skills and powerful GIS tools, [wherein] residents are more likely to influence where resources are allocated and to whom the resulting costs and benefits are distributed" (*Ibid.*). The students designed a GIS tailored toward MPRA's needs and conducted four training sessions with the neighbourhood residents.

A digital base map was obtained from the City of Milwaukee and then customised, using ArcView,™ to analyze and display linked Milwaukee Master Property File data for working on housing-related issues. The Metcalfe Park residents also created their own databases using ArcView™ based on local information including vacant lots, garbage disposal problems, as well as the names and addresses of neighbourhood residents. The data were subsequently geocoded for further use and analyses. After the third training session, "residents were building their own queries covering topics from slum landlords to building code violations," having gained sufficient knowledge to understand the information that was accessible to them (*Ibid.*).

In 1994, ESRI provided neighbourhood organisation with a copy of ArcView™ software, and UWM loaned a computer for resident use, which would be located and maintained in the neighbourhood at the Metcalfe Park Police Substation. Training and support sessions were to continue until such a time when residents were able to work on their own. Over the longer term, the project was intended to address other local issues such as crime incidence and toxic waste disposal.

While this project did succeed in engaging many neighbourhood residents in a more participatory, knowledge-sharing process, there is no evidence of the program having continued beyond 1994. As a "neighbourhood [still] troubled by crime, crack cocaine, rundown residences, absentee landlords, and vacant lots laden with shards of glass from broken liquor bottles," Metcalfe Park does not appear to have benefited over the longer term from being an informed citizenry ("Church Leads Way," 2001). Rather, the neighbourhood remains desperately in need of a broader social, economic, and political framework for neighbourhood restructuring, which may extend beyond the scope of PPGIS.

5.2.5 Critical Summary

The Metcalfe Park Project did achieve some important successes. First, this was one of the first university-community PPGIS projects of its kind which attempted to place the technology in the hands of the grassroots. The details of the participatory GIS process have been documented and are instructive for future efforts. While the project was not sustainable, many lessons were learned and have since been applied to later initiatives. Second, valuable data were collected from the project, which may be used further in subsequent neighourhood-based research initiatives.

Finally, a relationship was established between the university and the neighbourhood group, one which continues today (c.f. UWM, Campus Design Solutions, 2002). Indeed, those residents which participated in the Metcalfe Park GIS project were empowered by having gained new technological knowledge. At the very least, the prospective advantages of a

community-based GIS were introduced to the neighbourhood -- an important first step toward a participatory GIS.

It is difficult to find fault in a pioneer project, but it still is necessary to point out aspects of the initiative which may have been overlooked. As mentioned above, the project was not sustainable over the longer term, which resulted in considerable disappointment for the neighbourhood (and UWM researchers). Clearly, the university should have maintained a longer term commitment to this community-based project, to ensure that the GIS operated efficiently and to ensure the continuous transfer of knowledge and expertise. Such is the downfall of many university-community ventures: university calendars, course requirements, and a shortage of staff and volunteers tend to shorten the lifespan of many community projects.

5.3 East St. Louis, Illinois: *Participatory Action Research and PPGIS*

5.3.1 Introduction

The East St. Louis Action Research Project (ESLARP) has demonstrated another pioneer effort in which the University of Illinois at Urbana-Champaign (UIUC) collaborated with East St. Louis neighhourhood organisations to tackle inner city revitalisation concerns. Information technologies (IT) and GIS have been used by UIUC researchers within a participatory action research (PAR) framework. PAR strategies are intended to empower local residents by engaging them in participatory measures that mobilise community revitalisation efforts.

5.3.2 Context

The City of East St. Louis, Illinois, was first settled in the late 1700s on the east bank of the Mississippi River, adjacent to its westerly neighbour, the City of St. Louis, Missouri. By the early 20th century, East St. Louis had become a prosperous industrial manufacturing centre. Labourers were obtained cheaply from the city by outside business interests, which ultimately undermined the city's tax base. Additionally, East St. Louis was one of many US cities which experienced the negative impacts of long-standing racial tensions between between African American groups and Eastern European immigrants (UIUC, EPNRP, 1999).

During the Depression, factories closed as companies sought out even cheaper labour in the Deep South. Staggering unemployment was exacerbated by racial rioting. Post World War II, the City of East St. Louis fell into financial and physical ruin. The decaying railway and urban infrastructure, accompanied by the construction of interstate highways, which cut through (and demolished) many of the inner city neighbourhoods, contributed to East St. Louis' demise. The urban phenomenon of white flight of city residents to the suburbs during the 1960s and 1970s, also contributed to the city's decline. Between 1945 and 1990, East St. Louis lost half its population base, declining from 88,000 people to 43,000 (Reardon, 1998). When the City faced bankruptcy in 1991, the State of Illinois assumed fiscal responsibility for its residents. Predominantly African-American (98 per cent), East St. Louis inner city neighbourhoods were clearly devastated by unemployment, poverty, and a lack of civic support.

5.3.3 Stakeholders

In the late 1980s, one state representative concerned with the city's continuing deterioration challenged the president of the University of Illinois to demonstrate the school's stated commitment to low-income communities. As a result, the University of Illinois Urbana-Champaign (UIUC) began to collaborate with local neighbourhoods which were seen as "the bridge between the university and East St. Louis citizens" (Reardon, 1998). UIUC's architecture and planning departments joined the state in providing a financial and technical support structure for low-income urban minorities. By 1990, such efforts were organised under the broader umbrella termed the East St. Louis Action Research Project (ESLARP).

A primary source of funding for ESLARP was received through the Community Outreach Partnership Centre (COPC) program of the US Department of Housing and Urban Development (HUD). Other participants included the US Department of Education, the US Environmental Protection Agency, the Corporation for National Service, US Department of Agriculature, University of Illinois Partnership Illinois, and East St. Louis Community Development Block Grants (*Ibid.*).

5.3.4 ESLARP Study

ESLARP's mandate has been to facilitate neighbourhood revitalisation efforts from a participatory action research perspective. Comprised of twelve UIUC faculty members, countless numbers of student volunteers, a project director and staff, ESLARP is a community-university partnership that emphasises participatory action practices which are intended to empower the grassroots. Previous academic efforts were criticised for being

impractical for and unresponsive to local organisations. As stated by UIUC professor Kenneth Reardon (1998):

> [I]nterview findings prompted the faculty to abandon their top-down approach in East St. Louis in favour of a more participatory bottom-up, bottom-sideways approach to community planning in which residents identify the issues to be examined, participate in the collection of field data, and collaborate in the analysis of this information (*Ibid.*, p. 325).

Neighbourhood organisations were seen to be a central component of participatory research strategies. Local residents have since participated in all aspects of ESLARP's projects, from the inception phase through to sustainable practices. University students have worked in collaboration with community members to assist in neighbourhood improvement strategies and to learn about distressed communities from the residents themselves.

IT and ESLARP

Given that, in this thesis, I am focusing on community-based PPGIS, I will shift my emphasis toward technological applications which have been used successfully by ESLARP. In 1994, ESLARP developed a web site that documents the history and mandates of their project, displays an archive of community-based courses, and provides access to various GIS and technological components embraced by the project (UIUC, ESLARP, 2003).

I commence this discussion with a brief overview of ESLARP's technological infrastructure which includes GIS-related technologies. This is followed with a review of ESLARP's usage of GIS, and concludes with a critical summary of ESLARP's PAR strategies for empowering the grassroots.

Neighbourhood Technical Assistance Centre (NTAC)

The Neighbourhood Technical Assistance Centre (NTAC) was opened in 1996, and is currently staffed by community development and technical specialists. Located at the UIUC campus, NTAC provides free planning, training, and community organising services to local nonprofit organisations and community groups. Additionally, the centre provides GIS data and analyses at the local level, serves as a repository for such information, and provides access to online data and GIS resources (UIUC, ESLARP, NTAC, 2003).

East St. Louis Geographic Information Retrieval System (EGRETS)

The East St. Louis Geographic Information Retrieval System (EGRETS) was introduced in 1996 (UIUC, ESLARP, EGRETS, 2003). EGRETS serves as an Internet Map Server (IMS) with limited GIS functionality. The EGRETS web site provides links to free digital data at the local, state, and federal levels; a search engine for East St. Louis neighbourhood maps; and information about the various kinds of data and information that are available through ESLARP.

PPGIS and ESLARP

ESLARP has used PPGIS as part of its community-based development strategy since 1994 (UIUC, ESLARP, 2003). UIUC faculty and students have collaborated with East St. Louis community groups to create their own local databases on conditions at the neighbourhood and parcel levels. Students and residents have gathered information on the condition of local infrastructures (such as street and building code violations), proposed transportation routes, housing related concerns, as well as wildlife habitat prospects.

5.3.5 Critical Summary

The important point to be made here is that ESLARP uses PPGIS to support participatory research strategies. A PPGIS, as such, does not direct the course of a project. Rather, neighbourhood residents work together with ESLARP members to determine appropriate strategies for urban revitalisation efforts. As aptly stated by Barndt (1998), "[PP]GIS is not the centre of the public participation universe" (p. 105). In the case of East St. Louis residents, PPGIS serves as a *tool* through which data are stored, analysed, and displayed, either in-house or, to a limited degree, online. Appearances can be deceiving, however, and so I am compelled to question the masked power-relations embedded in ESLARP's usage of a PPGIS.

By power-relations I mean the interplay (or lack thereof) between neighbourhood residents and the UIUC participants, particularly in terms of accessing and using a PPGIS. One major obstacle for East St. Louis residents is that of geographic location -- the NTAC and UIUC are located at the University of Illinois, Urbana-Champaign, some 160 miles away from the City of East St. Louis. This factor alone discriminates against those residents unable to access or afford to pay for transportation to and from UIUC.

Second, PPGIS and technical services are provided by GIS experts and university students through NTAC and ESLARP course-related programs. East St. Louis community groups do not conduct their own PPGIS analyses; rather, such information is provided by experts and is conveyed by means of an Internet Map Server (IMS). Despite arguments to the contrary, an

IMS (such as EGRETS) does not fully democratise public participation in a GIS. As has been stated before hand, an IMS displays a filtered view of geographic information. Whereas the server/host controls what information is displayed, the client/recipient has a limited ability to interact with the interface, and little control over what is displayed.

Hence, the technology remains both geographically and technologically out-of-reach for many East St. Louis community groups, and, subsequently, could be considered as potentially disenfranchising (particularly for those individuals who do not have access to the Internet). There is no evidence of community members having participating in the processes of PPGIS analysis; rather, such information is provided to the neighbourhood in a top-down manner by academics and technical specialists.

5.4 Minneapolis and St. Paul, Minnesota: *Community GIS Consortium*

5.4.1 Introduction

Minneapolis and St. Paul have experienced a considerable history of city-supported neighbourhood development initiatives. Community Development Corporations (CDCs) and District Planning Councils (DPCs) have operated as private nonprofit organisations within the Twin Cities, and are committed to collaborative efforts directed at the community level. The Neighbourhood Revitalisation Program (NRP), directed by the cities, and the Neighbourhood Planning for Community Revitalisation (NPCR) program, directed by the Centre for Urban and Regional Affairs (CURA) at the University of Minnesota (UMN), are active participants in local neighbourhood revitalisation initiatives.

The combination of a supportive civic network and technological infrastructure, as well as considerable enthusiasm and expertise provided by the UMN, have greatly contributed toward numerous successful community-based efforts in the Twin Cities. For more than ten years, PPGIS has been introduced within local Minneapolis and St. Paul neighbourhoods, studied intensively, and critically evaluated.

This section commences with a discussion of the PPGIS setting in the Twin Cities, and is then followed by an overview of the broader community-university consortium which links local neighbourhood PPGIS efforts with numerous other stakeholders. The structure of the consortium is complex, but a necessary requisite, in terms of facilitating sustainable community-based PPGIS initiatives. As discussed by Elwood (2000), the city neighbourhood of Powderhorn Park has found PPGIS to be of considerable utility in its revitalisation efforts. As such, I conclude this section with a critical overview of PPGIS usage by the Powderhorn Park Neighbourhood Association (PPNA).

5.4.2 Community GIS Consortium

The following discussion provides an overview of a broader community research agenda which has engaged community, university, government, and nonprofit organisations in the sharing of data, information, and knowledge with local neighbourhoods. In tandem with the University of Minnesota's (UMN) Centre for Urban Affairs (CURA), neighbourhood organisations in the Cities of Minneapolis and St. Paul have collaborated with a variety of partners, under the auspices of a consortium, in order to enhance community capacity.

A closer look at the structure of CURA reveals the extent of this collaborative effort which include the Neighbourhood Planning for Community Revitalisation (NPCR) project, Minneapolis Neighbourhood Information Systems (MNIS), and the St. Paul Community GIS Consortium (CGISC). The former initiative is directed toward community capacity building utilising academic resources and expertise, while the latter two programs are aimed at providing neighbourhood PPGIS capacity.

Neighbourhood Planning for Community Revitalisation (NPCR)

Established in 1993, the NPCR is comprised of a consortium of academic research affiliates and supporters in the Twin Cities. The program is governed by the participating universities as well as local community organisations. While administered by CURA, the NPCR is funded locally by the St. Paul Companies and the Twin Cities Local Initiative Support Corporation, and at the federal level by HUD and the McKnight Foundation (UMN, NPCR, 2003). Partnerships are built between local communities and universities in order to enhance community capacity and to provide a research venue for students to engage in community-based learning ventures.

MNIS (Minneapolis) and CGISC (St. Paul)

The CGISC and the MNIS are projects operated jointly between UMN, the Cities, the NRP, and local community groups (UMN, CGISC, 2003; UMN, MNIS, 2003). These programs are geared toward enhancing neighbourhood capacity to utilise information technology in general, and PPGIS, in particular.

Community residents are expected to actively participate in developing PPGIS for local use, attend training sessions and municipal meetings, as well as present their own PPGIS projects at local conferences. In exchange, residents are given access to City property data files and are provided with the necessary GIS software and education as per a data sharing agreement. The CGISC, for example, has drawn up a participation agreement which formalises the terms of data access and usage in contract with a community group. The participating community group is expected to pay an annual fee for data access (e.g., $250 per year for MNIS communities) as well as a one-time membership fee, determined by the CGISC board (UMN, NPCR, CGISC, 2003).

Various local PPGIS studies in Minneapolis and St. Paul are available online (UMN, NPCR, 2003). The Powderhorn Park Neighborhood, for example, has been the subject of numerous MNIS studies. In one related project, block-level census data were used to examine the patterns and concentrations of ethnicity and race in the neighbourhood. The resulting GIS analysis indicated that the majority of Powderhorn Park's residents were comprised of an ethnic mix (African American, Latino, and White), and its northern perimeter was predominantly Latino. There were very few blocks of all-Caucasian residents. These results were intended to be used by the neighbourhood association to identify the needs of specific ethnic groups in the neighbourhood (*Ibid.*).

MNIS has undertaken GIS studies of other neighbourhoods in Minneapolis, including crime and safety analysis using locally collected data from Harrison Neighbourhood, collaborative urban planning exercises using municipal data from Longfellow Neighbourhood, and

greenway planning using city and local data from Seward and Longfellow neighbourhoods (UMN, NPCR, MNIS, 2003).

The NPCR community GIS initiatives (MNIS and CGISC) appear to be successful partnerhip ventures, at least for the time being. The success of such projects is dependent upon the willingness of all participants to share information and resources. A GIS is considered particularly useful in this type of initiative, as it provides a logical structure for organising, analysing, and disseminating geographic data.

Several limiting factors, however, may discriminate against resource-poor community organisations attempting to participate in such initiatives. In order to participate in the consortiums, neighbourhood groups must demonstrate that they have a rudimentary GIS infrastructure in place, as well as access to the Internet. Moreover, as noted earlier, neighbourhood organisations are expected to contribute toward the costs of the consortium. Additionally, a number of administrative tasks must be handled by local groups (e.g., quarterly use reports). Those community groups in greatest need of assistance may be overlooked if they are unable to meet such stringent membership requirements.

5.4.3 Powderhorn Park Study

Elwood's (2002, 2000) research on Powderhorn Park's involvement with a PPGIS will be referred to in the following discussion. She employed qualitative strategies for gathering information about the neighbourhood, which included interviews with local residents and Powderhorn Park Neighbourhood Association (PPNA) staff, participant observation, and

document analysis of material dating back to 1985. Such techniques were intended to capture the diversity of viewpoints, particularly those at the ground level. Elwood's intent was to explore the efficacy of neighbourhood PPGIS and to assess the impacts of the technology on the Powderhorn Park residents.

The Powderhorn Park neighbourhood, located in south central Minneapolis, is primarily residential, and is populated by approximately 8000 residents from various ethnic groups (Elwood 2000). The PPNA serves as a key local institution for mobilising neighbourhood revitalisation efforts, including housing upgrades, economic development, and family support measures. PPNA employs several paid staff members to provide community assistance with using the organisation's computer facilities. Funding for the centre is derived from the Neighbourhood Revitalisation Program (NRP), foundation grant support, and community development block grants. In cooperation with the NRP, Powderhorn Park has begun to incorporate PPGIS as part of its information technology (IT) development strategy (*Ibid.*)

PPNA has been using e-mail and the Internet since the mid-1990s. In 1996, the organisation purchased a GIS software package (MapInfo) and has developed its own digital database using Microsoft Excel for property and housing data, community participant data, and local information. Additionally, neighbourhood data are provided by and shared with the City of Minneapolis and Hennepin County. The important point to be made here is that data are acquired from multiple sources ranging from the City to the neighbourhood residents. This process taps into a rich source of local knowledge which, in turn, can verify the accuracy of data collected by government agencies.

5.4.4 Critical Overview of the Powderhorn Park Study

The introduction of PPGIS technology to the Powderhorn Park neighbourhood was facilitated by the fact that PPNA already had an IT infrastructure in place. Additionally, the staff had a centralised data repository with which to develop the needed information base for a PPGIS. A supportive political climate for neighbourhood-guided initiatives also contributed to PPNA's successful implementation of a community PPGIS. As mentioned above, the sharing of digital data facilitated the PPGIS process. Moreover, cooperative local agencies were able to provide some continuity in terms of funding and technical consultation.

Challenges

As is the case for most non-profit organisations, PPNA has been constrained by limited financial resources. This factor has affected all aspects of of its operation, including IT development and management practices. Staff have not received adequate training to undertake more complex GIS and data manipulation tasks. Members have faced severe constraints on the amount of time they are able to dedicate to updating and maintaining databases. Powderhorn Park residents have also been faced with financial limitations, which, in turn, has limited their access to PPGIS hardware and software, training and assistance.

Neighbourhood PPGIS

Housing issues have factored in strongly in terms of the PPNA PPGIS. Their digital data repository has enabled the association to conduct a variety of comprehensive property-related analyses in Powderhorn Park. Examples of community PPGIS efforts include: assessing the

concentrations and geographic locations of dilapidated rental properties, determining the neediest areas for housing repairs, as well as identifying locations that experienced a loss of affordable housing. Additionally, PPNA has used their PPGIS to monitor neighbourhood changes over time. Both quantitative data (e.g., a change in property values) and qualitative information (e.g., resident perceptions of neighbourhood conditions) have been analysed by means of a PPGIS to determine the impacts of various property improvement grants.

Perhaps most significantly, PPNA used its PPGIS to challenge the City planners' housing policy. The neighbourhood database indicated a severe housing loss due to a large number of substandard size lots. PPNA then approached the City with an innovative proposal to conduct a design competition for housing suited to smaller lot sizes. The association received approval from the City in 1998, and is in the process of increasing Powderhorn Park's housing stock (Elwood 2000).

Impacts of PPGIS

While the PPNA's use of a PPGIS appeared largely positive in terms of mitigating housing problems as well as enhancing access to public data, the initiative did have several negative impacts on neighbourhood residents. The complexity of planning discourse became embedded in the information derived from the PPNA PPGIS. The language used to communicate with local government officials, regarding neighbourhood housing improvement strategies, was coded in accordance with government planning rhetoric (Elwood 2002). Local knowledge and every-day language of marginalised residents (e.g., renters, persons of colour, the elderly) were forfeited in favour of bureacratic knowledge and

expertise. This perhaps unintended result has created some barriers in terms of public participation, thereby further disenfranchising an already marginalised citizenry.

5.5 Summary of the Case Studies

I conclude this chapter with an overview of the three case settings, and frame each within Leitner *et al.*'s (2002) conceptualisations of models for PPGIS provision (as was discussed in chapter four).

The Metcalfe Park Study (Milwaukee) may be classified as a university-community partnership. The UWM attempted to introduce and implement a PPGIS within the community of Metcalfe Park. The UWM did not succeed in implementing a sustainable community-based PPGIS, but did gather valuable information by documenting the process. Additionally, inroads were made in terms of opening up a dialogue between the university and the neighbourhood organisation. At the very least, the Metcalfe Park Study allowed university researchers to engage in a participatory PPGIS process, which, in turn, informed the community organisation of the prospects (good and bad) of acquiring a PPGIS.

The ESLARP Study may also be considered a university-community partnership, albeit from a Participatory Action Research (PAR) viewpoint, which bypassed the importance of a public participation GIS. ESLARP's Neighbourhood Technical Assistance Centre (NTAC) is, in part, a neighbourhood GIS centre. In addition to GIS-related activities, NTAC provides East St. Louis neighbourhoods with other technical services (e.g., assistance with grant applications). Local groups have limited participation in the PPGIS, by means of an Internet

Map Server (EGRETS), which is operated externally by university researchers and technical experts. Hence, ESLARP partnerships have tended to be successful primarily as a result of PAR strategies, in which the opportunity to participate in a PPGIS has been limited to researchers and university students.[13]

PPGIS projects in Minneapolis and St. Paul vary in their complexity in terms of partnering activities, prospects for sustainability, and models for PPGIS provision. Key stakeholders in a PPGIS consortium herald from an aggregate of various government agencies, philanthropic organisations, universities, and community groups. Hence, when viewed in terms of Leitner *et al.*'s (2002) criteria, a consortium may encompass all six models of PPGIS provision, and combinations thereof. The important point to be made here is that innovative partnership strategies appear to facilitate successful PPGIS initiatives, at least for those community organisations which are able to participate in such strategies.

The Powderhorn Park Study is one (rare) example of a community-based PPGIS, which may, ultimately, become sustainable. Several factors contributed to the successful implementation of the Powderhorn Park PPGIS, including a pre-existing technological and institutional infrastructure, community support for revitalisation initiatives, and local enthusiasm for, and support in, collaborative ventures. The project does face a number of constraints (e.g., limited funding and technical training), and recent studies have concluded that planning officials tend to speak a language laden with technical jargon, which, subsequently, tends to marginalise those community residents who are unable to understanding their meaning.

[13] My thoughts are to rename such strategies as partially-participatory, given that only part of the community revitalisation process is fully participatory.

While projects such as the Powderhorn Park PPGIS are still in their infancy, only time and further research will determine the outcome of such efforts.

6.0 A PPGIS MODEL

6.1 Introduction

The introduction and management of a PPGIS may possibly be even more complex than similar procedures in a GIS. This is largely due to complex social, economic, and political variables which are implicit in a grassroots organisation (c.f. Ghose & Elwood, forthcoming; Ghose & Huxhold 2001). Whereas a formalised institution usually has the fiscal and human capital required to implement a GIS, a community group tends to run short of funding and must rely on external support for technical (and other) requirements (c.f. Reardon, 1998) . While a corporate body may experience some institutional difficulties in adopting a GIS, research indicates that the likelihood of implementing a successful GIS is closely linked with adherence to standard GIS management strategies (c.f. Lo & Yeung, 2002; Onsrud & Pinto, 1993; Huxhold, 1991). A PPGIS, on the other hand, may fail at any stage of the GIS implementation process. This is due to a number of factors which were discussed in chapter four, including lack of community interest in the project, difficulty acquiring data, and lack of an information intermediary (Craig, 1994; Sawicki & Craig, 1996). The complexity of a PPGIS must be interpreted and then made understandable for a neighbourhood organisation; hence, an information intermediary is considered a vital component of a PPGIS. A highly flexible, open-ended approach to introducing and implementing a PPGIS is desirable for those grassroots organisations which choose to participate in using the technology.

It is my intent to provide a PPGIS model which would be applicable in a variety of community settings. I employ a modified life-cycle approach which has been adapted from

many traditional GIS models. Foote and Crum (2000), for example, have provided a life-cycle planning approach to GIS project management which "involves setting goals, defining targets, establishing schedules, and estimating budgets for an entire GIS project." They view a life-cycle planning approach as a practical means with which to implement and maintain a GIS project, and have identified seven key phases in the process:

- problem definition
- feasibility study
- analysis
- system design
- acquisition and programming
- implementation
- maintenance

Lo and Yeung (2002) advocate for a systems development life-cycle (SDLC) approach to GIS project planning, implementation, and maintenance. A SDLC model incorporates three generic phases of a GIS in which the steps are both cyclical and recursive, including (1) the problem definition phase, (2) the development phase, and (3) the maintenance phase (p. 377). This approach employs a software engineering methodology that allows for modification at each step of the project. The model proposed in this chapter is also constructed of three phases; but, rather than focusing solely on the continuous improvement of the technology, the proposed model is also intended to enhance the integration of a PPGIS at the grassroots level.

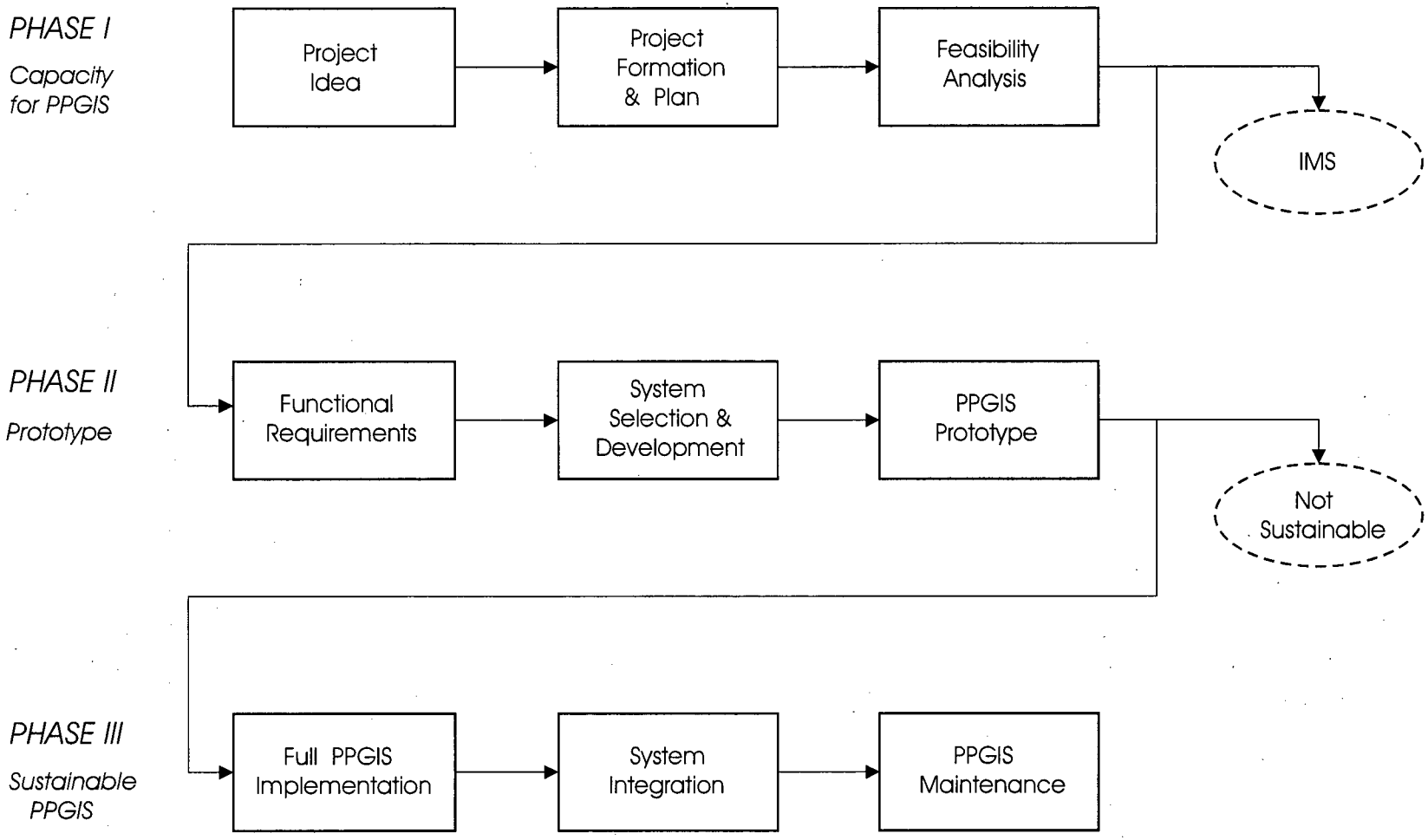
In the proposed model, a tri-partite schematic is recommended for the implementation of a community-based PPGIS. At the outset it is critical to determine whether or not GIS is

viable or even appropriate for a neighbourhood organisation. A *feasibility analysis* is an important first step in determining if a community group can indeed benefit from a PPGIS. Evaluation at this stage can save considerable time and expense should a community group not demonstrate the need or capacity for a GIS. The second phase of the model is both institutional and technical in orientation. While a community's usage of a GIS is a primary focus, the design of a PPGIS must also rely upon sound GIS project management principles. As such, a *functional requirements* study, procedures for *system development and design*, and a PPGIS prototype must be covered in the second stage of a designing a PPGIS model. Various studies have demonstrated that many PPGIS projects do not succeed beyond this phase. On the rare occasion, however, a community-based GIS may succeed in reaching a third stage of development -- that of a *sustainable* PPGIS.

6.2 A PPGIS Model

In **Figure 2**, I provide a conceptual illustration of the proposed model for a PPGIS. This framework will be referred to throughout the chapter as each phase is presented in turn. Considerable emphasis is given to the first two stages of this PPGIS model. For a variety of reasons which will be discussed below, grassroots PPGIS efforts tend to lose momentum either at the end of the first level (i.e., poor community response to the prospect of implementing a PPGIS), or else by the end of the second phase (i.e., when the prototype is introduced to the community). The third phase -- full implementation of a PPGIS -- is almost never realised. None-the-less, there are many examples of community-based GIS projects that have demonstrated the potential to succeed beyond the preliminary phases. Clearly,

Figure 2: A Proposed Model for PPGIS



Adapted from: Foote & Crum 1999

there are concerns at the rudimentary level which must be addressed and resolved in order to facilitate future PPGIS endeavours.

In this chapter, I propose a framework for PPGIS which is intended to be both practical and cognisant of the needs of a grassroots organisation. While, in theory, I draw upon various GIS project management principles, my primary concern is directed toward the community group which may or may not wish to implement a PPGIS. This is not intended to be an all-inclusive, one-size-fits-all approach to community-based GIS efforts. Rather, the model provided is generalised enough to be appropriate for those neighbourhood organisations that demonstrate the political will and capacity to participate in a sustainable PPGIS venture. The chapter commences with a detailed discussion of the first two phases of the proposed model (participant assessment and PPGIS prototype development), which is then followed with a generalised overview of the third phase (full PPGIS implementation) of the framework. I conclude this chapter with a critical summary of the utility of the proposed model.

6.3 Phase 1: Capacity for a PPGIS

A successful corporate GIS is comprised of several key elements: adequate funding, professional project management, suitable technological infrastructure, technical expertise, and access to high quality data. A PPGIS, however, must also evaluate and be adapted to the unique context within which it is situated. Hence, it is important to assess local capacity for a PPGIS prior to investing considerable time and expense in attempts to implement the project. To side-step this first phase of PPGIS planning and evaluation would almost certainly lead to the failure of the project.

In this section I present the preliminary steps for determining whether or not a community organisation has the capacity for a PPGIS, which are outlined in **Table 6** *Phase I: Capacity for a PPGIS.* Given the complexity and costs of implementing and operating a GIS, any oversight at the onset of a PPGIS project could contribute to the failure of the initiative. I can not emphasise strongly enough that planning and careful documentation of procedures undertaken and results derived from the research are a necessary requisite throughout the PPGIS lifecycle. Such efforts will save tremendous time and expense later on, particularly if the project is deemed viable enough to advance to the third phase -- that of a sustainable PPGIS.

Table 6. Phase I: Capacity for a PPGIS

Concept	Goal	Process
Project Idea	Preliminary investigation	Engage community organisation in a participatory process
	Identify **needs** and **purposes** of a PPGIS	Conduct extensive research in collaboration with community
	Identify preliminary project requirements	Analyse research and present to community organisation
Project Formulation & Plan	Identify project participants	Conduct community meetings and seminars; advertise
	Inventory organisational and technological capacity	Compile detailed information on all PPGIS participants
Feasibility Analysis	Determine appropriateness of a PPGIS	• Professional analysis • Present finding to community • Decide whether or not to proceed any further

6.3.1 Project Idea

A first step in any GIS project commences with a needs assessment to determine the organisation's requirements for the technology. A PPGIS project, however, is unique for a number of reasons which include: community reliance on an external information provider, the need to build neighbourhood capacity for a complex technology, community collaboration with project partners, and local adaptation to the various implications of the technology.

As was discussed previously in chapter four, a GIS facilitator/information intermediary plays a significant role throughout the life-cycle of the PPGIS project. In this phase of the project, the GIS expert will be relied upon heavily by community representatives to direct research for preliminary analyses, and to interpret a complex technology so as to make it understandable for the community group.

The concept of a PPGIS must be presented to a community organisation, a process which may be in and of itself quite daunting. Most grassroots groups are not as formally structured as larger businesses (e.g., government) and are therefore susceptible to intra-organisational conflict. Hence, it is important to bring key local representatives on board at the inception of the PPGIS project, as one means to gain community consensus. Various studies in the literature recommend that the PPGIS facilitator host local information seminars and meetings in order to introduce the technology in a face-to-face setting, to encourage local support in the venture, and to initiate social networks which will be integral to project development (c.f. Sawicki & Craig, 1996; Craig, 1994).

Once the community organisation has demonstrated interest in preliminary information sessions, the GIS provider conducts research on the community to identify potential local usage of a PPGIS. Research findings should then be presented to the neighbourhood group and prospective participants, and the results documented for further use. The presentation must be realistic in terms of what a community organisation can and can not achieve when using a PPGIS. Hence, the technology should be tailored to suit the community's requirements (not those of the external participants). More than one community-based information session may be required as local feedback must be continuously solicited and then incorporated into the design of a PPGIS.

6.3.2 Project Formulation and Plan

Once the concept and utility of a PPGIS has been introduced to the neighbourhood organisation (which, indeed, can be a lengthy process), the formulation of the new model should be commenced with a capacity and needs assessment to determine whether or not a GIS is even viable for an organisation. At this stage, considerable research should be undertaken by the GIS expert (and assistants when required) commencing with an inventory of local resources, assets, and knowledge. An evaluation of community and stakeholders' capacity for implementing and using the technology would help determine the appropriateness of a PPGIS. Additionally, an inventory of the capacities and goals of all stakeholders is recommended in the first phase of any community-GIS initiative, in order to prevent unnecessary duplication or resource expenditures.

This step entails compiling an inventory of the goals and assets of all PPGIS participants. Somewhat similar to "asset-based community development" strategies, the criteria used to assess the appropriatenes of a PPGIS are based on a neighbourhood's assets and capacity to take on the technology (c.f. Kretzmann & McKnight, 1993). While the process of enhancing local assets and capacity is considered far more empowering for a community than an inventory of its deficits, neighbourhood problems must also be recorded for future PPGIS analyses and policy development strategies.

GIS Expert/Information Provider

Research indicates that a GIS champion typically mobilises community-based GIS initiatives (c.f. Sieber, 2000). On occasion, some community representatives have approached a university faculty member in order to engage in local participatory efforts. For the purposes of this model, I will rely on a scholar-advocate approach in which a professor and university researchers communicate and collaborate with a community group (and other participants) to determine the efficacy (and, later, implementation) of a PPGIS (c.f. Schmitt, 1997). It is important to note that the neighbourhood organisation must ultimately decide whether or not it wants to participate in such a venture; efforts to the contrary would appear coercive.

Project Participants

Previous evidence suggests that potential PPGIS participants should explore all avenues for possible collaborative strategies, which includes looking at other GIS initiatives in the community or region. Regardless of background and business interests, participants in a

PPGIS venture are expected to contribute toward the community organisation's best interests throughout the life-cycle of the project. As shown in **Table 7**, each project participant demonstrates a unique set of goals and assets which can be combined for productive use in a community-based PPGIS effort.

Table 7. Goals and Assets of PPGIS Participants

Participants	Goals	Assets
Community Groups	• Local empowerment • Access to useful information • Participate in decisionmaking that affects their community	• Volunteers • Local knowledge • Social networks

Nonprofit Organisations	• Enhance local empowerment
	• Research opportunities
		• Access to funding
		  • funding
		  • institutional networks
		• Volunteers

Local Schools	• Learning opportunities
	• Community participation in the local learning environment
		• Access to:
		  • knowledge & expertise
		  • techology & facilities
		• Volunteers
		• Local knowledge

Local Agencies and Government	• Enhance local empowerment • Shift fiscal responsibilities to the local level	• Funding • Data • Technology & facilities • Knowledge & expertise
Universities and Colleges	• Transfer of knowledge • Research opportunities	• Access to: • data and funding • Technology & facilities • Knowledge & expertise • Volunteers

The literature reviewed in earlier chapters indicates there are at least four categories of community stakeholders that tend to engage in a PPGIS, including community groups, nonprofit organisations, local businesses and government agencies, universities and colleges.

I have appended a fifth resource to the list (one which has often been overlooked by community-based GIS projects) -- children who attend local schools (elementary to senior high school level). School children can contribute a wealth of local knowledge, and tend to have tremendous ethusiasm for technology in general.

A collaborative project which brings together the resources of many participants stands a much greater chance of success than that of a solitary GIS "experiment." Cooperative efforts tend to increase the amount of funding, knowledge, and human resources needed to implement a PPGIS. Data-sharing agreements go far in terms of facilitating the use of a PPGIS. Indeed, approximately 80 per cent of a corporate GIS's financial costs are dedicated to data acquisition, data cleaning, modeling and processing, and the situation with respect to a PPGIS is unlikely to be substantially different.

Capacity Inventory of Participants

Capacity for GIS will vary, particularly in terms of understanding the technology as well as possessing the local infrastructure required to operate a GIS. While metropolitan community organisations tend to have greater technological capacity than rural neighbourhood groups, there are exceptions to this norm. In any case, the evaluative process should be tailored to best suit a community's interests.

The value of a capacity inventory of participants will be realised throughout the project life-cycle. This process should be repeated on a regular basis through the duration of the project and embedded within the maintenance stage of Phase III (full implementation of a PPGIS).

The primary purpose of conducting an inventory at the inception of the project, however, is to ascertain local capacity for the technology and to identify sources of funding, research, and GIS expertise. Much of this information will have been gathered informally during preliminary investigations of the PPGIS venture. At this stage, the researcher/GIS expert must prepare and organise clear documentation of the analysis and results. Once the survey of participant capacity has been completed, the results should be presented to the community organisation and project participants for local feedback.

6.3.3 Feasibility Analysis

A feasibility analysis provides the basis upon which a PPGIS is deemed appropriate (or not) for a neighbourhood group. All steps leading to this stage have been incrementally evaluative, a factor which should assist participants in making their final decision. As such, a final analysis of community capacity for a PPGIS is compiled in consultation with all project representatives, documented, and then presented to the community organisation either through local meetings or else by means of an IMS (provided the community has local access to the Internet). Regardless of the outcome, researchers must document and archive meeting proceedings and/or IMS interactions for future reference. There may be future instances in which a neighbourhood organisation decides to participate in further PPGIS ventures. Research and information derived from the preliminary capacity assessment phase can also provide valuable insight into research for future PPGIS strategies.

6.4 Phase II: PPGIS Design and Prototype

Provided a community group has demonstrated the capacity to use a GIS, the next logical step would be geared toward the design and development of a PPGIS prototype. In most instances, this phase is exemplified by community-university projects that emphasise course-related student-learning opportunities. Frequently, when the course ends, so does the PPGIS. If, on the other hand, the participants express an interest in pursuing a longer term commitment to a sustainable PPGIS, then a range of GIS project management principles must be incorporated in the process. As noted earlier in the chapter, there is considerable value in devising a carefully thought out PPGIS implementation and management plan.

Many of the steps involved in formulating a PPGIS tend to occur in no particular order, yet each contributes incrementally to the design of the model. While an important first step is to formalise a PPGIS arrangement in terms of the participants and funding sources, past studies have indicated that the implementation of a PPGIS tends to be a recursive process. Reasons for this include: new stakeholders joining (and departing from) the project, staff turn-over and limitations on university faculty time, changes in technology and in the community group's technical requirements, and so forth. As such, this model is intended to be flexible enough to suit the unique circumstances and needs of a grassroots organisation.

I commence this section with a discussion of the various functional requirements of a PPGIS project, which are presented in **Table 8** *Phase II: PPGIS Design and Prototype*. The number of steps comprising this stage are considerable and, subsequently, will be discussed briefly in turn. The intent of this portion of the chapter is to provide guidelines, rather than precise

steps, for designing a PPGIS prototype. This is followed by an overview of the selection and development of a suitable system for a PPGIS. The section is concluded with a discussion of the presentation and results of a PPGIS prototype.

Table 8. Phase II: PPGIS Design and Prototype

Concept	Goal	Process
Functional Requirements	Identify key community representative(s)	Social networks will have provided representatives in Phase I
	Identify GIS expert(s)	GIS leader will have emerged in Phase I
	Develop and establish a PPGIS organisational structure	Identify roles & responsibilities of PPGIS participants
	Identify funding needs & sources	Refer to social connections & inventories conducted in Phase I
	Secure participant support	Signed agreements
	Establish location of the PPGIS	All participants should meet & consensus must be gained
	Identify data sources & technical requirements; and prospects for sharing data & technology	Refer to inventory on technical infrastructure in Phase I; and social networks
System Selection & Development	Identify & secure suitable PPGIS software & hardware	Dependent on financial costs and PPGIS requirements
	Design sample database	GIS expert should prepare a sample database for the PPGIS prototype
	Implement PPGIS training sessions	Set up training seminars & Workshops for the users
PPGIS Prototype	Test the PPGIS prototype	Present to community organisation & participants; test & evaluate
	Prototype testing outcome	Determine whether or not to proceed any further

6.4.1 Functional Requirements

In a corporate GIS project a functional requirements study is intended to analyse the kinds of data required for the project, how they will be used, and to determine what products will be produced (Foote & Crum, 2000). For the purposes of a PPGIS, this process identifies the organisational structures needed in order to ensure the success of the project, as well as the technical expertise required to design, implement, and operate the system. One task must be reiterated here: the community organisation must be consulted with on a regular basis in order to ensure that the PPGIS is indeed a participatory endeavour.

Organisational Structure

In determining the functional requirements of a PPGIS, a first step is to clearly identify and assign roles to all of the key project participants. A GIS expert will have already been selected earlier in the modeling process. This may also be an appropriate entry point for a new GIS provider to join the initiative. Additionally, representatives from the community organisation should be identified and brought into the project design process. Social networks established in the preliminary phase of the PPGIS will prove invaluable at this point. Those participants who have displayed enthusiasm for the project are most likely to remain onboard as part of a broader organisational effort. Hence, a PPGIS project management structure must be introduced and put in place at this point. Participants will be assigned particular roles and responsibilities and a high level of interactivity between project participants should be encouraged. Suchvstrategies must be pursued in order to ensure full community participation in the PPGIS.

Secure Partnerships

All external (and local) participants are expected to commit to the PPGIS project for specified periods of time. Data sharing agreements, confidentiality and project commitment documents may be one means with which to secure partnerships. Funding arrangements held with external stakeholders who are not willing to commit over the longer term may, subsequently, lead to the demise of the project. Participants having to meet external academic deadlines, such as faculty and students, can at times compromise the design process. It is important to know at the outset how much time each participant can realistically contribute to the project. Once again, GIS project management strategies, such as time management principles, come into play. On a final note, the community organisation must also be held accountable for its level of participation in the PPGIS. If local support has dwindled by the time the prototype is introduced, prospects of the PPGIS project succeeding are marginal.

Location of the Prototype & Training

A decision must be made by the stakeholders regarding where the PPGIS will be housed. Frequently, a PPGIS is first operated from within a university and then shifted to a location in the community once the project is deemed viable. During the transition process, however, dedicated computer access should be made available for the community organisation, preferably at a local venue, in order to ensure active local participation in the project.

Additionally, PPGIS information and training sessions are vital for enhancing local technical capacity and for engaging neighbourhood residents in a participatory GIS. Ideally, these

sessions would be conducted in the community. If, however, the PPGIS prototype and learning seminars are situated in a university lab, provisions should be made so that the community organisation feels comfortable enough to participate in the development of the project. Indeed, the transfer of information and skills should be an ongoing process, one in which all PPGIS participants contribute to the knowledge base.

Database Planning

Access to high quality digital data can be very costly for a community organisation. Hence, data sharing arrangements held with external stakeholders may prove to be the best financial solution for groups with few resources, at least in the US. While many Canadian universities participate in a data sharing arrangement with the federal government, which is known as the Data Liberation Initiative, the use of such data is restricted to research purposes only -- the data can not be disseminated to the public, or used for commercial purposes (StatsCan, 2001).

The process of database planning commences with the identification of user information needs. Much of this research will have already been conducted in Phase I of the PPGIS project. Provided the information gathered has been well documented (e.g., metadata), a GIS expert should have little difficulty in designing an appropriate database. The acquisition of new data will have been facilitated by stringent partnership requirements (noted previously). The fiscal, human, and technical components of the database can be very complex and are best left to a GIS expert to determine. Ideally, the final product would have some capacity for flexibility: past research has indicated that some community groups are innovative in

their use of a GIS and may attempt to re-engineer the initial design. Further discussion on the subject is best left for another venue.

6.4.2 System Selection and Development of the Prototype

The selection and development of a suitable system for a PPGIS is comprised of several factors including:

- use of an existing computer and software, or else purchase of a new system
- design of a sample database
- implementation plan for using the new technology
- extensive training in use of the PPGIS

While the acquisition (or borrowing) of a computer and suitable software is presumed a necessary component of any PPGIS system, a working (prototype) database should also be added to this list. Given that extensive training sessions are to be conducted in order to train participants to use a PPGIS, careful thought must also be given to the prototype database. Building upon this logic, the construction of an implementation plan and a PPGIS manual/data handbook are also recommended at the system development stage. The time frame for and complexity of undertaking the development of a PPGIS is considerable, and has not be fully addressed in this discussion.

A PPGIS prototype provides a means for testing a system, soliciting/eliciting user (e.g., community) responses to the systems, allows the researcher to better estimate the amount of time needed for system implementation and training, and can be revisited (e.g., benchmarks/indicators) for funding purposes and project evaluation thoughout the PPGIS life

cycle. In essence, adjusting a project at the prototype stage results in cost and time savings later in the life cycle. Insights yielded from a prototype analysis should guide PPGIS implementation in a logical and cost-effective manner.

A GIS pilot project/prototype should be kept small and flexible in order to test and revise GIS functionality as many times as may be required. In terms of a PPGIS, the prototype marks the end of the participant evaluation and preliminary project design phases. A PPGIS is presented to and then tested by a community organisation to determine whether or not the technology is suitable for participants who have received technical training and assistance. As noted above, this stage frequently marks the end-point of a community-based GIS university course or short-term partnership. In other instances, a grassroots organisation may simply not have the capacity to work with the PPGIS without ongoing assistance. Much knowledge and experience will have been gained by all participants, however, and the prospect of a sustainable PPGIS may still be realised.

6.5 Phase III: Sustainable PPGIS

Relatively few, if any, examples of a fully sustainable PPGIS have been documented in the literature. Given the short history of community-based GIS efforts, this is not surprising, yet, on the other hand, somewhat disappointing. The term sustainable PPGIS is used to describe a fully operational community-based GIS that is reliant on little external assistance. As noted in the previous chapter, there are several PPGIS initiatives which may have evolved to a sustainable level, but still remain dependent on a GIS intermediary and external support. As such, the concluding portion of this chapter is somewhat speculative in scope and, therefore,

must be structured around standard GIS project management practices (and adapted to a grassroots context).

6.5.1 Full PPGIS Implementation

As noted in Phase II, the design, introduction, and evaluation of the prototype (or pilot study) PPGIS requires both time and considerable resources. The majority of PPGIS projects are terminated by the end of the pilot phase. In spite of this somewhat dismal outlook, there remains, nonetheless, the prospect (for a select few) of attaining a fully sustainable PPGIS. Certain contextual circumstances play a significant role in the successful implementation of a PPGIS, including:

- utility of a PPGIS for the community group
- community capacity for a PPGIS
- participant commitment to a longer term PPGIS
- collaborative networks maintained between stakeholders
- a high level of enthusiasm for the PPGIS (community and participants)

As such, the full implementation of a PPGIS is both a social and a technical process. It is imperative that participants maintain a balance between, at times, contradictory approaches to GIS project management in a community setting.

In **Table 9** *Phase III: Sustainable PPGIS*, the full implementation of a PPGIS is presented, which involves several steps, including system integration, system testing, extensive database development and metadata, and user training. This process should be directed by a PPGIS management team which will have been identified during the prototype design phase. Key roles will have been assigned in earlier phases, and it is quite possible that a more complex

organisational infrastructure may evolve during this third phase of a PPGIS project. While some would express concern regarding the bureaucratisation of a participatory initiative, the considerable time, expense, and expertise already invested in previous stages of the PPGIS model far outweigh the potential caveats of intraorganisational politics.

Table 9. Phase III: Sustainable PPGIS

Concept	Goal	Process
Full PPGIS Implementation	Post-prototype evaluation	Ensure that the PPGIS is viable for the longer term
	Secure PPGIS facility & continue to enlist community support	Consensus must be reached regarding the location of the PPGIS
	Secure all technical components required for the longer term	Ensure technical infrastructure is in place & reliable
System Integration	Extensive database development & metadata	GIS expert should be hired to design & maintain full database
	Extensive user training & PPGIS handbook	Conduct recurring training sessions & periodic information updates
	System testing	GIS expert should implement & evaluate the system
PPGIS Maintenance	Establish framework for practical management strategies	System re-assessment, benchmarks, & indicators
	Continue to recruit support & new funding sources	Consolidate social networks & provide media coverage
	Continue to engage community members in the project	Consolidate social networks & provide media coverage
	Engage in research & development strategies to explore new avenues for PPGIS initiatives	Partnerships with universities & colleges; student intern research opportunities

In many respects, the implementation phase of a PPGIS is patterned in a manner similar to that of the prototype phase. The two stages differ, however, in terms of magnitude and level of commitment to the project. While the prototype phase provides a shorter term, testing

ground for a PPGIS, the implementation phase demonstrates a longer term commitment of project participants and resources dedicated toward the successful outcome of a sustainable community-based GIS.

6.5.2 System Integration

System integration of a GIS involves the acquisition of all system components in accordance with previously documented specifications, as well extensive testing of the integrity of system (NCGIA, 1997). Considerable ground work will already have been covered in earlier phases of a PPGIS, which should subsequently expedite this process. The system integration stage of a PPGIS marks the start of full implementation of the technology.

GIS software and hardware will have already been acquired during the prototype design phase. In all likelihood this infrastructure was either borrowed or leased for a set period of time. Hence, the PPGIS management team will need to purchase licence renewals and/or buy or else lease suitable hardware (which will be upgraded over time) for the longer term. Perhaps most significantly, considerable funding will also be needed for extensive database testing and development.

System Database

While a sample database would have been designed and tested at the prototype stage, a functioning PPGIS (like any GIS) is reliant upon a well-designed, fully integrated database. Most GIS practitioners consider database planning as the "single most important activity in GIS development" (NCGIA, 1997). The demands of a PPGIS may exceed current

programming capacity, however. The translation of oral histories to digital format is but one of several examples that designers are faced with today (c.f. Rundstrom, 1998; Marozas, 1996). As such, a PPGIS database should be designed to be flexible enough for future expansion, to incorporate alternative forms of data and other unforseen requirements. Space does not permit further discussion of the detailed and complex procedures involved in the construction of a fully integrated GIS database. I therefore direct the reader toward comprehensive research already conducted on the subject (c.f. Lo & Yeung, 2002).

User Training

User training is a necessary requisite to the successful implementation of a GIS. As noted earlier in the chapter, PPGIS users will have been trained throughout the assessment and pilot project stages of the venture. This approach is expected to provide the system users with adequate time in which to learn fundamental GIS principles, apply the knowledge in practice under the guidance of a GIS facilitator, and gain enough experience to use a PPGIS without constant assistance.

PPGIS Facilities

A decision must be made by the PPGIS management team as to the best location for the facilities. Ideally, the technology would be placed in the community so as to provide immediate access for the residents. A fully implemented PPGIS should continue to engage community residents in the participatory process, particularly if the project is intended to be sustainable.

6.5.3 PPGIS Maintenance

Once a GIS is up and running, system maintenance and user support are considered vital components of this later stage in a GIS life cyle. For a PPGIS, this entails myriad details which are expected to be handled in an appropriate manner by the project management team. Important considerations include:

- practical GIS management strategies to ensure the system runs smoothly
- continued re-assessment of system processes and updates, data requirements, and community information needs
- ongoing recruitment of personnel, funding, and data sources (never a certainty for community organisations)
- continued research and development concerning PPGIS applications, and methods for ameliorating the potentially negative impacts of a community-based GIS
- encouragement of grassroots groups and local nonprofit organisations to fully participate in all aspects of operating and maintaining the PPGIS

6.6 Summary of the PPGIS Model

In this chapter I have proposed a generic model for a PPGIS, one that can be applied in a variety of grassroots situations. This framework is structured around three distinct phases which, in large part, are reflective of a more traditional GIS implementation model. In this proposed model, the key differences between the implementation of a GIS and a PPGIS lie within the unpredictable context of a community group, and the various related social and institutional networks and partnerships affiliated with such an organisation. Hence, the recommended framework for PPGIS implementation (for a neighbourhood group) must be *flexible* enough to accommodate the uncertainties inherent in this type of participatory venture.

The three phases of the PPGIS model include: (1) evaluation and analysis of the prospects for a PPGIS, (2) design and introduction of a PPGIS prototype, and (3) full implementation of a sustainable PPGIS. Some community organisations are deemed not suited for using a GIS and, hence, may not advance beyond the first phase. Frequently, at this point, an IMS (a quasi-PPGIS) would be designed and delivered to the community by an external provider.

The second phase has been realised by numerous community-university GIS partnerships in the US. Most commonly, a GIS professor and university students engage in a partnership with a community organisation in order to conduct a short-term (e.g., course-based) learning project for all participants. More often than not, PPGIS ventures tend to conclude by the end of the second phase. The third phase -- a sustainable PPGIS -- is almost never realised. Recommendations for implementation strategies have been provided in the chapter, but future research will be the only true determinant as to whether or not such efforts will result in a successful outcome.

When viewed from a critical perspective, the proposed model provides a general framework for community-based PPGIS evaluation and implementation procedures. While not rigorously tested (at least, not in this thesis), the model is replicable and, therefore, of value for those seeking a practical and community-oriented approach to PPGIS project design and management.

7.0 PPGIS IN CANADA

7.1 Introduction

Community-based PPGIS initiatives appear to hold considerable promise for US neighbourhood organisations wanting to engage in the public decisionmaking forum, yet few are considered entirely successful. Given the difficulties faced by such initiatives in the US, many questions arise concerning whether or not the prospect of a university-community PPGIS partnership is a viable prospect for Canadian neighbourhood organisations. What are the limitations that Canadians must face when attempting to use and implement a PPGIS? Based on US experiences, how will Canadian community groups deal with some of the more complex political implications and impacts of PPGIS initiatives?

An extensive Internet search yielded relatively few urban community GIS projects in the Canadian context. Such Canadian initiatives are frequently referred to as "community mapping projects," rather than a PPGIS. Indeed, only one site in British Columbia (BC) was deemed appropriate enough to meet the criteria for an urban community-university PPGIS project; which begs the question why there is a paucity of such research in Canada. It stands to reason that Canadian PPGIS efforts may face even greater hurdles than that of their US counterparts, for a number of reasons discussed in previous chapters, including:

- stringent restrictions on data access (including high costs and copyright issues)
- complexity of the technology (for community groups)
- few Canadian community organisations have a formalised institutional infrastructure (and even fewer have an existing technological infrastructure)
- limited number of government funded community redevelopment programs

- US-based software companies are less likely to donate software to Canadian nonprofit organisations

In this chapter, I provide a brief overview of one urban PPGIS initiative in the Canadian context, to illustrate some of the limitations which Canadian neighbourhood organisations might face when attempting to implement a PPGIS. During my research, I also contacted the Cities of Burnaby and Vancouver, BC, to determine whether any urban-sponsored, community-based PPGIS projects existed in their neighbourhoods. The planning departments in both cities had, admittedly, not sought out neighbourhood participation in the design of a PPGIS (Dhudwal, 2003; Mark, 2003). Instead, each city provides local communities with geographic information by means of an IMS. In this thesis, I have not considered an IMS to be a PPGIS, in the truest sense. Rather, I view it to be restricted interface in which a citizen has limited access to and participation in the PPGIS process. It may be that a university-community partnership holds the greatest promise for future community-based, Canadian PPGIS endeavours. This notion is premised on a number of variables which will be presented later in the chapter.

7.2 Community Mapping Project

In 1995, the prospect of a Community Mapping Project (CMP) was conceived by professor Ross Nelson, of the University College of the Cariboo (UCC), Kamloops, BC (UCC, CMP, 1996). In cooperation with a local anti-poverty group (Kamloops Active Support Against Poverty Society), UCC engaged in a capacity-focused research strategy (c.f. Kretzmann & McKnight, 1993) to promote the development of more affordable local housing. Nelson and several university students used GIS for conducting their inventory, assessment, and analysis

of local housing stock and related concerns. Funding for the project was received from Homes BC of the Ministry of Municipal Affairs and Housing, the Real Estate Foundation of BC, and the Canadian Federal Summer Student Employment Program.

The primary goal of the CMP was to compile an inventory of local housing supply to guide policy makers in making more informed decisions regarding housing development strategies. Portions of the population who were unable to secure affordable housing were targeted in the analysis which included, low income households, senior citizens, aboriginal and ethnic minorities, and the disabled.

In 1996, a variety of housing related maps and three reports were made available by the CMP for viewing online (UCC, CMP, 1996). The information displayed showed the spatial patterns of Kamloops housing and services. This preliminary step provided the structure upon which further community-based inquiry could be based. As stated in a local newspaper,

> . . . the project takes [the community mapping] concept a step further to include interest groups in social housing and information on how to access them . . . . The end product wil be a data base created by the students to serve as a resource for different groups with a stake in social and community issues (Muir, 1996).

Three reports and accompanying sets of maps and tables were generated using 1991 Statistics Canada census data. The studies were titled "Kamloops Housing Needs for Different Populations," "Housing Affordability Report," and "Accessibility of Rental Housing in Kamloops" (UCC, CMP, 1996).

The "Kamloops Housing Needs for Different Populations" study was an analysis of the spatial patterns of socioeconomic and housing variables in the city. The variables examined included, men and women aged 40 to 60, single persons, single parent families, and unaffordable housing. The combination of statistical analysis and mapping of such variables yielded some interesting housing patterns. A "critical areas" map, for example, illustrated that the northern and northwestern portions of Kamloops comprised the highest numbers of persons and families which spent greater than 30 per cent of their income on rent.

The "Housing Affordability Report" was based on several measures of housing need in order to determine the levels of need in the city. The variables included:

- unaffordable housing in which a person is considered to live in poverty when he/she is paying 30 per cent or more of their income on shelter[14]
- local, provincial, and national rent comparisons as an indicator of housing needs
- the distribution of affordable housing within the City of Kamloops

The research determined that housing needs within the city can not be solely determined by the "rent greater than or equal to 30 per cent of income" criterion. The scale of analysis (enumeration area) may not have been sensitive to certain data correlations, and the above-mentioned variable did not account for the cost or the sufficiency of housing in Kamloops.

The "Accessibility of Rental Housing In Kamloops" study was aimed toward a general audience, which provided information on rental housing stock, accessible housing, and information on public facilities for persons with physical disabilities. A database was compiled of criteria which determined the accessibility of physical locations and structures,

based on their exterior and, when appropriate, interior attributes (e.g., stairs, living spaces, and floor surfaces).

The results of the Community Mapping Project were published on a web site in 1996, and have had few updates since that date (UCC, CMP, 1996). This project only succeeded in reaching the first phase of a PPGIS development life-cycle (as discussed in chapter six). Results were posted online (which include simple IMS maps of housing accessibility in the city),[15] with no mention of any form of community-based PPGIS activity. The technology was not implemented within the communities; rather, the university provided the communities with information and maps by means of public presentations, the media, and by publishing their results on a web site (Nelson, 1997).

There are a number of possible reasons which may also have limited the further development of the CMP, including:

- lack of community interest in the project
- limited community access to public data and the PPGIS
- complexity of learning how to use the technology (for communities)
- lack of funding and support needed to take the CMP to the next level
- university research time frame constraints

Yet, it is encouraging to know that the data collected and information derived in the CMP process are archived at UCC. Moreover, Nelson and the UCC are currently involved in a federally funded Community-University Research Alliance (CURA) project, as part of a

[14] As defined by Statistics Canada.

multi-participant initiative titled *Cultural Future of Small Cities*.[16] Given the scope of such ongoing research pursuits, it is hoped that the university will be able to engage Kamloops communities in future PPGIS endeavours, given the value of, and need for, geographic information.

7.3 University-Community Partnerships in Canada

The university-community research model has been selected as exemplary for the Canadian context, as it appears to hold the greatest promise for Canadian PPGIS ventures for the following reasons:

1) Canadian universities participating in government data sharing initiatives (e.g., Data Liberation Initiative) are able to *present* community organisations with hard copy maps (generated by a GIS using digital socioeconomic data, for example, at the Enumeration Area scale (Leubbe, 2003).
2) University faculty and students are a valuable resource for community-based ventures, particularly those which require technical knowledge and expertise (e.g., GIS analysis)
3) Universities have considerable access to government funding and often collaborate with external stakeholders in research initiatives (e.g., UCC-Kamloops CURA project)
4) A university Geography department, for example, usually has the necessary infrastructure to house a GIS; a prospective site for training community residents to use PPGIS, either through course work or seminars

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[15] A simple IMS interface depicting housing accessibility in Kamloops may be viewed online: http://www.cariboo.bc.ca/ae/ses/geog/cmp/citymapa.html

[16] Cultural Future of Small Cities is a Community-University Research Alliance (CURA) funded project. The Kamloops study may be viewed online at http://www.cariboo.bc.ca/smallcities/ResearchProgram/index.htm

While there are limitations which may affect Canadian university-community partnerships, I am optimistic that many future PPGIS ventures will, in time, reach the third phase of PPGIS development -- that of a sustainable community-based PPGIS. In providing a detailed account of the various caveats and challenges faced by similar partnership ventures in the US, this thesis should helped inform future endeavours of the pitfalls which have been documented in past PPGIS efforts.

What remains to be seen, however, is whether or not the proposed PPGIS model, in chapter six, is viable in the Canadian context, or any other setting, for that matter. My recommendation for future research would be a rigorous testing of the proposed model, particularly within various Canadian community organisations. Careful documentation of interviews and close inspection of information derived from such research would be of considerable value for future PPGIS research initiatives.

8.0 CONCLUSION

A primary objective of this thesis has been to gain a thorough understanding of the scope of the newly emerged field of PPGIS. I commenced this research with a brief history of antecedents to PPGIS, in order to situate such research within the GIS and society research context. In order to lay the groundwork for a deeper understanding of the PPGIS agenda, I then examined key concepts which comprise much of the PPGIS discourse, including *empowerment*, *marginalisation*, *public access* and *participation*. As noted previously, a PPGIS may be seen as both empowering and, alternatively, marginalising for community groups. While the technology can provide such organisations with a means with which to gain entry into the public decision-making arena, it can (for many groups) be too costly to acquire and difficult to use, thereby limiting their participation in such ventures.

A number of conceptual frameworks and case studies have also been discussed in the thesis, in order to illustrate the complexity of PPGIS initiatives in the US. The conceptual frameworks presented were intended to demonstrate useful methods for conceptualising, implementing, and evaluating urban, community-based PPGIS projects. As the field of PPGIS is still relatively new, I would expect that considerable improvements will come to the fore in future research efforts.

The information derived as a result of this research process has provided an invaluable foundation for the design of a generic community-based PPGIS model. The proposed PPGIS model is intended to be implemented in incremental steps, so as to accommodate the various

needs of different neighbourhood organisations without overwhelming such groups with the complexity of the technology. Given that most communities are comprised of diverse, heterogeneous populations, it is important that each organisation be provided with a PPGIS model which best suits its particular needs and context. Neighbourhoods which do not have the capacity for implementing a PPGIS may be better served by using an IMS, at least in the shorter term, while continuing to investigate future prospects for a community-based PPGIS partnership. Communities which already have an existing technological and institutional infrastructure, on the other hand, are much more likely to achieve a sustainable community-based PPGIS.

It has also been my intent to investigate the reasons for the paucity of PPGIS endeavours in Canada. One primary reason for the relative absence of such Canadian efforts may be due to government policy which restricts equitable access to public data. While there are valid reasons for protecting certain forms of data (e.g., confidentiality and privacy laws), many would argue that government data dissemination is driven by cost-recovery mechanisms. Given that a PPGIS is largely data-dependent, a lack (or absence) of data would render such a system useless.

I conclude this thesis with several recommendations concerning the PPGIS model which I have prosposed, and provide suggestions for further research. First, it is critical that researchers identify a neighbourhood organisation's PPGIS requirements *prior* to implementing the technology. This important first step will determine whether or not a PPGIS is even appropriate for the community group. Moreover, by focusing on the

community's information needs, it is hoped that external stakeholders will assist in the design of a PPGIS which is reflective of the community's interests (instead of that of the information provider).

Second, an information intermediary/data provider plays an integral role in determining the outcome of a PPGIS project. For the lay person, PPGIS can be difficult to learn to use, to implement, and to maintain. As such, external expertise is needed in order to facilitate the learning process, as well as the acquisition, implementation, and maintenance of the technology. As recommended in previous chapters, institutional arrangements should also be formalised to the extent that participants are cognisant of, and held responsible for, their role in the project. It is expected that project participants which are held accountable for their actions will demonstrate a stronger commitment to the PPGIS project, which, in turn, can lead to a longer term, more sustainable project.

Third, a community-based PPGIS stands a much greater chance of success when it is comprised of a number of stakeholders which share a common interest (i.e., the well-being of the community group). The more successful PPGIS initiatives in the US (e.g., Powderhorn Park) have tended to be multi-participant partnerships, within which various resources are pooled together as part of a collaborative effort. As noted in previous chapters, there are a significant number of government and nonprofit funding structures in place in the US, which are intended to assist those community organisations that demonstrate the greatest capacity for change -- a community-based PPGIS is a means with which to *demonstrate* that capacity.

I conclude with one final recommendation for all PPGIS initiatives -- a PPGIS is premised on the notion of *public participation*; therefore, it is critical that participating grassroots organisations be fully involved in each step of the PPGIS process. To do otherwise would seriously undermine future prospects for a PPGIS, both for researchers, and more importantly, community organisations.

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